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Foreword

International Journal of Food Technology & Nutrition is a scientific, peer reviewed, international journal that provides rapid publication of articles in all areas of food technology and nutrition. The scope of this journal is to provide a platform for scientists and academicians worldwide to promote, share and discuss various new issues and developments in different areas of food and nutrition. The Journal will consider submissions of quality papers describing the results of fundamental and applied research related to all fields of food technology and nutrition.

Knowledge of food technology is critical to the development and growth of major aspects of food science, including production, processing, preservation, distribution, safety, engineering, technology and nutrition. Each of these areas is a vital component not only in the production of commercialized food, but also in bringing added value to it. Putting this science into practice also requires an understanding of broader issues, such as national and global regulations concerning the identity, manufacture, and transport of foods. All food-processing technologies involve a combination of procedures designed to achieve the desired conversion of raw materials. These are conveniently categorised as unit operations, each of which has a specific, identifiable and predictable effect on a food. Unit operations are grouped together to form a process. The combination and sequence of operations determines the nature of the final product.

A comprehensive understanding and appreciation of food technology also offers insights into consumer perspectives and preferences regarding issues such as genetically modified foods, nanomaterials in foods, functional foods, nutraceuticals, and food safety. The successful application of this knowledge is essential in promoting health and wellness through food and nutrition. While traditional food technology deals with major macronutrients and micronutrients, this journal addresses the modern application of phytochemicals from plant foods and herbal medicines to functional foods and dietary supplements. By applying this understanding of the interaction between genetics, nutrition, and lifestyle, there is tremendous potential to develop new food products, which will optimize health based on an individual's unique nutritional needs. This emerging field of food technology, which includes the use of microarray data, is starting to be utilized by government regulatory agencies to combat malnutrition, reduce incidents of food-borne illness, and ensure overall food safety.

International Journal of Food Technology & Nutrition is looking to publish original research findings, breakthrough technology development, as well as innovative and practical applications in food and nutrition that will advance the understanding of human food intake, metabolism, and health. It seeks to publish papers that employ integrated approaches from multidisciplinary sciences including, but not limited to, food and nutrition sciences, food technology, engineering, biomedical and medical sciences, chemistry, physics, biology, biochemistry, agricultural and social sciences. Of particular interest are new research approaches, technologies, and applications in food development, processing, preservation, storage, distribution, waste management, consumer food intake and acceptance, food regulation and metabolism and food and dietary impact on human health and behaviour.

Editor-In-Chief

Prof. Dr. Vullnet Ameti

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Original scientific paper

IMPACT OF SOLAR DRYING ON NUTRITIONAL PROPERTIES OFCERTAIN VARIETIES OF GREEN BEANS

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Abstract

The green beans aresignificant agricultural cropwith good nutritional properties. Usually the young legumes are used for human consumption. In this research three varieties were used such as, yellow, green and colorful butter green beans, from the vicinity of Skopje. The technology of drying was performed in the solar dryer, after application of blanching as a pretreatment. To estimate the impact of the drying process on the nutritional properties, examinations were made for the following parameters: carbohydrates, proteins, oils, water, total dry matter and the energy value. For the fresh green beans was estimated the highest value of total dry matters (11.81 %), for the variety *green molivka*, as well as for the energy value (50.75 kcal). The dried variety of *colorful butter* green beanswas distinguished by the highest value (90.56 %) of total dry matters and the highest energy value (374,85) kcal was estimated in the dried variety of *golden molivka*.

Keywords:green beans, fresh, drying, nutritional properties

1. Introduction

Among the vegetables, the *Fabaceae* constitute a broad and very large botanical family, consisting of more than 450 genera and over 12,000 species. Manyspecies are important as food sources for humans and animals. Beans, a major constituent of this family, are utilized both, for fresh green pods as vegetable and dry seeds as pulse (Yamaguchi *et al.,* 1997). The common bean is an annual plant, grown worldwide specifically for their edible beans. Green beans are a summer vegetable crop with fairly short growing season. There are two main classifications of beans: the edible pod beans and shell beans, and the colors and shapes of each vary tremendously.

The green beans are edible pod beans that can be grown as bush beans or pole (running) beans. They are often referred to as string beans because a fibrous string originally ran along the seam of the bean pod. The string is noticeable when snapping off the ends of the pod. This snapping noise is the reason for its other common nickname, *snap beans* (**http://plantanswers.tamu.edu**). According to the shape, size and the color there are different beannames. Based on the size, the classifications are:small (<25 g /100 seeds), medium (25 g to 40g) and large (> 40g/100 seeds). Regarding the form, the grain can be round,oval, elliptical, rhomboid, kidney-shaped, prismatic andcylindrical (Romero-Arenas et al., 2013). Pods are almost always considerably longer than wide; lengths rangefrom 8 to 20 cm or more, with widths of less than 1 to several cm. Depending on cultivar, pod ends may have a pointed or blunttip; cross-sectional shapes vary from round to elongated oval, and someare heart shaped. The pod color of green beans can be green, golden, purple/red, or even streaked, but the beans inside the pod are always green. Pods of most present-day cultivars are relativelysstraight, although some are normally curved. Most cultivars have light to dark bluish green pods; others are yellow (wax), purple, or multicolored.

The seed number is another cultivar characteristic; most snap bean cultivarscontain three to five seeds; dry or common bean types tend to haveseveral more. Mature seed sizes exhibit enormous variation in size andweight, ranging between 5 and 20 mm in length and the individual seedweight of some cultivars vary from 0.15g to more than 0.80 g. The seed shapes are round, orbicular, ovoid, oblong, and kidney. The seed coat colorsare cultivar-specific, can occur in numerous colors and combinations, and are of some importance.

The harvest decisions for snap beans are based on the stage of the pod development.For high yields, the snap bean pods should achieve maximumlength before significant seed enlargement takes place and while the pod is still succulent.The ideal situation is to have all pods at the same stage of development.For the green beans, it is essential from a nutritional and marketing point of view that the growing pods are harvested at a right stage to optimize the gains with respect to their yield and quality (Saxena et al., 2010).

After harvesting, the green beans need to be cooled as quickly as possible to minimize quality deterioration resulting from the biochemical changes or the respiration (Brosnan and Sun 2001). The snap bean pods have a high respiration rate and should be rapidly cooled to about 5 °C and maintained at 95 % RH. Temperatures less than 3 °C for more than several days need to be avoided because they cause chilling injury. Pod shelf life of acceptable quality for 2-3 weeks is achievable with storing the green beans at 5-10 °C and 95 % RH (Rubatzky et al., 1997).

The shelf life of the green is very short and it can be significantly expanded by different processing techniques, as drying, canning and freezing. Each of these techniques can be used commercially and by domestic approaches. If processed properly and the storage packing is properly sealed, all approaches could produce safe and nutritious processed food with extended shelf life (Sinha, 2011).

The nutritional and biological value of the green beans are determined according to the content of proteins, carbohydrates, oils, cellulose, vitamins and other components. According to the data from USDA-NDL (2009), the following proximate nutritional composition in 100 g of fresh green beans was assessed: water 90.32 g, carbohydrate, by difference 6.97 g fiber, total dietary 2.7 g, protein 1.83 g, total lipid (fat) 0.22 g, ash 0.66 g, minerals as: calcium 37 mg, magnesium 25 mg, phosphorus 38 mg, potassium 211 mg, sodium 6 mg, as well vitamins: vitamin C, total ascorbic acid 12.2 mg, folate, total 33 µg, carotene, beta 379 µg, vitamin A, 690 IU, lutein + zeaxanthin 640 µg, vitamin K (phylloquinone) 14.4 µg and the total energy value of 31 kcal. The vitamins A and C contained in the green beans are excellent antioxidants that reduce the amounts of free radicals in the body and prevent the building up of plaque in the arteries and veins. The green pods are rich source of proteins, minerals and vitamins (Punia *et al*., 2008). The fresh raw green beans are a major vegetable type that consumers purchase for consumption, while processed vegetables in dried, frozen and canned forms are also available.

The green beans can be processed at the domestic level before consumption. The domestic processing brings about a significant change in the sensorial properties and nutritional qualitiesof the vegetables (Kala & Prakash, 2006). The processing consists of a succession of operations combining purely (bio) chemical reactions and physical changes (diffusion or mass transfer), causing quantitative and qualitative changes in the food constituents (Pouillot et al., 2003). It could be highly relevant to the predictions of chemical transformations, with particular losses in micronutrients during the processing of the foods. For instance, the initial concentrations of micronutrients are variable, or chemical parameters should be given with some uncertainty due to the approximation in their estimation (Rigaux et al.,2016). Depending on the conditions applied, the nutritional quality decreases, e.g. amount of nutrients and phytochemicals, although the bioavailability of certain compounds such as carotenes increases (Dekker et al., 2000). The changes in the sensorial properties such as texture and color are assumed to be controlled during the processing to meet appropriate sensory preferences, to be acceptable for consumption.

Drying can be described as an industrial preservation method in which water content and activity of fruits and vegetables are decreased by heated air to minimize biochemical, chemical and microbiological deterioration. The major objective in drying of the agricultural products is the reduction of the moisture content to a level that allows safe storage over an extended period of time. Also, it causes a substantial reduction in weight and volume, minimizing packaging, storage and transportation costs (Doymaz, 2004).

The most common drying method for vegetables in the world is open air-sun drying. This drying technique has some disadvantages: Its' time-consuming, causes exposure to environmental contamination, and requires significant manual labor. Furthermore, the direct exposure to a solar radiation results in undesired color changes. In addition, the quality of the dried products may be significantly lowered. Therefore, using solar and hot air dryers, which are far more rapid, and provide uniformity and improved hygiene, are inevitable for industrial food drying processes (Doymaz & Pala, 2002; Karathanos & Belessiotis, 1997).

2. Materials and methods

Although the green beans, as a leguminous vegetable have good nutritional properties, there a lack of scientific data for nutritional composition of different varieties of green beans, especially in Macedonia. Therefore, the main goal of this paper is to estimate some nutrients in the fresh pods of the most common used green beans, as well as their changes due to the application of the drying process.

In this research were used pods of three varieties of green beans (*golden molivka, green molivka and colorful butter* green beans), produced by individual farmers at the villages in the vicinity of Skopje. The fresh pods of all of the examined varieties of the green beans were measured in their length and width, as well their sensorial properties (appearance, color, taste and smell) and nutritional composition.

The drying process was performed at home conditions. For that purpose, young healthy and fresh pods of green beans were used, without mechanical damage, where the ends were cut off. Than the pods were washed with clean water and each pod was cut into 2 to 3 pieces and placed in a pot of boiling water for blanching, at a temperature of 85 ºC for 5 minutes. Blanching helps the beans to dehydrate quicker. It releases some of the juices and stops enzyme actions.Then, the pods were plunged into cold water in order to stop the cooking process, and were drained afterwards. The sensory evaluation (appearance, color, taste and smell) was performed on the blanched pieces of green beans.

The process of drying is performed to evaporate the free water in order for the microorganisms to become disabled, and to decrease the weight and the volume of the pods. At the same time, the amount of dry matter increases, which increases the all nutrient components. The home drying oven was used to dry the already prepared pieces of pods green beans, for all examined varieties. The drying was performed at a temperature of 60 – 70 °C, for 5 hours and then the temperature was reduced to 40 – 50 °C. During the drying process, the pieces of the green beans were frequently stirred and turned over. The dried green bean pieces were packaged and stored in airtight containers.

The dehydrated pieces of green beans were tasted to estimate their sensorial properties (appearance, color, taste and smell) and evaluate the same nutritional components as in fresh ones: water and total dry matters, by using drying ovens, at a temperature of 105 °C, to a constant mass; proteins by Kjeldahl method; lipids by the Soxhled method (Vračar, 2001); total carbohydrates were calculated, by the determined values for proteins, lipids and the content of water; the total energy value represents the sum of the energy value of proteins, fats and total carbohydrates, expressed in calories (kcal) or kilojoules (kJ). The applied methods were standard laboratory methods, with proved statistical precision, accuracy and repeatability of the results.

3. Results and Discussion

By measuring the length and the width of the pods, it was estimated that the variety *golden molivka*had a width of 0.8 to 1 cm and a length of 10-13 cm; the variety *green molivka*had a width of about 1 cm, with a different length of 14 - 18 cm and the *colorful butter* green bean pods were characterized by a width of 1 to 1.5 cm, with a length of 12 to 15 cm. Comparing to literature data from other research, (Ljubosavljević, 1989), these three varieties are characterized with: 12 to 15 cm in length and about 1 cm in width for g*olden molivka*; 1 cm width and length of 14 - 18 cm for *green molivka*; length of about 10 cm for *colorful butter* green beans.

According to the estimation of the sensory properties of the fresh varieties of the green beans, the pods of the variety *golden molivka*, in fresh condition were characterized by a golden-yellow color, poorly expressed aroma and typical taste of green beans, with straight, roundshape, with poorly expressed aroma, fragile and juicy. The blanched pieces of the green beansof this variety got softer, their color did not change, but their aroma and taste became weaker. By drying, the pods became solid, without special taste and aroma. The yellow color turned to yellow-brown. The fresh pods of the variety *green molivka*had green color, with a distinctive flavor and taste for green beans that are poorly expressed, round and straight in shape, fragile and juicy. After blanching, the podsgot softer, without changing of color, and the taste and the aroma were of a lower intensity. The dried pieceswere characterized by yellowish green color, with almost no flavor and taste. The fresh variety of the *colorful butter* green beans pods were flattened in shape, straight, fragile and juicy, with a flavorless taste and a weak characteristic aroma. The pods were yellow, with anthocyanin spots. After blanching for 10 minutes, the anthocyanin spots disappeared, the color became yellowish gray, the pods became soft, and the flavor and the taste were even weaker. It is interesting to note that if the process of blanching lasts 3 to 4 minutes, the anthocyanin spots remain unchanged. The dried pieces became solid, with retained color and shape, more so than the other two varieties.

To estimate the total nutritional value of the examined samples of fresh, blanched and dried green beans the following parameters were analyzed: water, total dry matter, total carbohydrates, proteins and oils. For obtaining the energy values, the calculations were made according to the content of essential nutrients and the results were expressed in kcal or kJ.

In the Graph 1 below are presented the results obtained from all examined samples of varieties and conditions of the green bean pods. The fresh pods of the green beans were characterized by the highest values for: the total dry matters (11.81 %) and total carbohydrates (8.10 %) in the variety *green molivka*; the protein (3.78 %) and oils content (1.24 %) in pods of the variety *golden molivka*. The lowest value of total dry matter (9.75 %) had been noticed in the variety colorful butter green beans, which means that the water content (90.25 %) had the highest value.

The results from examination of blanched pods of green beans shows that the variety *colorful butter* had the lowest value of total dry matter (6.90 %) or the highest value of water content (93.10 %). On the other hand, the variety *green molivka* had the highest values for the total dry matters (10.80 %) and total carbohydrates (7.84 %), while the highest values for proteins (3.12 %) and oils (0.78 %) were measured in the variety *golden molivka.*

From the Graph 1 it can be noticed the highest values for the dried pieces of green beans as following: the total dry matters (90.56 %) and total carbohydrates (69.17 %) in the variety *colorful butter* green beans; the proteins (24.26 %) and oils (1.08 %) in the variety *golden molivka.* Despite this, the variety green molivka had the lowest value (89.75 %) of total dry matter, what results the highest content of water (10.25 %).

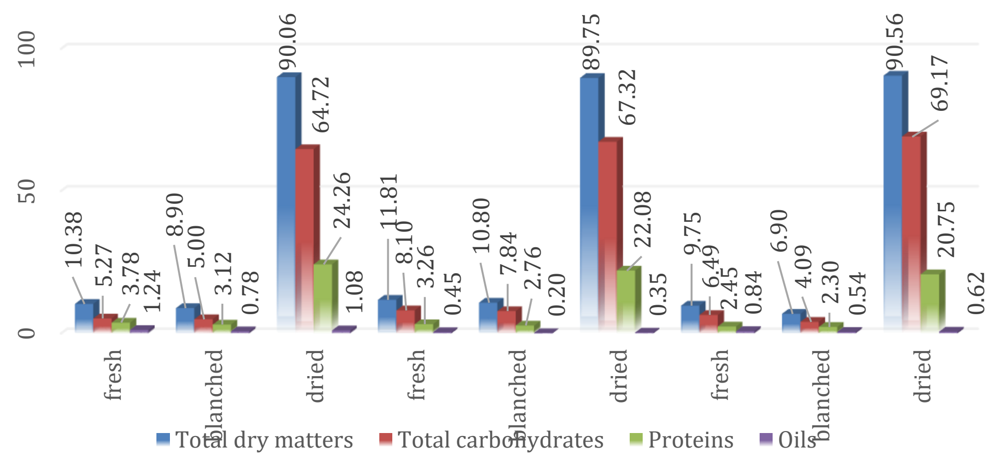

Figure 1. *Nutritional value ing/100 g of the examined varieties of green beans*

In terms of the nutritional properties of the examined varieties presented in Graph 1, it is noticeable that the pods of *golden molivka* variety had the highest content of proteins (24.26 %) in dried pieces and oils (1.24 %) in the fresh pods of green beans. The variety *colorful butter* green beans had the highest values for water content (93.10 %) in blanched pods and the highest values for total dry matter (90.56 %) and total carbohydrates (69.17 %) in dried pieces of green beans.

Based on the obtained results for nutrients composition, the energy values were empirically calculated (Graph 2.) for all of the varieties of green beans that were analyzed in this research. The highest energy value had the fresh pods of the variety *green molivka* (50.75 kcal or 212.46 kJ) and also the blanched ones with 45.31 kcal or 189.69 kJ; the dried pieces of the variety *golden molivka* had the highest energy value 374.85 kcal or 1569.16 kJ and the colorful butter green bean had almost similar energy value (374.48 kcal or 1567.64 kJ).

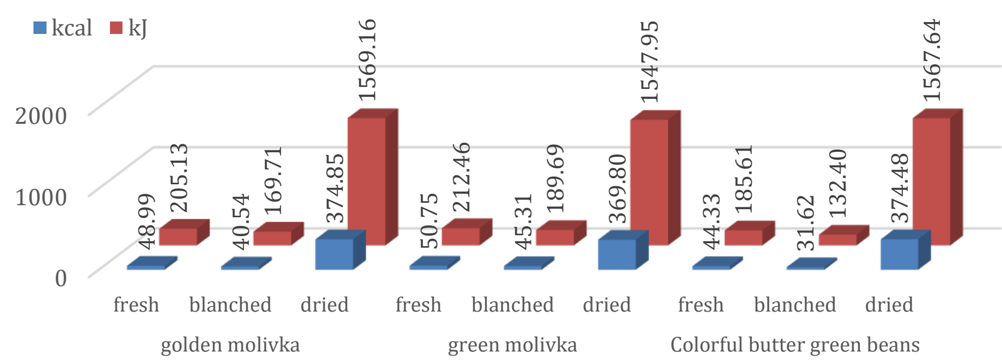

Figure 2. *Energy values in g/100 g of the examined varieties of green beans*

The highest difference in the content of the total dry matter between the fresh and the blanched pods (2.85 %) and between the fresh and the dried pods of 80.10 % had the variety *colorful butter* green beans. Among the dried varieties, the difference of the total dry matter was the lowest (0.31 %) between the *golden molivka* and *green molivka*, and the highest (0.81 %) between *green molivka* and *colorful butter* green beans.

Taking into the account the fact that in the content of total dry matter are included all nutrients that participate in the energy value of the food, similar differences were estimated between the examined varieties. The variety *colorful butter* green beans had the highest difference of the energy values (12.71 kcal) between the fresh and the blanched pods, as well as between the fresh and the dried ones (330.15 kcal). In terms of the varieties of dried pods, the lowest difference of the energy values (0.37 kcal) was estimated between the *golden molivka* and the *colorful butter* green beans. Unlike this, the highest difference (5.05 kcal) was estimated between the *golden molivka* and *green molivka*.

4. Conclusions

According to the results in this research, it can be concluded that all of the examined varieties of fresh and dried green beans had a nutritional composition with satisfactory content of the essential nutrients, as well as the energy values.

It was estimated that the dried green beans had low percent of water content, about 10 %, which means that the rest of the content is the total dry matter. In the content of the total dry matter are included all of the nutrients, from which the most are total carbohydrates, then proteins, while the content of oils is significantly low. Comparing the content of nutrients and energy values of the fresh and the blanched pods of green beans, all of the examined dried varieties had the highest obtained values. The highest values (90.56 %) of total dry matters had the pods of dried variety *colorful butter* green beans. The dried pods of the varieties *golden molivka* and *colorful butter* green beans had almost similar estimated high energy values 374.85 kcal and 374.48 kcal respectively.

The advantage of the dried green beans is that they can be stored for a longer period of time, even up to 2 years. Despite its advantages, dried green beans are poorly used in our country despite the fact that we have excellent growing conditions.

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Original scientific paper

RESEARCH OF SEVERAL HYBRIDS OF CORN FROM THE REGION IN THE AGRO-ECOLOGICAL CONDITIONS OF KOSOVO

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Abstract

The research of seven maze hybrids from Croatia was performed during 2011/2012 and 2012/2013 by comparing the hybrids with their characteristics that belong to the FAO group. The research was performed in important cultivating regions of Kosovo that is in the research fields of Agricultural Institute of Kosovo in Peja and in Pestova – Plain of Kosovo. The agro climatic and pedology conditions of Kosovo, compared to the obtained yields in the maze indicate that one that does not use the full genetic potential of the hybrids that are cultivated in Kosovo. Due to this reason, a new genetic potential was used into this study. The obtained results indicate that the hybrids cultivated in the fields of Pestovo provide a yield that in other attributes like stem and husk is better than maze cultivated in the fieldsof Peja. From the studied hybrids, Jumbo 48KR indicated more favorable attributes, the other hybrids indicated average attributes, while the lowest was observed with the hybrid BC 288 BKR.

***Keywords*:** yield, Jumbo 48 KR, protein content, fat content.

1. Introduction

The corn (Zea mays L.) represents one of the most important crops. In Kosovo, the surfaces that are used to cultivate this culture reach 70.000-80.000 ha per year, which represents around 32.27% of the arable land (Fetahu, 1998, Aliu et al, 2008). In the last period, the average yield of the corn is rather low and it ranges between 4.0 – 5.0 t/ha (Montgomery et al, 1970, Salilari et al, 2000). The yield as a main characteristics of the culture is conditioned not only by the corn genotype, however it also depends in the external conditions (Andriç et al, 2006, Berkiç et al, 2006, Musa, et al, 2003), other factor is that the corn requires a high level of nitrogen, whereby the kernels require 20-25 kg per ton (Muzilli & Oliveira, 1992; Sangoi et al, 2001). Higher immobilization and lower mineralization may contribute to decrease N availability in no-tillage maize during the crop establishment (Ernani et al, 2002).

The success of genetic improvement of maize yield depends on several factors such as initial sources of genes, improvement method, and types of the gene actions involved in yield control, inheritance and genetic control of related traits such as capacity of production (Rezaei et al, 2004). Biomass accumulation in kernels begins shortly after fertilization and can be represented by a sigmoidal pattern in which a lag and a linear growth phase can be distinguished (Duncan et al, 1965).

In general, the agro climatic and pedology conditions of Kosovo, compared to the obtained yield in corn, indicate the lack of utilization of full genetic potential of the hybrid varieties that are produced in Kosovo, therefore this study will serve as additional impetus to increase the production of various corn hybrids that originate from the region.

2. Materials and methods

The study was performed in the span of two years (2011/2012 and 2012/2013) whereby the first studied various corn hybrids from Croatia (BC 288 BKR, BC 354, BC 394 KR, BC 5982, BC 408, BC 418 BKR and Jumbo 48 KR) with the aim of determining the adaptation to the agro climatic conditions and possible introduction in the national list of Kosovo.

The evaluation was conducted at two different localities of Kosovo known for different agro climatic and pedology characteristics (Peja - Research Station of Kosovo Institute of Agriculture and Pestova - private agriculture company). The experimental design was a complete randomized block design in three replications (Berzsenyi & Lap, 2004). Each hybrid was sown in plots 10 m long and 0.7 m wide with 1m space distant each other. Previous crop in trials set up in Peja was winter wheat, while in Pestovo was potato. The sowing was done manually within optimal time (third decade of April) in both of localities, with the sowing distance of 25cm within a row according to the FAO group of maturity each experimental plot received the following amount of fertilizer: 350 kg/ha (NPK 10:30:20), as a basal application, 150 kg//ha (Urea) and 50 kg/ha (KAN) respectively, split in two top dressing application, in both of respective localities, evaluation has been performed in the field (plant height, the height of the first cob within the plant and cobs number/plant),and in the laboratory conditions (grain yield, crude protein content), according to the ISTA regulations (International Seed Association ,1996). The obtained data were statistically processed using MSTAT-C program (Crop and soil sciences Dept., Michigan St. Univ., USA).

3. Results and Discussion

From the Table 1 we observe that the height of the plant and the positioning of the first husk in the plant was the highest with the hybrid JUMBO 48 KR and the height of the plant 245±2.08 cm in Pestova, respectively 236±2.24 cm in Peja, whereas the height of the first husk was 109±1.25 cm in Pestova, respectively 104±0.85 cm in Peja, while the lowest height of the plant was observed with hybrid BC 288 BKR with 220±2.50 cm in Pestova, respectively 202±2.10 cm in Peja, also the lowest height of the first husk was observed at hybrid BC 288 BKR 92±1.26 cm in Pestova, respectively 83±1.06 cm in Peja. In addition, from the Table 1 clearly wecan observe that in general all the hybrids that were cultivated in Pestova indicate more favorable attributes. The highest number of husks per plant is observed at hybrid BC 288 BKR with 1.4±0.55 it was the same for Pestova and Peja, whereas other hybrids yielded lower number of husks.

Table 1. The height of the plant, the height of the husk and their number per plant at the researched corn hybrids

Hybrid	Location	The height of the plant (cm)	The height of the husk (cm)	Number of husks
BC 288 BKR	Peja	202±2.10	83±1.06	1.4±0.55
	Pestova	220±2.50	92±1.26	1.4±0.55
BC 354	Peja	225±2.86	88±2.02	1.2±0.25
	Pestova	237±1.60	94±1.04	1.2±0.32
BC 394 KR	Peja	220±2.00	90±1.65	1.3±0.13
	Pestova	237±3.05	95±1.45	1.3±0.35
BC 408B	Peja	218±1.00	93±2.60	1.3±0.38
	Pestova	228±1.08	98±0.68	1.3±0.14
BC 418 BKR	Peja	227±2.55	99±1.58	1.2±0.56
	Pestova	239±3.50	104±1.02	1.2±0.28
BC 5982	Peja	220±2.16	95±0.58	1.2±0.20
	Pestova	232±3.08	105±2.06	1.2±0.18
JUMBO 48 KR	Peja	236±2.24	104±0.85	1.2±0.26
	Pestova	245±2.08	109±1.25	1.2±0.22

From theTable 2weobserve a great diversity between the observed corn hybrids regarding the length of the husk, the number of circles in the husk and the number of kernels in the husk.

The largest length of the husk is indicated at hybrid JUMBO 48 KR with 25.0±0.96 cm in Pestova, respectively 23.5±0.85 cm in Peja, while the shortest length is indicated at hybrid BC 288 BKR with 20.0±1.12 cm in Pestova, respectively 19.5±0.85 cm in Peja.

Number of rows of kernel also indicates pronounced variations at the researched hybrids of the corn. The highest value is indicated at hybrid BC 5982 with 17±0.45 in Pestova, respectively 16±0.20 in Peja, while the lowest number is observed at BC 394 KR me 13±0.17 in Pestova, respectively 12±0.35 in Peja.

Regarding the number of kernel in rows the highest value is observed at hybrid BC 394 KR with 55±1.35 in Pestova, respectively with 52±1.01 in Peja, while the lowest is with hybrid BC 288 BKR with 42±0.55 in Pestova, respectively with 39±0.56 in Peja.

Table 2. The obtained values of husk parameters, at the researched hybrids

Hybrid	Location	The length of the husk (cm)	Number of rows	Number of rows in the husk
BC 288 BKR	Peja	19.5±0.85	16±0.40	39±0.56
	Pestova	20.0±1.12	18±0.36	42±0.55
BC 354	Peja	21.5±1.04	14±0.26	44±0.90
	Pestova	22.5±0.96	16±0.45	46±0.60
BC 394 KR	Peja	23.0±0.95	12±0.35	52±1.01
	Pestova	23.0±0.96	13±0.17	55±1.35
BC 408B	Peja	23.0±0.85	14±0.44	47±0.86
	Pestova	23.5±1.22	16±0.55	51±0.56
BC 418 BKR	Peja	23.5±1.11	14±0.46	49±1.20
	Pestova	24.5±0.76	16±0.40	51±0.95
BC 5982	Peja	20.5±0.85	16±0.20	41±1.26
	Pestova	21.0±0.44	17±0.45	45±0.68
JUMBO 48 KR	Peja	23.5±0.85	12±0.35	48±0.80
	Pestova	25.0±0.96	15±0.18	52±1.08

Table 3. The yield that was obtained at researched corn hybrids

Hybrid	Location	Yield kg/crop	Yield t/ha	
			With cob	kernel
BC 288 BKR	Peja	16.2±1.75	9.8±0.76	7.9±0.85
	Pestova	18.0±1.73	11.1±0.73	8.9±1.20
BC 354	Peja	17.0±0.87	11.5±1.16	9.6±1.10
	Pestova	18.3±2.02	12.2±1.31	10.2±1.42
BC 394 KR	Peja	15.5±1.50	10.2±1.81	8.5±0.92
	Pestova	17.5±2.29	11.5±0.96	9.6±2.46
BC 408B	Peja	15.2±1.04	10.1±0.94	8.4±1.31
	Pestova	17.5±3.91	11.5±1.47	9.5±1.14
BC 418 BKR	Peja	16.5±1.50	11.0±1.32	9.0±0.87
	Pestova	21.3±6.03	13.1±0.95	10.7±0.85
BC 5982	Peja	15.6±1.61	12.3±1.11	10.2±0.96
	Pestova	17.8±1.76	13.8±1.35	11.4±1.32
JUMBO 48 KR	Peja	17.5±2.78	11.5±1.57	9.6±0.82
	Pestova	21.6±3.51	13.9±1.25	11.6±1.02

From the Table 3 we observe that all the studied hybrids indicate a high yield, respectively the highest yield expressed in kg/crop has hybrid JUMBO 48 KR with 17.5±2.78 kg/crop in Peja and 21.6±3.51 kg/crop in Pestova.

Nevertheless, as it is common, the yield is calculated in unit t/ha taking into account the weight of cob and kernel, based on this a higher yield expressed in t/ha with cob and kernel is observed at hybrid BC 5982 with 12.3±1.11 t/ha in Peja and 13.8±1.35 t/ha in Pestova both taking into account the cob, whereas with kernel only with 10.2±0.96 t/ha in Peja and 11.4±1.32 t/ha in Pestova, a similar yield is observed with hybrid JUMBO 48 KR, whereas a lower yield was observed with hybrid BC 288 BKR with 9.8±0.76 t/ha in Peja and 11.1±0.73 t/ha in Pestova with cob and 7.9±0.85 t/ha in Peja and 8.9±1.20 t/ha in Pestova with kernel, a lower yield was observed with hybrid BC 408 B.

Protein content at the studied hybrids is variable as observed in graph 1, it is higher at hybrid BC 94 KR that is 15.3% for the Peja region and 14.7 for Pestova, the hybrid JUMBO 48 KR also has a higher protein content of 14.2% in Peja and 13.9% in Pestova, while lower content is observed with hybrid BC 408B with 11.0% in Peja and 11.9% in Pestova. In general, the hybrids that are cultivated in the region of Peja indicate a higher content of protein compared to those cultivated in the location of Pestova. We consider that this happened as a result of reaction of various genotypes of the corn hybrids with the more favorable agro climatic conditions for the researched varieties in the region of Peja.

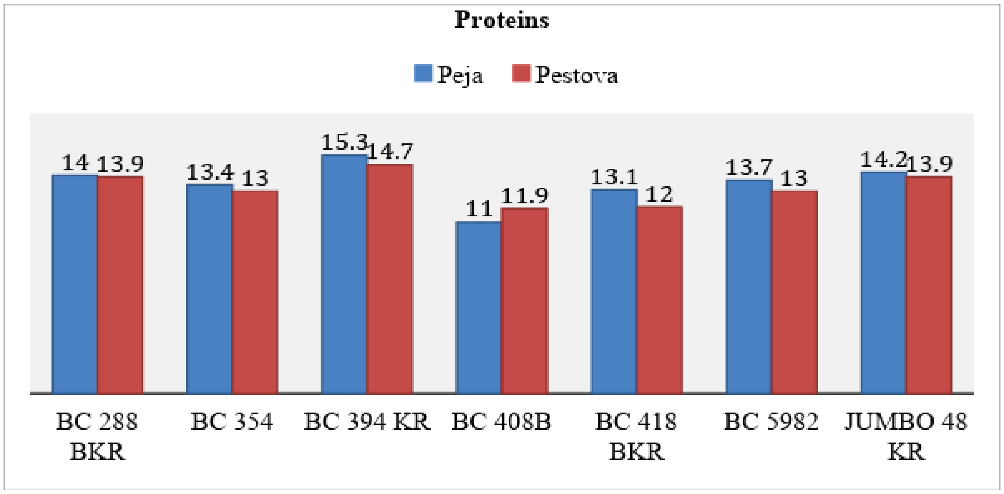

Figure 1. Protein content in (%) at various corn hybrids

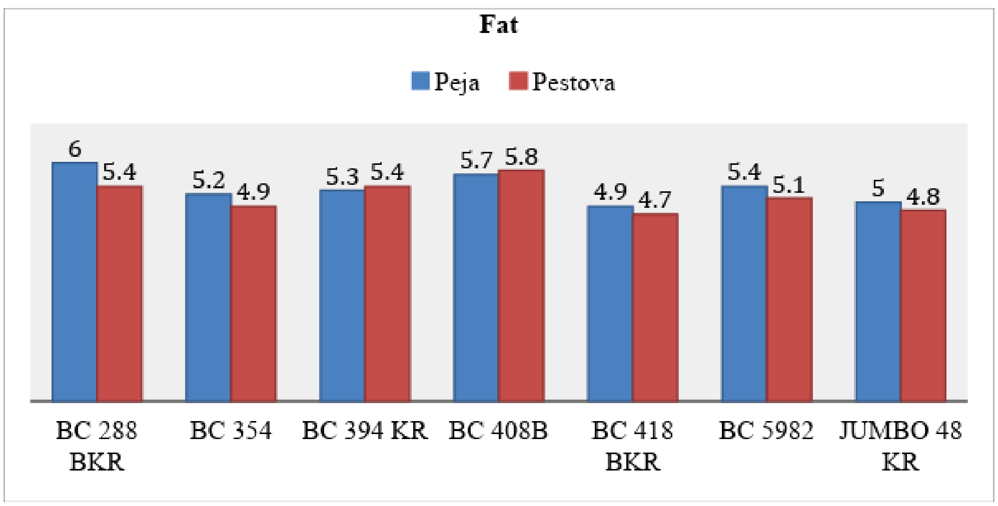

Figure 2. Fat content in % at the various corn hybrids in the researched locations

Regarding fat content expressed in % at the researched corn hybrids, differences in various locations were observed. Generally speaking, the cultivated hybrids in the location of Vushtrri – Pestova indicated a lower fat content in their kernel. Hybrid BC 288 BKR has a higher fat content with 6.0% in Peja and 5.4% in Pestova, then it is hybrid BC 408 B with 5.7 % in Peja and 5.8% in Pestova, whereas lower fat content is observed at hybrid BC 418 BKR with 4.9% in Peja and 4.7% in Pestova.

4. Conclusions

Based on the obtained results from the research crops with corn in the Plain of Dukagjin – Peja and in Plain of Kosovo – Pestova, we can conclude as follows: the height of the plant as well as the height of the positioning of first husk in the plant is the highest at hybrid JUMBO 48 KR. Regarding the length of the husk, the number of circles inside the husk and the number kernel rows in husk, the hybrids BC 5982 and JUMBO 48 KR indicate better results. Regarding the obtained yield at the researched hybrids based on the locations, higher yield is obtained in the location of Pestova compared to the location of Peja, whereas a higher yield is obtained with hybrids BC 5982 and JUMBO 48 KR. In major part of the cases, the cultivated hybrids in the location of Peja have a higher protein content, whereas the hybrids with higher content are BC 394 KR and JUMBO 48 KR. Hybrids BC

288 BKR and BC 408 B have a higher protein content, whereas the majority of the hybrid cultivars cultivated in location of Peja have a higher protein content.

Recommendation

Location of Pestova was more suitable for the production of hybrids, even though more favorable chemical content is observed with varieties cultivated in location of Peja, whereas hybrid JUMBO 48 KR adapted more favorably in both locations.

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Original scientific paper

THE EVULATION OF PHENOTYPIC VARATION OF NATIVE POPULATIONS OF THE BEAN IN MACEDONIA

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Abstract

The genetic variation is a raw material for the improvement of plants and one of the important components of every ecosystem or agricultural system generator (Pham 2000). Using this we can come to the development of lines, hybrids, the improvement of population, the development of synthetic cultivars with high frequency of desirable genes for yield, quality and resistant towards environmental stresses. As much as diversified is the spectrum of genetic variation, the higher is the frequency of desirable genes manipulation in the genetic backgrounds of the new appearance of plants. (Saavedra, 2002). The genetic plant variation can be accounted in the phenotypic and molecular level using different methods and techniques (Wouw 1999, Kearsey 2000). The amount of phenotypic variation is important not only in using breeding programme for the improvement or development of new genetic make-up of plants, but also for better understanding the role of flora in a practical and useful environment. Practically, the evaluation of phenotypic variation is simpler than the evaluation of molecular variation. Even if the morphological variation is highly influenced by the environmental conditions, it doesn't give a clear scene of the real genetic variation that exists among and between different genotypes of a population, and morphologic markers are used for the characterization of germplasm. For identification of genetic variation are used different methods. All of them are based on the differentiation of polymorphisms that exist between different genotypes. Either these polymorphisms might be qualitative or quantitative. Usually the phenotypic plant variation is assessed to rank and weigh or quantify phenotypic differences that exist between individuals of a population, between and among species. Through the estimation of phenotypic variation, genotypes are classified in different groups in order to facilitate the planning of crossing among plants in a breeding programme. The need of genetic diversity is increasing as is the need for food. It is also essential for a sustainable development of agriculture which adapts according to the environmental alternation, and continuous functioning of biosphere regarding mankind survival. As the other plants, existence of genetic variation in the bean is an important component for a successful programme application for genetic development that aim the improvement for characters as the number of beans per pod, protein content, resistance to drought and other environmental stresses. This study aims to identify genetic diversity of native bean populations using morphological polymorphisms, as well as their relation will be determined through the different statistical analysis, creating the possibility of estimation of their evolutive and philogenesys history.

The Pollog area is opulent with genetic bean resources. Its geographic position, climate and the landscape have enabled this zone the cultivation of autochthon plants a long time ago, not only for genetic development but also for the cultivation of different agricultural plants. Owing to good and edaphically climate as well as the microclimate and habitat of this zone, the genetic variation can be easily detected by local farmers. In this study, the most important is the evaluation of genetic variation between the local varieties for agronomic traits. The target of this study generally is based on the evaluation of the collected populations in the field conditions.

Keywords **:** phenotypic variation, hybrids, geographic position, environmental stresses

1. Plant material and methods

As a plant material of this research are used 22 autochthon populations of bean with an early, secondary and dilatory cycle, collected in Pollog area, generally in the villages and suburbs of Tetova, Skopje and Gostivar (fig.1). As we can see in the figure below, most of the population (63.6%) are collected in the areas of Tetova.

The research for the realization of this study is focused on the evaluation of the autochthonous population of beans in field conditions. The region where the collection is conducted is approximately 450-500m above sea level. The air average temperature in the Pollog's area is 11.3°C.

The highest temperatures are recorded in August (average temp. of air is 22.2°C), and the lowest temperature is recorded in January (with average temp. of air 0.3°C). The average amount of rainfall in Pollog area is 700-1000 mm per annum, but the most of the rainfalls are in autumn and winter seasons and less in summer time. The soil is of deep subsoil, full of nutrient, as well as necessary microelements for normal growth and breeding of the bean crop. The trials are conducted in the plots of the Xhepçishte village (Pollog area). Precautions of the vegetables are done being based on the cultivation technology of this plant.
For the estimation of the genetic diversity existing between and within the collected autochthon bean populations are used several descriptors (Villa 2006, Hazekamp 2000), taking into account: the sowing date; the number of days until sprout, the leaf color in three stages of growth; the leaf shape; the leaf durability; the stem diameter; the stem length; the stem shape; the vegetable type; the number of days until flowering; the flowering duration; the number of flowers per plant; the color of flowers; the size of the flower bud; the shape of the pod; the thickness of the pod; the pod width; the length of the pod; the color of the (immature) pod; the color of the mature pod; the number of the days while harvest maturity; the number of days while physiological maturity; the droop of the pod; the number of the pods per plant; the number of the beans in pod; the beak shape of the pod; the beak length in mm; the position and orientation of the pod's beak. As morphological characteristics of the seed evaluated are: the shape of the seed; the color of the seed peel (film); the brightness of the seed peel; the weight of 1000 seeds; the length of the seed in mm; the width of the seed in mm; the thickness of the seed in mm and the ratio length: width. For every character, measurements are made in 10 plants within the variant and the average is computed, which is used not only to estimate the differentiation among the populations, but also for statistical analysing genetic variation models.

The elaboration of data for the identification of the variation source for each feature is made one-way variance analysis. The analysis of data is based on the scheme of the complete random block, using some different statistical softwares for elaboration of data in order to specify and alleviate their interpretation (Sobral 2000).

2. Results and discussion

According to the autochthonous populations of the white bean in Pollog area it comes to a conclusion that the populations differ a lot from each other in many characters with agronomical importance. It is thought that huge roles have played the factors of the external ambient of the microclimatic zones in which place they are cultivated, as well as the selections of the farmers living in the local areas. The areas in where these populations are cultivated have different climatic and edifice amplitudes as well as in some ways they are isolated from each other throughout geographical barriers. As these populations are specific for particular areas, their exchange or transferral to other growing areas of this territory did not happen or it happened but in a small amount that were unable to cause big recasts in genetic vectors of the phenotypic variation.

The evaluation of the phenotypic polymorphisms for plant and grains descriptors. Considering the phenotypic polymorphisms, it is possible to make the differentiation of the autochthonous bean populations (Toll, 1995). As a result of the variance analysis, it proves that there are genetic differences confirmed by statistical way for plant's characters (Tab. 1) among the bean populations.

Tab.1 The variation analysis for plant's features.

Variation source	Square sum	Degree's at large	Square average	Score F.	Table F.
The populations	1579.91	12	131.66	1.93	1.89
The features	190004.1	6	31667.35	392.40	2.23
Lapse	5010.59	72	67.90		
sum	197394.6	90			

Also for the kernel descriptors ensues a genetic variation confirmed by statistical way, offering more chances for the breeders of this plant, to manipulate slightly and successfully the characters of the plant, which are very important for the cultivating aspect as well as refining.

Tab.2 The variation analysis for grains characteristics

Variation source	Square sum	Degree's at large	Square average	Score F.	Table F.
The populations	321306	12	26775.48	2.04	1.87
The features	5608137	7	801162.4	61.18	2.12
Lapse	1099923	84	13094.32		
Sum	7029365	103			

Also there are observed a lot of phenotypic distinctions for the characters separately taken. The characters with the bigger variations (tab.1), such as the number of the kernels per plant, the weight of 1000 kernels, the product and the number of pods create more chances for the breeders of this plant to create different or mediatorial ways of markets of the new genetic off-springs. But other characters such as the stem diameter, the number of the flowers per plant, the thickness of the seed, doesn't show a big breeding potential, apart from the aspect that such characters do not show any special interest for plant's breeders.

One of the characters, which represents one of the objectives of the breeding programme of the bean for the improvement of the product's components, is the number of the kernels per pod (Swami Nathan 2002, Li, etc., 1998). According to elaboration of the outcome data throughout the evaluation of this character from the collected populations ensues that there is no genetic difference which could be considered by the breeders. Also, for the improvement of this character, the collected populations do not show any special value from the individual point of view, therefore, the breeders have limited chances if they use as a genetic material in their programme only these populations.

Table 3. The variations for the major characters

No	Features	Variant
1	Vegetative Cycle	93.677
2	Log's diameter	1.019
3	Number of bines per flower	1.450
4	Pod's length	4.418
5	Pod's width	7.192
6	Pod's number	618.847
7	Grain's number per pod	1.108
8	The weight of 1000 grains	34410.9
9	Grain's length	17.340
10	Seed's thickness	1.258
11	Grain's width	3.450
12	Pod's	2.994
13	The production	24975.6

Tab.4 The coefficients of the correlations for the plant's characters

Features	Veg.cycle	Log's diam	No.bine p.fl.	Stub's length	Stub,s width	Stub,s thickness	Stub,s no
Veg.cycle	1						
Log's diam	0.599	1					
Nr.of bines per Fl.	0.543	0.32	1				
Stub's length	0.756	0.46	0.390	1			
Stub,s width	0.487	0.83	0.519	0.47	1		
Stub,s thickness	0.418	0.72	0.386	0.54	0.85	1	
Stub,s no	0.298	-0.05	0.464	0.00	0.06	-0.02	1

The evaluation of the relationship between plant and seed characters. On behalf of the usage of the autochthon populations in the programs of bean breeding is the exploration of correlations between some major characters (Tab.4 and 5). In general, the correlation coefficients for plant's characters prove positively but the correlations are not so strong excepting the correlative links between pod's length and vegetative cycle, the pod's width and the diameter of the stem as well as the thickness of the pod and the log's diameter and thickness of the pod and the width of the pod. In the programs of breeding which aim the improvement of the vegetative cycle is helpfully to take into consideration the length of the pod; in order to abbreviate the vegetative cycle, we have to select the plants with short pods because the correlative linkage between these two characters is positive.

In general, the correlative relations among the seed's characters ensues weak excepting the correlative linkages between the production and weight of the 1000 kernels and the production and thickness of the seed. Even though it is not a strong linkage, it is assumed that also the linkage between the seed's thickness and length could be taken into consideration during the explorations and breeding of this crop plant. It ensues from the table 5 that if the breeders aim the production's expansion of the white bean by using in their programs for genetical improvements genetic autochthon materials of Pollog area, their program's priority or objective have to be the weight of 1000 kernels.

Tab.5 The coefficients of the correlations for the kernel's characters

The features	Nr. of grains. per plant	The weight of 1000 gr.	Length	width	thickness	Therep. Thick. /width	Produc
Nr. of grains. per plant	1						
The weight of 1000 gr.	0.61	1					
Length	0.09	0.08	1				
Width	0.07	0.21	0.18	1			
Thickness	-3	0.18	0.57	0.48	1		
Therep. Thick. /width	0.10	-0.23	-0.37	-0.20	-0.42	1	
Production	0.41	0.76	0.47	0.39	0.66	-0.36	1

4. Conclusion

Pollog area is rich in genetic variation of autochthonous white bean, which comprises a valuable genetic resource for the breeding and cultivation of this crop plant.

The greater genetic variation exists especially for quantitative characters and, mainly for the production and its components.

Most of the populations could be used as parental components in various schemes of genetic improvement, not only for the white bean cultivation with high productive capacity, but for the improvement of those that already exist in local area.

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Original scientific paper

THE PRODUCTION OF BEANS' FEATURE WHICH IS INFLUENCED BY THE ENVIRONMENT

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Abstract

The production is a complex feature of the result of many functions of plant growth, and its quantitative feature, which is heavily influenced by the environment. Environmental effects may be different. Thus, the output can change for the same population from one environment to another. The supremacy of one population compared to other populations, the potential is estimated in the framework of manufacturing and of other indicators of desirable agronomics. Production capacity, as all other quantitative features can be measured and presented with a continuous variability around an average value, where the variability between all values is continued. For this reason, the production capacity can be called a continuing feature. Recently many researches have been made regarding the legacy of elements of the production; the results obtained should not be considered as final, partly due to phenotypic plasticity of these traits. It should be emphasized that the production is base target for each genetic improvement program of beans, because they pose the interests of its cultivation. For the studied populations turns out a considerable genetic variation for producing. And the production values for plant from one population to another vary, ranking from 113 to 540 gr / plant. Even this feature variance is the largest 20034.23 significant indicator of genetic diversity that exists among the populations studied. Based on these values, we can say that it will serve as source of populations where genetically are used various programs for improving the genetics of the production

Key words: production, beans, environment, improvement, variation.

1. Materials and methods

As a vegetative material of this research are used 22 autochthon populations of bean with an early, secondary and dilatory cycle, collected in the Pollog area, generally in the villages and suburbs of Tetova, Skopje and Gostivar (fig.1). As we can see in the figure below, most of the population (63.6%) is collected in the areas of Tetova.

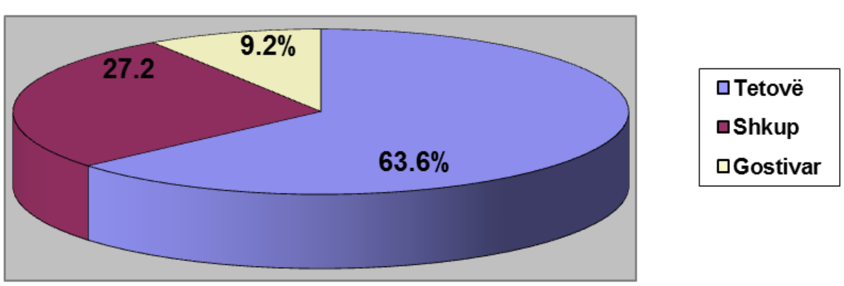

Figure 1. The populations collected in Pollog area

The research for the realization of this study is concentrated in the evaluation of the autochthon population of beans in field circumstances. The zone where the study is performed is approximately 450-500m above sea level. The air average temperature in the Pollog's zone is 11.3°C. The highest temperatures are in August (average temp. of air is 22.2°C), and the lowest temp. is in January (with average temp. of air 0.3°C). The average quantity of rainfall in Pollog area is 700-1000 mm per annum, but the most of the rainfalls are in autumn and winter seasons and less in summer time. The soil is of deep subsoil, full of nutrients, as well as necessary microelements for normal breeding and developing of the bean.

2. Results and discussion

It should be emphasized that production is the base target for each genetic program on the improvement of beans, because this feature presents the interests of its cultivation.

For the studied populations it results a considerable genetic variation for the production.

Thus, the production values for each plant from one population to another are different, ranking from 113 to 540 gr / plant.

Even the variance of this feature is great 20034.23 as a significant indicator of genetic diversity that exists between populations studied.

Based on these values, it can be said that populations serve as a huge genetic source, to be used in various programs for genetic improvement of production.

Table 1. Features of the bean plant production

Populations	The number of bean pods per plant	The number of grains per bean pod	The number of grains per plant	The weight of 1000 grains	The production per plant/gr
1	107	5.6	559.2	563	337.3
2	79	5.6	442.4	520	230
3	84	6.3	529.2	728	385.6
4	101	6	606	570	345.4
5	114	5.9	672.6	182	122.4
9	110	7.6	836	496	414.6
10	101	6.3	636.3	883	561.8
11	82	5	410	439	179.9
12	55	4.3	238	544	129
13	40	5.6	236.5	699	165.3
16	77	4.6	354.2	719	254.6
18	66	6.6	435.6	450	196
20	36	6	216	608	131.3
21	98	6.6	646.8	559	361.5

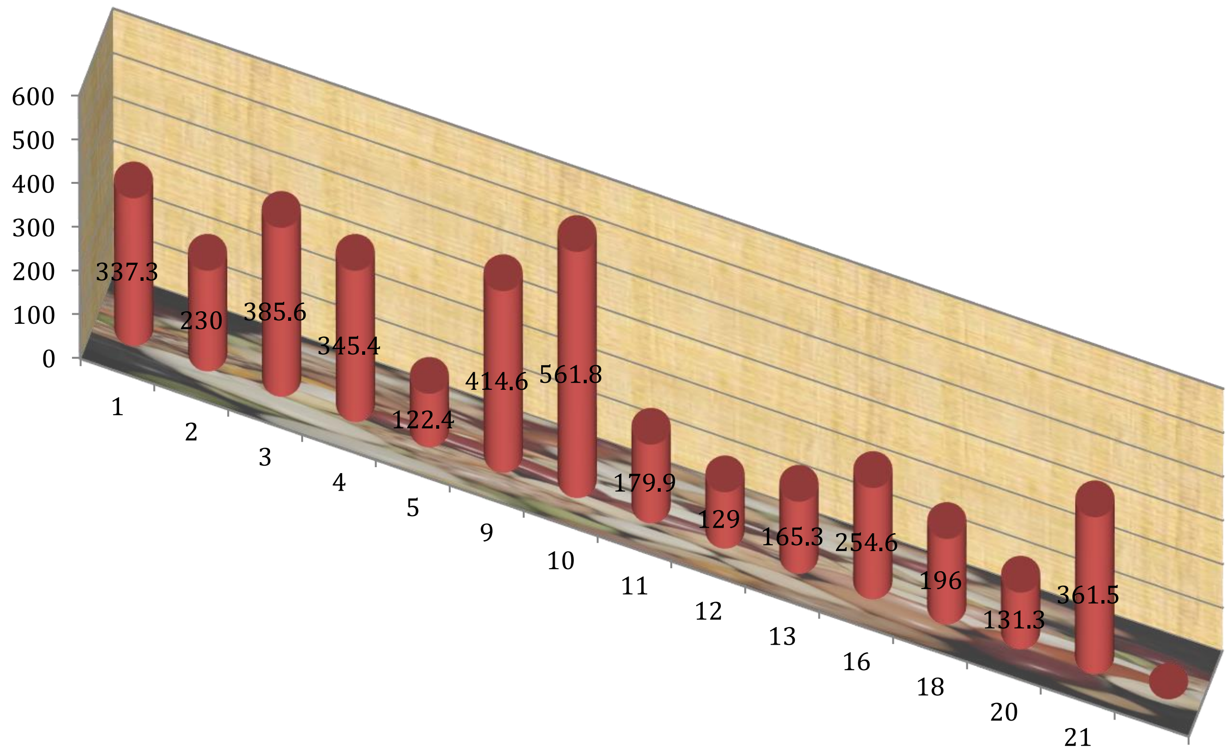

Figure 2. The production per plant/gr

3. Conclusion

The involved populations in the study, result into a considerable genetic variation for the production. Production values per plant, from one population to another, are different, ranking from 113 to 540 gr / plant. The variance of this feature is also great 20034.23, as significant indicator of genetic diversity that exists between the studied populations. Based on these values, it can be said that populations serve as huge genetic source for usage in various programs of genetic improvement of production.
A greater genetic variation exists mainly for quantitative features, and mainly for the production and its components.

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Original scientific paper

PHYSICAL-CHEMICAL AND SENSORIAL CHARACTERIZATION OF MACEDONIAN DRY FERMENTED SAUSAGE (SUCUK)

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Abstract

In this study, the influence of ripening on some physical-chemical and sensory properties of the Macedonian sausage produced under controlled conditions has been investigated. Fermentation time has an influence on the quality characteristics of Macedonian fermented dry sausage products. The effect of smoking and drying on physicochemical, sensory and microbiological properties of sucuk was determined during fermentation and after smoking application. Optimum fermentation period was determined for sucuk samples with desirable characteristics. Dry smoked sucuks were fermented at different fermentation intervals (0, 2, 4, 6, 8 and 15 days). Five days of smoking were applied for sucuks. All process parameters were applied under industrial conditions. Weight loss during the processing is not very high (up to 35 %). Smoking and drying processes increased the lipolysis (g oleic acid /100g) and dry matter contents (protein, fat, salt and ash) of sucuks while decreasing the pH values, moisture content and all bacterial counts (total viable bacteria) ($P< 0.05$). Significant differences in the pigment concentration of smoked sucuk were found ($p< 0.05$). In terms of physicochemical, sensory and microbial properties, fermentation period resulted in sucuk samples with good acceptability and quality characteristics.

Keywords: Sucuk, dry fermented, pigment concentration, lipolysis

1. Introduction

Macedonian sucuk is dry fermented sausage and is produced in larger quantities in all areas of the country in a traditional and commercial way. Traditionally, it is produced during the winter period by filling the bovine fillet meat and loins of elderly animals with the addition of kitchen salt, black pepper and garlic in thin beef wraps, and then drying it in a classic smoke without controlling the atmospheric conditions. However, the commercial sucuk is produced from beef and tallow with the addition of salts, spices, antioxidants, nitrites and starter cultures. As such, the sucuk is filled with artificial, usually collagen wrappers and subjected to controlled atmospheric conditions of drying and ripening. However, few meat industries own chambers for production of sucuk in controlled conditions, so the sucuk is dried in classic smokers, and very often, they afterwards undergo a short heat treatment. According to the Rulebook on quality, products are manufactured according to the manufacturer's specification. The tradition of production and consumption of sucuk in the territory of Macedonia and beyond has taken place since the Ottoman Empire. (Gasparik-Reichardt et al., 2005) The fermented sausage is known under the name "soudjuk" or "sucuk", which in the past was produced only from beef meat, and today also of sheep and buffalo meat. Today, a variety of fermented meat products are produced. These products vary in maturity (slow, medium, fast), depending on the carbohydrates used during drying. At the same time, the final pH of the product (pH 4.7-5.5) aroma and hardness of the product are also different between fermented meat products (Kröckel, 1995).

Fermentation, salting and smoking are one of the oldest preservation methods and sausage types are one of the oldest meat products (Petaja-Kanninen and Puolanne 2007; Vuković, 2012). Fermented dry sausage is a high quality product in the meat industry, valued and demanded by consumers. The first data of fermented sausage turn us back to 3000 BC, and more information comes from China and the Mediterranean region around 2000 BC (Petäjä-Kanninen and Puolanne, 2007). Sugars (glucose, sucrose, sometimes lactose) are added to fermented meat products in industrial production. In the fermentation and maturation stages, lactic acid bacteria turn to glucose, the primary energy source, in lactic acid, the main ingredient that provides the pH reduction. This acidification in the environment is important in obstructing undesirable pathogenic bacteria that are low pH-resistant and ensures the development of typical organoleptic character of the fermented meat product (Bover-Cid et al., 2001).

There are many different types of fermented sausage and its diversity varies by country, region, climate, heritage and culture (Lebert et al, 2007; Talon et al, 2007; Roseiro et al, 2011, Santos et al., 2011). Fill forms are numerous, even for products of the same name; some are kept secret. Time, temperature, drying humidity and the process of smoking are processes that influence and control the quality of the finished product (Ockerman and Basu, 2007; Tabanell et al, 2012). Thus, the traditional sausage that originated in the Mediterranean areas is mainly preserved only by drying, while sausages originating from central and northern Europe are dried and smoked (Toldrá et al, 2004; Latorre-Moratalla et al, 2008). It is difficult to carry out the classification and grouping of all the additives used in the industrial production of fermented dried sausage, but the most important additives are: cooking salt and GDL, which are the basic substances of meat products (Čavlek 1993, Vukovic, 2012). Preservation of meat products is among the oldest technologies since ancient times. The meat smuggling has been discovered since ancient times when hunters hunted, fried and smoked meat, believing that this meat stays longer and smells better.

A few studies have focused on the manufacturing technology, microbiology and compositional characteristics of the Macedonian dry fermented sausage (Stojanova et al. 2017), but the effect of ripening on the lipolysis, pigment concentration and microbiology have not yet been studied. The objective of this research was to evaluate the effect of fermentation on the physical-chemical properties of dry fermented sausage during its maturation. Smoke is produced from wood residues such as sawdust (Feiner, 2006).

2. Material and methods

Meat used in Macedonian sucuk production was purchased from Austria. Sucuk dough was prepared from cattle meat trimmings (80%) mixed with fat from ribs (20%) as base material. Then, salt (2.0 %), sugar with GDL (1 %), potassium nitrate (E 252) nitrates (0,02 %) spices (0,1-0,5%) were added. The meat was minced to 2 cm then decreased to 3 mm at 0˚C with speed of 1300 rotation / minute and the spices were added and mixed. No starter culture was added. The meat mixture was stuffed into artificial casings (Kutezin, Czech Republik, 40 mm diameter), with the final weight of each sausage being around 700 g. The filling speed is 10 pieces per minute. After conditioning (12 hours at 18-20 °C and air humidity 58-60%), the products are subjected in fermentation, drying, smoking and ripening under the following regimen: drying and smoking at 18-19 °C, 86-92% RH, air circulation 0.2-0.5 m / s, duration of 5 days ripening at 17 °C, 78% RH, air circulation 0.5-0.8 m / s, duration of 10 days. The smoke was poured during 5 days in duration of 3 hours at microclimate 19 °C and 80-85% RH.

2.1. Sampling and sample preparation

From two replications, sucuk samples were taken before and after heat treatment on the 0, 2, 4, 6, 8, and 15 of fermentation. pH, moisture, salt, ash, fat, protein, free fatty acidity, total pigment concentration analyses and microbial counts were determined in sucuks. Sensory analyses were determined only for heat-treated products. All analyses were carried out in duplicates.

2.2. Chemical analyses

Ten grams of sample was homogenized in 100 ml of distilled water, and pH of this mixture was determined by a pH meter (Metler Toledo). Moisture, salt, ash, protein, fat and residual nitrite contents measurements were determined according to the methods described by AOAC (1990). The determination of free fatty acids, respectively lipolysis was performed according to Kurt and Zorba (2010) while the free fatty acid content was expressed as g oleic acid / 100g (Egan et al., 1981). FFA analysis was done according to the alkaline titration method and the FFA was calculated as mg KOH/g fat.

2.3. Microbiological analysis

Microbiological analyzes were performed according to the ISO 4833: 2003 method, determining the total number of aerobic mesophilic bacteria at 30 ° C (Official Gazette, 2013)

2.4. Statistical analyses

One way (ANOVA), Post-hoc (Duncan test) was performed, using the software package SPSS program for Windows, version 9.0 (SPSS Inc., Chicago, IL, USA). Differences were considered significant at $P < 0.05$.

3. Results and Discussion

Temperature during heat treatment plays an important role in lowering humidity. As can be seen from the presented results, the moisture content in the sausage is in the range of 55.71% - 38.43%. During this process, it is noted that the moisture decreases faster due to the drying process. Gökalp & Ockerman (1985) stated that the decrease of the moisture content in the sausage produced at high temperature is faster, which can be explained by the rapid pH drop at high temperature. Soyer et al. (2005) found higher levels of moisture produced at different temperatures. Lizaso et al. (1999) found initial moisture of 56.26% in the fermented sausage at room temperature then decreased until 39.49% after fermentation and drying processes.

As can be seen from the results shown, the pH in the sausage at the beginning is 5.08, then it goes down to 4.85. The fermented sausage pH at various levels of temperature and drying begins to significantly decrease. The pH reduction is due to the formation of lactic acid. Similar results were obtained from Ensoy et al. (2010). Increasing the level of fat slowly increases the pH of other samples; this fits with other studies by Ahmad (2005). pH plays an important role in preserving foods, generally the most acidic foods. Another parameter for lowering the pH is the GDL, with the addition of an excessive amount of GDL can result in the deterioration of the sensory properties.

Tabel 1. Changes in chemical composition and microbiological properties during ripening of dry fermented sausage

Parameters	**Ripenig (days)**					
	0	2	4	6	8	15
Moisture (%)	55,71±0,36^{d}	52,62±0,44^{ç}	52,53±0,09^{ç}	48,47±0,31^{c}	40,39±1,73^{b}	38,43±0,03^{a}
Salt (%)	6,25±0,49^{a}	8,35±0,92^{b}	7,65±0,21^{ab}	8,60±2,69^{b}	8,45±0,07^{b}	9,00±0,28^{b}
pH	5,08±0,01^{d}	5,04±0,01^{ç}	4,92±0,01^{b}	4,85±0,01^{a}	4,95±0,01^{c}	4,94±0,01^{c}
Acidity	8,55±0,78^{a}	10,35±0,49^{c}	12,40±0,57^{ç}	9,40±0,28^{b}	14.10±0,28^{d}	14,05±0,35^{d}
Ash (%)	4,45±0,01^{a}	/	5,31±0,10^{ab}	/	/	5,96±0,80^{c}
Protein (%)	7,26±0,18^{a}	/	11,25±0,36^{b}	/	/	22,57±1,37^{c}
Fat (%)	24,44±0,01^{a}	/	25,06±0,01^{b}	/	/	40,41±0,01^{c}
TAPC	6,58	/	/	/	/	1,47

ppm (mg/kg), Lipolysis g/ oleic acid/100 g fat, $^{a-e}$ Means within the same row with different superscript letters are different ($p < 0.05$), TAPC- total aerobic plate counts.

Proteins are the most valuable ingredients of meat products. Hence, protein content is used as an objective criterion based on which product quality can be assessed (Vukovic, 2012). The protein content was of a high average in the Macedonian sausage. The results of this research show that Macedonian sucuk contains significant proteins (Soyer et al., 2005).

As can be seen from the presented results, the protein content in the sausage revolves around the 11.25 range and goes by increasing the percentage in the range of 22.57. As can be observed during production, the amount of protein depends on the production temperature and the drying of the product (Table 1). The total fat content of sausage filling ranges from 24.44, which goes up and reaches 40.41%. In Table 5, there are differences ($p<0.05$). Dropping in the flesh does not affect much the fat growth. The results obtained in this study are consistent with the results of other studies related to the change in the amount of fermented sugar fat during production.

The ash content in the Macedonian sausage is conveyed to the filling stage, the smoke ranging from 4.45 raises to 5.31 and the last day marks the highest value of 5.96. The grace is followed in three days, even on the first day (0), on the fourth and fifteenth day. Table 5 shows changes ($P<0.05$).

Salt is the main flavouring agent used in the production of sausage and contributes to the basic characteristics of the taste of the final product. The amount of added salt depends on the type of sausage and especially on the fat content. The acceptable level of salt in the sausage depends on the country and the laws. However, the highest and lowest levels of salt are often used. Although the salt is not generally used in concentrations sufficient to maintain it, it performs an antimicrobial activity. Some bacteria are restrained. Other microorganisms tolerate a much higher concentration of salt. Salt also performs other functions in the sausage; it is digested in water and helps with water capacity and emulsifying capacity of meat proteins. The use of salt only gives a dry salty product that has a non-attractive color. Today, salt is commonly used in combination with sugar. The salt should be clean and sufficient to spread easily in the flesh. Analysis of the lipolysis results are summarized in the Table. The linear effect of the fermentation and maturation period was found to be important (P <0.05) for lipolysis.

As shown in Figure 1, lipolysis was intensified by increasing the fermentation period. During the fermentation period, the level of free fatty acids in fermented dry sausage depends on the hydrolysis activity of lipase, microbial metabolic processes and oxidative reactions that alter the free fatty acids released on lipolysis (Soriano et al., 2006). Such lipases are mainly of endogenous origin and these enzymatic activities increase with reduced pH values in dry meat products (Vestergaard et al., 2000). Long process with light fermentation conditions allows a relatively higher enzymatic activity and therefore a larger production of fatty acid. An important percentage of the production of free fatty acids in dried meat products is the result of phospholipid hydrolysis (Toldrá, 2004).

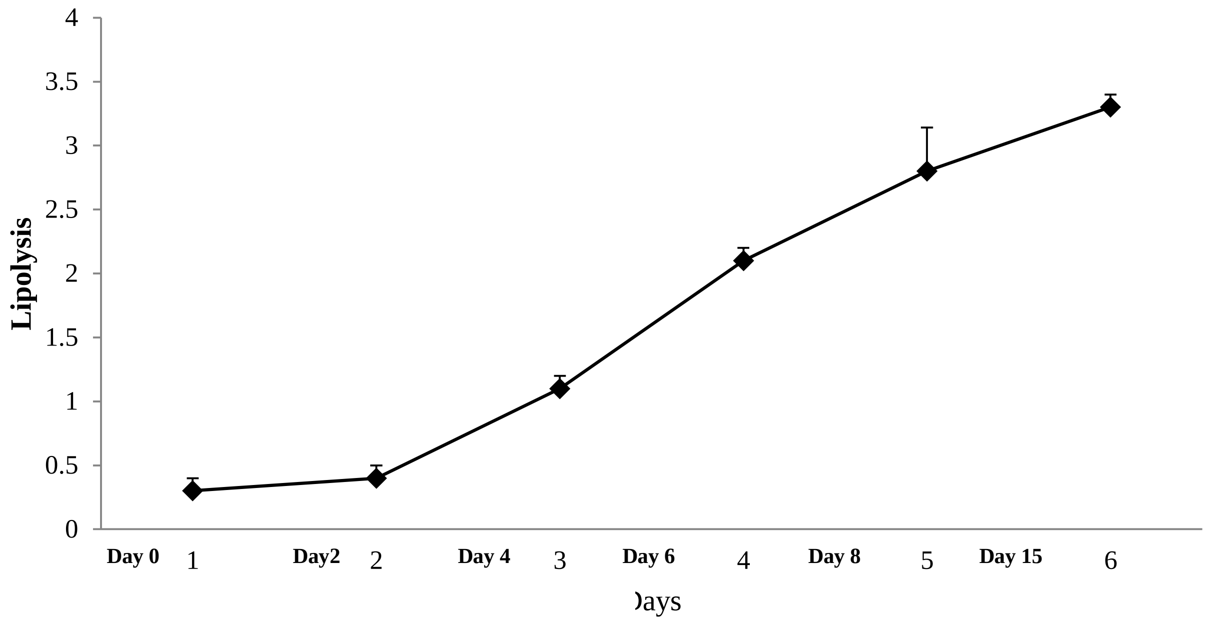

Figure 1. Lipolysis of traditional Macedonian sucuk produced under industrial conditions

The process of colour formation is very complex, especially in fermented dry sausage. During the production of the Macedonian sausage were examined the impacts of the production period, additives, fumigation, drying and packaging on the colour intensity of sausage (Figure 2). The aim is to follow all the parameters and movements that are made in the sausage, wanting to form the desired colour, flavour and taste accepted by consumers.

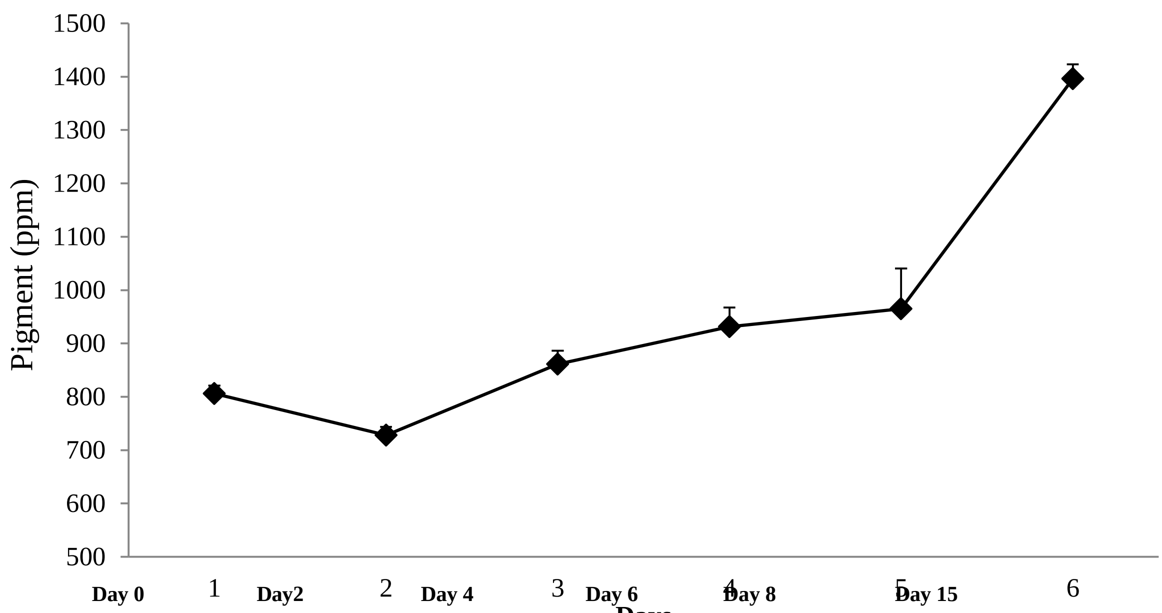

Figure 2. Pigment concentration of traditional Macedonian sucuk produced under industrial conditions

Oxidizing processes in meat and meat products lead to degradation of lipids and proteins (including pigments) which in turn contribute to the deterioration of colour, structure (bond connection) and aroma (Zanardi et al., 2002). Lipid oxidation products can interact with hematic pigment, resulting in increased iron sensitivity to oxidation and deterioration of the meat product (Alderon et al, 2003). Traditionally, lipolysis was thought to be related to bacterial lipase activity (Kenneally et al., 1998). Lipolysis, together with proteolysis, is believed to play a central role in aroma formation (Chizzolini et al., 1998) and could be affected from the curing salts or ingredients such as nitrite-nitrate (Martin et al., 2006).

The growth of the bacteria was affected by acidification or by the inability of the starter to compete with the autochthonous microbes, which was in accordance with Lizaso et al. (1999) and Samelis et al. (1998) who considered acidification to be the main cause of micrococci-staphylococci inhibition in dry fermented sausages.

Bacterial lipases are produced during the growth phase and the production is influenced by growth conditions with maximum amounts formed at optimum temperatures and pH for growth. Total mesophilic bacteria could be responsible for lipolysis in the early stages of ripening, when conditions of temperature, pH and NaCl % would be more favourable (Makhzoum et al., 1995). The majority of bacterial lipases showed highest activity in a neutral to alkaline pH range and between the 30-40°C temperature ranges (Kenneally et al., 1998). Mesophilic bacteria grow best at moderate, not very hot or very cold temperatures, usually between 20 and 45 °C (68 and 113 °C). During the analysis it is noted that the number of aerobic mesophilic bacteria on the first day (0) was log 6,58. The maximum permissible number of mesophilic bacteria is 6.69 log (Official Gazette of R. of Macedonia No. 100 / 2013). During fermentation and drying the number begins to decrease until log 1,47 on the 15th day.

From the sensory point of view, the sausage from the last day was in compliance with the specific regulations. The 15th day had the largest number of points compared to other days (Figure 3).

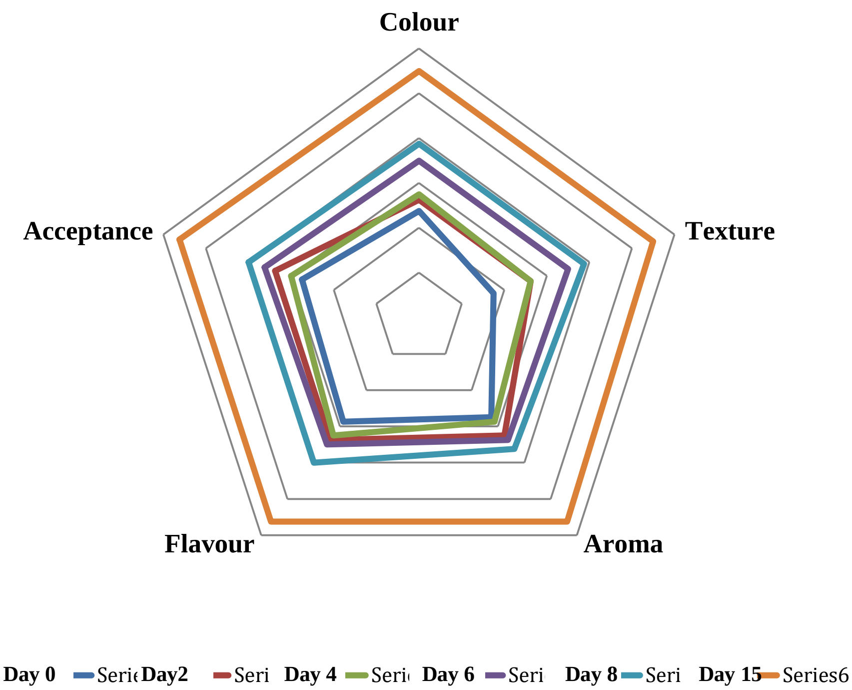

Figure 3. Changes in sensory properties of Macedonian sucuk during the ripening

4. Conclusions

Based on the presented results obtained in this study it can be concluded that the total chemical composition and the sausage pH from different fermentation periods were significantly different (p<0.05). The highest pH value was determined in the sausage samples from the first day (5.08) and the lowest in the sausage from the eighth day (4.85). The moisture content during fermentation is significantly reduced (p < 0.05) from zero day by 55.71% on the fifteenth day to 38.43% at the end of the drying process (15 days). That represents a decrease from 55.71% to 38.43%. The protein content is increased by the fermentation and drying process, from 7.26% on the first day to 22.57% on the last day (15 days). The total salt content in the Macedonian sausage grows in the fermentation period from zero day of 6.25% to the ninth day of 9.00%. The content of kitchen salt in the Macedonian sausage varied from 6.25% (zero day) to 9.00% (fifteenth day). With an increase in the fermentation time until the fifteenth day, the amount of lactic acid increases from 8.55% to 14.10%. The highest percentage of fat was determined on the fifteenth day (40.41%), and the highest protein content on the fifteenth day with (22.57%). The profile of the sausage color during the 15 days of fermentation was studied in detail, with a significant influence of the fermentation on the pigment concentration. There are recent researches and legislations on additives, regarding the negative health effects of chemical preservatives, especially nitrite in meat products, thus the behavior of natural starters against competitive natural flora in the absence of antimicrobial additive could be an advantage in ripening.

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Short communication

COMPARATIVE STUDY ON NUTRITIONAL AND TECHNOLOGICAL VALUES OF RED PEPPERS FROM SOME LOCALITIES OF POLOG REGION IN MACEDONIA

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Abstract

The aim of the presented study is to characterize the proteins, ascorbic acid, capsanthin, dry matter and ash content of sweet (B) and hot (L) red pepper cultivar (*Capsicum annum* L.) from Macedonia using the localities' combinations: Falishe (BF and LF), Zhilce (BZH and LZH), Sedlarce (BS), Brvenica (BB) and Rataje (BR and LR). The peppers fruit were harvested on october and dried in a semi-shading conditions for 7 – 8 months on traditional conditions. The dried red pepper from the (HR) locality has a higher content of dry matter 86.40% compared to other localities which indicates that it is dried and stored in more favorable conditions compared to other localities. The highest ash content has dried red pepper from the SZH locality with 8.27%. The results show great differences between localities' combinations and sampling dates for the protein, ascorbic acid and capsanthin content.

Keywords*:Capsicum annum* L, peppers fruit, capsanthin

1. Introduction

Pepper (*Capsicum annuum*), is the most popular vegetable crop in the country, with an area of 8.528 ha. Pepper production is more common in the regions of Strumica, Polog, Skopje and Kumanovo. In the Polog region, the pepper cultivar covers an area of 856 ha, with an average yield of about 21.362 kg / ha. It is used for fresh and processed consumption such as: semi-products (semi-frozen, frozen, dried, peppers in vinegar, pineapple wafers) and as final products (Ajvar, dumplings, chillies, baked peppers, fried peppers and pepers in vinegar).

Red pepper (*Capsicum annuum* L.) is a valuable vegetable crop not only because of its economic importance but also because of its nutritional value, mainly as a great source of reddish natural color due to the pigment content capsicum and antioxidant compounds (Lee et al., 1995, Howard et al, 2000) Cultivation of Kurtovska kapija is the most requested cultivar by the processing industry, due to its preservation quality and processing into ajvar; one of the most sought products abroad. They are exported as fresh, and processed.

The results of chemical analysis of pepper fruit by many authors showed that: it is very rich in high content of carbohydrates, proteins, coloring matters (carotenoids), mineral substances (K, Ca, Fe, P, Na) Vitamin C (Vitamin C to 270 mg / 100g) and Vitamin B. It is estimated that in the fresh state the species contains twice as much vitamin C as the lemon.

Pepper fruits in the processing industry must be full, rich in high percentage of fruit pulp and intensely red colored. Pepper fruits are rich in ascorbic acid. This depends on the fact that during processing and conservation of high temperature production, vitamin C is lost and that the ascorbic acid is not stable at temperatures ranging from 60 to 65 °C

The red color of pepper derives from carotene and carotenoid capsanthin and capsarubin, which are very valuable, as they are used for production of chili and sweet peppers. Capsanthin and capsorubin are the main carotenoids responsible for the red pepper color. In addition to their main role as a dyestuff, they are also known as antioxidants and inhibitors of colon cancer cells (Zachariah et al., 2008).

The aim of this study was to determine the content of dry matter, protein, ash, ascorbic acid and capsanthin of sweet (S) and hot (H) peppers during natural drying conditions by farmers' combinations of localities: Falishe (BF and LF), Zhilce (BZH and LZH), Sedlarce (BS), Brvenica (BB) and Rataje (BR and LR). The fruits of peppers were harvested in October and were dried in semi-dark conditions for 7-8 months under traditional conditions. Due to the high nutritional value, it represents the most important vegetable culture in the country.

2. Material and methods

Cultivar of Kurtovksa Kapija from main localities of the Polog region is used as a sample. The sweet red pepper seed and the chili sowing are used for the production by local farmers. For many years, red pepper varieties have been cultivated in the localities of the Polog area where it is adapted to the natural conditions of the area. The period of red pepper vegetation is around 75-80 days. The dried red peppers collected from five localities in the Polog region were prepared for sampling by removing the stems and seeds, and as such were ready for analysis. The analyses were conducted at the Laboratory of Food Technology in Tetovo. Standard laboratory methods equipment and reagents were used (Vracar, 2001).

Figure 1. Preparation of red peppers fruit samples and homogenization

For the analysis of the chemical components of the material, the standard analytical methods described by AOAC (1995) were used. The procedure for determining the dry matter content is determined by drying it at 105 °C until reaching the constant mass. The ash content was determined by burning it at 550 °C until a constant mass was obtained according to the procedures 923.03 and 971.3 given by AOAC. Nitrogen content (N) was determined using the Kjeldah method according to AOAC 978.04, the protein content is calculated as N × 6.25. The content of vitamin C in red pepper fruit and carotenoids were determined by the iodometric method and extraction with acetone according to Vracar (2001).

3. Results and discussions

Pepper cultivars are distinguished by specific biological, morphological and productive properties as well as the purposes for which they can be used (Jankulovski, 1983). The peppers that are collected in the technological maturation are characterized by the shape and appearance that is characteristic of the variety culture (Marković et al., 1998). The first raw fruit used for analysis should be of good quality, which is evaluated by sensorial characteristics, physical-chemical analysis and nutritional value (Pruthi, 2003). Varieties for drying must be at the time of technological maturity. The overcooked fruit is not suitable for drying due to tissue softening and may result in bark separation during drying. The analyzed results of the dry sample for each type of locality are presented in Figure 2 and 3 with the following characteristics:

Figure 2. Chemical components (dry matter on the left) of red pepper cultivars from different localities

According to the figure above, it can be seen that dried red pepper from the locality HR has a higher content of dry matter 86.40% compared to other localities, which indicates that the LR locality species is dried and stored in more favorable conditions compared to other localities. The highest ash content is in dried red pepper from the SZH locality with 8.27%. By comparing the results of the quality parameters between the dried red pepper cultivars for the five localities there was a noticeable change in dry matter and ash, which is due to the water content along with soluble substances during drying (Cvetkov, 1982).
From the obtained results, it appears that the highest percentage of protein is found in the locality of SZH 21.26% and lower in SF 10.89%, which is not the same as per vitamin C, showing the best results in HF 952 (mg / kg), while lower results were reported at HZH 532 (mg / kg). The content of vitamin C in peppers depends on: growth conditions, maturation rate, etc, and ranges from 200-400 mg/100g, and it is more present in small fruit peppers than in large ones (Jankulovski, 1983). According to Vracar (2001), the vitamin C content in red peppers is about 200 mg / 100 g.

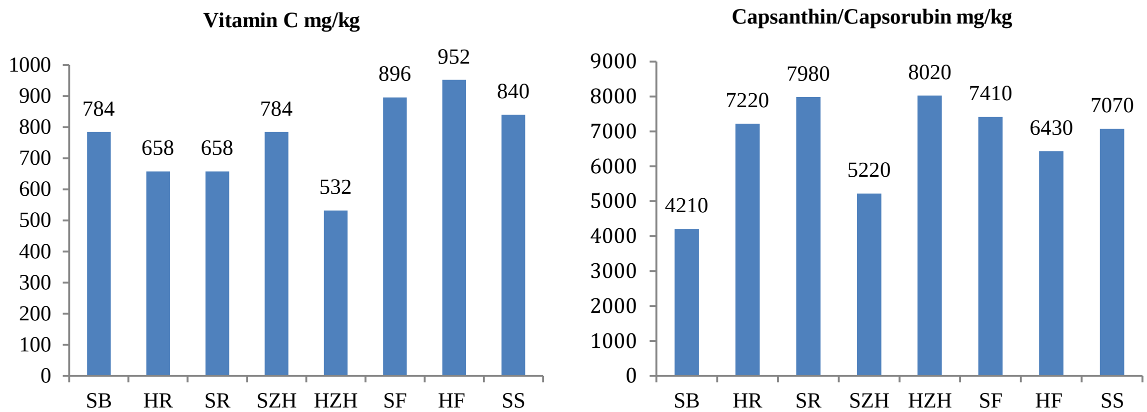

Figure 3. Vitamin C and Capsanthin content of red pepper cultivars from different localities

Differences in color content in pepper fruits are due to many factors such as agricultural agrochemicals, fruit maturity, and so on. In the fruits of red pepper, the color is expressed as: capsicum about 70%, capsule 14%, carotene about 6%, zeaxanthin 5%, cryptoxanthin and others about 5% (Jankulovski, 1983).

4. Conclusions

The results show great differences between localities' combinations and sampling dates for the content in proteins, ascorbic acid and capsanthin. Due to the high nutritional and biological value the species represents the most important vegetable culture in the country.

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Original scientific paper

QUALITY CHANGES OF INDUSTRIAL AND TRADITIONAL AJVAR IN THE POLOG REGION

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Abstract

Ajvar's production in our country is a very important and prospective potential sector for the agro-processing industry. Because of the high nutritional value, the species represents the most important vegetable culture in the country. The analyses were carried out in the raw material and in the ajvar of industrial and traditional production for their nutritional values: dry matter, moisture, total acidity, pH, vitamin C, capsanthin, ash, sugars and cellulose. The analyzed nutritional components in fresh peppers of Prilep and Tetovo showed a higher value in dry matter and a significantly ($p< 0,05$) higher concentration in vitamin C in the Tetovo region (130.5 mg / 100g) compared to the Prilep region (99mg / 100g). The vitamin C and the capsanthin content in the fruit of the pepper varies depending on the cultivar, agro-technical measures and processing methods. In the industrial production there was a higher amount of sugar and cellulose compared to the traditional ajvar.

Keywords: Capsanthin, Vitamin C, Cellulose, Sugar, Ajvar

1. Introduction

Ajvar is a product obtained from grated or roasted peppers (without seeds), with a percentage of 15-20% of dry matter and the introduction of spices according to taste. The product is specific and important to our region, and highly valued in the world market. (Markoviq & Vraçar, 1998)

Ajvar is produced by processing (grinding, etc.) of red pepper and eggplant with the addition of one or more other types of vegetables, then spices, vegetable extracts and sugar (sucrose), while the total amount of species from other vegetables, except peppers, should not be greater than 25%. (Regulation 69, 2014). Ajvar is a pasteurized product, made with roasted, chopped and homogenized peppers, cooked and fried in open containers up to the specific content. Vegetable oil, salt max. 2%, sugar and optionally, vinegar, garlic, etc., can be used as supplements (Karakasova et al., 2008).

Pepper belongs to the Solanaceae family, *Capsicum annuum* L. peppers and is an important vegetable culture, always used because of its economic importance and chemical composition. There are different types of pepper, colored in different colors (green, yellow, orange, red and purple), in different shapes and sizes and with characteristic flavors (Lucier et al., 2001).

In addition to being used for fresh-food consumption, large quantities are also used in the processing industry as semi-products (semi-frozen, frozen, dried, peppers in vinegar, barrel-type) and final product (ajvar, lutenica, puddhur, hazae, roasted peppers, fried peppers and peppers in vinegar).

Industrial pepper *Kurtovska kapija* is the most requested by the processing industry due to its quality of storage and processing into ajvar and one of the most requested products abroad. It is exported as fresh or purchased from domestic traders and processors. Industrial production in 2010 was 10.3 tonnes, expressed in percentage 22%, and in the traditional way (homemade) 2.1 or 4.5% (2011).

The purpose of this paper is to analyze the quality of the product, and to make comparisons between ajvar in traditional and industrial conditions.

2. Material and methods

Sampling
The nutritional values of the ajvar produced in industrial and traditional conditions as well as the fresh raw material of kurtovska kapia from two regions, Polog and Pelagonia, used for Ajvar production, were analyzed. The study was carried out in 2017, using raw material (red species) from the 'Green product', Tetovo vegetable processing factory, which is provided by two regions. The research focused on the analysis of quality parameters: dry matter, pH, total acidity, ash, vitamin C and capsanthin, cellulose and sugars in industrial and traditional ajvar. The analyses were done according to standard laboratory methods (Vracar, 2001). Also, an industrial ajvar sample of 680 g, was provided by the 'Green Produkt' company, and another traditional ajvar sample of 700g was provided from homemade production. The samples were analyzed at the Laboratories of the Faculty of Food Technology and Nutrition at the University of Tetova.

Ajvar Processing Technology
Ajvar is a very widespread product in our country. It's traditional and widely used in our region. The Ajvar technological processing was carried out in the industrial enterprise 'Green Produkt', Tetovo. The preparation was carried out by manual grading of peppers, according to the color and size equation, where the size of the breaks is particularly important and should be calculated according to the needs of the grinding machine. Then peppers were cut and stems and seeds were removed manually. The final product is obtained by grinding ripe or unripe peppers, to which seasonal spices are added. Boiling until a much-matched mass is obtained, while the sparkling water obtained by spraying is spilled gradually up to a certain point.

Chemical analysis of herbal material
In order to determine the quality and nutritional value of fresh peppers and ajvar, the following chemical parameters have been analyzed:*Dry matter* - by gravimetric method, drying samples in dryers at 105 ºC in constant mass, (Method by drying in oven at 105 ° - for determining dry matter in peppers and ajvar (Vraçar et al 2011)*Total Acidity* - applying a volumetric method where 0.1 M digestion of NaOH is used as a titration solvent; (Titration method with NaOH - determination of acidity (Voća et al, 2011).*The ash* was determined by combustion of the samples in the Moffle furnace (Nabertherm) gravimetric method (AOAC, 1995) at a temperature of 550 ° C.

Content of Vitamin C and Capsanthin
Vitamin C was determined by applying an iodometric method, using a solution of 0.1 N (I_2) for titration. The results were expressed in mg of ascorbic acid per 100 grams of pepper (Schweizerisches Lebensmittelbuch – Method 703.1 Determination of ascorbic acid in fruit and vegetable juices, iodometric. Vitamins such as vitamin C are sensitive and can be degraded by the influence of temperature, the presence of oxygen, light moisture, pH and the duration of the undergone treatment (Rebouças et al, 2013)

Capsanthin- The determination of the capsantin was based on the method (FAO JECFA monograph 5 (2008) The material extract 1 ml was carried out in 10 ml of acetone to determine the contents of the capsanthin. Absorption was measured at a wavelength of 460 nm at a spectrophotometer ULTRASPEC 5300PRO) in 1 cm quartz cutter.

Determination of total sugars
Determination of cellulose was performed by the method ISO 6865 2000 Sensory analysis. The determination of this analysis was based on the Practice (Vracar, 2001). Regarding the evaluation points, which are altogether 20, the data collected were analyzed and the average for each according to the table was determined.

Sensory evaluation for paprika ajvar's
The panelists were asked to rate the samples for their saturation, lightness and visual quality on a score card. Quantitative descriptive analysis (Stone et al., 1974) was used to quantify the perceived responses.

Statistical Analyzes The variance analysis was performed using the linear generic model (SAS - 1995) where the treatment and repetition effects were used as the responsible variables. The Tukay test that is used, is a multiple comparing test and is used to compare treatment averages. The level of differentiation signal between the treatments was considered in $p<0.05$.

3. Results and Discussions

Physico-chemical results of fresh pepper
The analyzed results of the fresh pepper variety, of two localities, are presented in the table 1:

Tabel. 1 Results of fresh pepper physical-chemical analysis

Parametres	Kurtovska kapia of Prilep	Kurtovska kapia of Tetovo	ANOVA
Dry matter (%)	8.61 ± 0.15	8.15 ± 0.39	NS
Ash (%)	0.83 ± 0.24	0.65 ± 0.46	NS
Total acidity %	0.60 ± 0.05	0.52 ± 0.03	NS
pH	4.42 ± 0.03	4.50 ± 0.02	*
Vitamin C (mg/100g)	99 ± 1.41	130.5 ± 0.71	*
Capsanthin (%)	1.64 ± 0.01	1.04 ± 0.21	*

*Significance for P<*0.05*, Average ±SD, NS non significant

The observed moisture content of the red pepper from Prilep region (91.39%) and Tetovo region (91.85%) are in accordance with the findings of Gordana, (1989). The dry matter in Prilep peppers was 8.61% and in the Tetovo region 8.15%. The low value of dry matter in both regions is influenced by the agroecological conditions that dominated during vegetation. Ash content of 0.83% for Prilep and 0.65% for Tetovo specimen is approximate with the author's findgins (Gordana, 1989) from 0.5-1.2%. Variety of Kurtovska Kapia has shown a high percentage of water and low content of dry matter in fresh peppers. The total acidity of the Prilep peppers is 0.60% and of Tetovo's peppers is 0.52%. According to the results presented in Table 1, there are no significant differences in the content of dry matter, water, ash and general acidity between the two regions according to ANOVA statistical processing. The pH value of fresh Prilep specimen is 4.42 and of Tetovo is 4.50. The highest content of Vitamin C resulted in the red pepper of the Tetovo region with 130.5mg / 100g, and the lowest in the Prilep region with 99mg / 100g, which is comparable to many other authors such as Karakašova et al., 2008). As other studies show, the highest or lower values of vitamin C in *Capsicum annuum* are dependent on varieties and phases of fruit ripening (Khadi et al., 1987; Howard et al., 2000).
Capsanthin contributes 30-70% of carotenoids to most varieties and cultivars. The percentage of capsanthin and capsarubin grow in the advanced stages of ripening (Deli et al., 1996). Regarding the capsanthus, the comparison of peppers from the two regions indicates that during the maturation phase the higher content of the capsanthin was found in the fresh peppers from Prilep with 1.64 and the lowest content was found in Tetova's peppers with 1.04. According to the author (Arimboor et al., 2014), the content of the capsantin ranges from 0.1 to 3.2 g / 100 g of dry matter.
According to statistical data, we can say that the last three parameters, pH, vitamin C, and capsantine, are distinctive (p <0.05) compared in fresh red pepper from the two regions.

Results of the qualitative analysis of industrial and traditional ajvar
The chemical content of industrial and traditional ajvar is given in the table 2.

Table 2. Characteristics of ajvar quality

Parameters analyzed	Industrial Ajvar	Homemade Ajvar	ANOVA
Dry matter %	24.00 ± 0.76	50.74 ± 0.87	*
Cinder %	3.29 ± 0.90	4.76 ± 0.18	*
Total Acidity %	0.67 ± 0.03	0.72 ± 0.01	NS
pH	4.82 ± 0.02	4.32 ± 0.03	*
Vitamin C (mg/100g)	41.00 ± 1.41	25.5 ± 2.12	*
Capsanthin (%)	1.60 ± 0.01	1.56 ± 0.06	NS

*Significance for *P<0.05*, Average ±SD, NS non significant

The results showed that the dry matter content of the ajvar prepared in the domestic conditions is significantly different compared to the industrial one.

This difference is closely related to the high-boiling time that peppers have passed during roasting. The table shows that the industrial ajvar is with 76.01% moisture and 24.00% dry matter, while the home made ajvar with 49.26% moisture and 50.74% dry matter.
The ash content compared to the higher peat values has an increase in ash percentages, with the industrial ajvar averaging 3.29%, while the home-made ajvar with 4.76%.
There is also a positive correlation of dry matter and ash in the ajvar of both productions. Regarding dry matter and ash at home-made and industrial ajvar there is a significant difference ($p < 0.05$),
The total acidity of industrial and home-made ajvar varies between 0.67% and 0.72%, respectively these data do not have a significant difference.
The pH of industrial ajvar is 4.82 and homemade ajvar is 4.32. By comparing these two, it results that the homemade ajvar is slightly more acidic than the industrial one and it is closely related to the above commented results on the total acidity.
Vitamin C has significant decrease from raw material values as a result of high temperatures during ajvar's production and between industrial and homemade ajvar there is a significant difference ($p < 0.05$).
Determination of the capsantin as a pigment in ajvar resulted: industrial ajvar with 1.60% and home-made ajvar with 1.56%. The differences in the content of Capanthin are not significant. Its parameters are not meaningful. Compared with the raw material, there are no significant differences in the variability of the contents of the capsanthin in the industrial and homemade ajvar.
The low percentage of cellulose, in the traditional conditions, is probarly because the preparation of ajvar in traditional conditions is done after roasting and peeling off peppers.

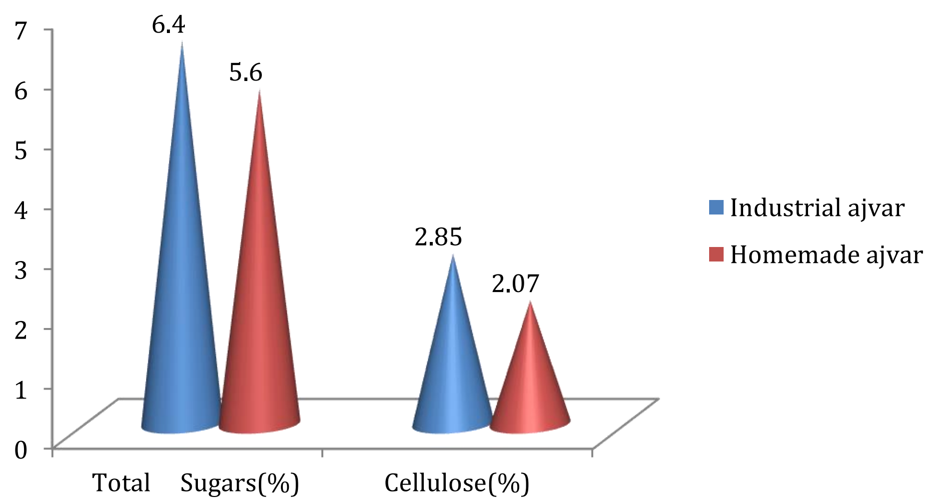
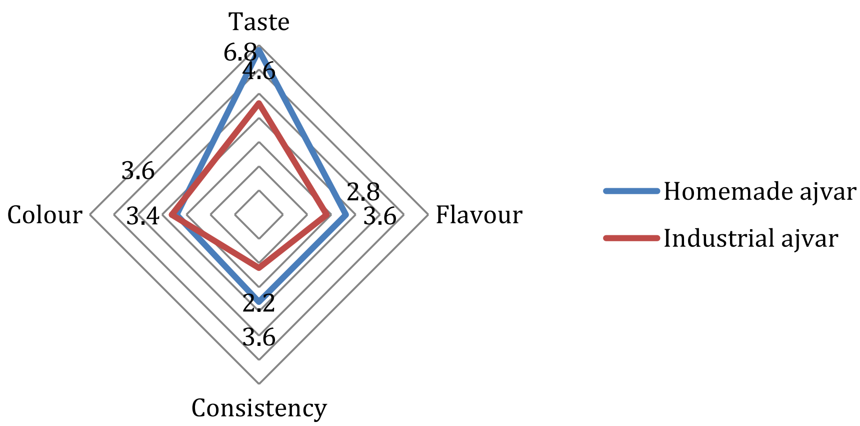


Figure 1 Sugar and cellulose content in industrial and homemade ajvar

Organic sensory qualities of traditional and industrial ajvar

The points given by the five panel members are located in the following figure for each parameter. These points reflect the analysis of the quality of the ajvar produced under traditional and industrial conditions, where each member expressed his grades from 1-7 for four given parameters.



Graph 2 sensory analysis

According to this evaluation, the highest scores for the taste, 6.8 points were given to the homemade ajvar.From the calculated average of scores given by the five members of the tasting panel, we conclude that the total points earned for the homemade ajvar are 17.3 while for the industrial ajvar 14.2.

From all sensory parameters it is noted that the highest scores are given to the taste which really distinguishes and has its own specific taste given the production mode and the relevant production formula.

4. Conclusion

Red pepper varieties of Kurtovska kapija differ in terms of chemical content depending on the locality where they are cultivated, ie, there are differences when comparing relevant parameters from peppers cultivated in different places.We conclude that the total amount of acids increases slightly in homemade ajvar in comparison to the industrial one, and this is because a certain amount of sugar is fermented during cooking.Vitamin C content decreases with prolonged thermal treatment, as is the case with homemade ajvar. Decrease in Vitamin C content is proportional to the thermal treatment of peppers until reaching the desired product.

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Original scientific paper

DETERMINING THE TOTAL NUMBER OF MICROORGANISMS IN RAW MILK

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Abstract

Obtaining a quality dairy product is conditioned primarily by the production of raw milk of satisfactory quality.
The application of microbiological criteria to raw milk aims to produce dairy products of satisfactory quality. Hygienically correct milk means primarily milk with a small number of microorganisms, low content of somatic cells and residues. Therefore, to determine the quality of raw milk there are three main factors: the number of microorganisms, the number of somatic cells and the chemical composition of the milk. The raw milk obtained from dairy cows as basic product is examined within the framework of the quality control system for raw milk. Cow raw milk should satisfy the criteria, i.e. to contain ≤100,000 CFU/ml. The number of micro-organisms is calculated from the results obtained during the one-year period, with at least 4 samples per month. The number of somatic cells is calculated from the results obtained during the one-year period, with at least 3 samples per month.
The samples of raw cow milk originate from two dairies (dairy (1 and 2), which buy raw milk from the territory of the municipality of Tetovo and are taken samples from one purchase line. During the one-year period, 6379 (N = 6379) raw milk samples. For the microbiological examination of raw milk, the method for determining the total number of bacteria with the BactoScan instrument, while for the number of somatic cells (SCC) the Fossomatic 5000 apparatus, was used.
The geometric mean of the results of the testing of raw milk on the number of micro-organisms, over a year, amounted to ≤100,000 CFU/ml, with over 95% of the collected raw milk. This indicates that the geometric mean of the number of microorganisms in the raw milk for the collection line does not meet the criteria given in the quality rule for fresh raw milk.

***Keywords**:* raw milk, total number of bacteria, somatic cage, microorganisms, dairy.

1. INTRODUCTION

Milk in its natural condition is very perishable food, because it is susceptible to rapid decay by the action of natural enzymes and contamination microorganisms. Good hygienic practice from farm to dairy products, effective cooling regimes, reduction of storage time and technologies for reducing spoilage and pathogenic microorganisms are basic measures that need to be achieved to maintain good quality raw milk (Sorhaug and Stepaniak, 1997). The provisions of the Law on Food Safety apply in all phases of production, processing, distribution of food and animal food (Law on Food Safety "Official Gazette of the Republic of Macedonia", No. 157, 2010). Under the Food Safety Law, Article 4, "Food" means any substance or product, in a processed, partially processed or unprocessed condition, intended to be or is expected to be consumed by the humans.

In order to produce milk of satisfactory quality in terms of microbiological status, microbiological criteria should be applied in raw milk. Raw milk, as a source raw material for the production of heat-treated milk, is tested within the framework of the quality control system for fresh raw milk. Raw milk is milk obtained from secretion of the mammary gland of one or more healthy animals from, which has not been heated to temperatures above 40°C or is not exposed to any treatment with the same effect. To process raw milk, it must:

- originate from a dairy animal that has at least 30 days to giving birth, or more than 8 days have passed since giving birth,
- depending on the species of the animal from which it is obtained, i.e. to be categorized as cow's milk, sheep's milk, goat's milk and buffalo milk,
- have a distinctive appearance, color, smell, taste and consistency
- in the case of the daily collection of raw milk, the milk should be cooled immediately to a temperature of not more than 8°C or not more than 6°C if the collection of raw milk is not done daily.

Pollution of milk with microorganisms occurs during secretion and after secretion of milk. Pollution of milk during secretion occurs in the milk canal. Milk originating from healthy cow udder contains less than 100,000 Cfu/mL and does not have a significant effect on the total number of microorganisms in a larger amount of milk (Murphy S. C. and Boor K. J., 2006). However, milk from cows with latent infection or subclinical mastitis contains mastitis causer and leads to an increase in the total number of microorganisms in milk from the farm (Bramley A.J., Mc Kinnon C.H., 1990). Milk contamination after secretion originates from the surface of the udder and body of the animal, the accessories and the equipment for milking and storage of milk and from the air (Wallace L. R. 2009). According to its composition, milk represents an appropriate environment for the propagation of microorganisms (Vujicic IF, 1985).

If the number of microorganisms in raw milk is increased, it will greatly affect the technological characteristics of the milk for processing or the quality of dairy products. This effect is multiple and is reflected in the disruption of hygienic correctness, chemical composition and changes in organoleptic properties, which leads to the decomposition of milk proteins and fats, the occurrence of bitter taste, changes in consistency, increase in the degree of acidity, separation of whey, the variability in the characteristics and the quality of the product, the reduction of the expiration date of the product, etc., These changes occur during the manufacturing process or during the storage period of the product. The total number of microorganisms, among other things, is an indicator of the health status of the herds, maintenance of farm hygiene, a procedure at that time of milk and milk for cooling (Berry D. P., Brien B. O., Callaghan E. J. O., Sullivan K. O. and Meaney W. J., 2006). Bacteriological quality of milk is an indicator of hygiene in primary production. Non-compliant sanitary procedures in milk production contribute to high variability and high index of variation of CFU/ml in all seasons (Trajkovska B., et al. (2015). For this reason, important parameters for determining the quality of milk are the total number of microorganisms and the number of somatic cells. According to many authors, SCC <100,000 cells/ml is normal in healthy mammary glands (Sordillo, LM et al., 1997), while SCC> 200,000 cells/ml refers to a bacterial infection (Schepers, AJ, et al., 1997).

If all appropriate hygienic procedures are carried out in the manipulation and cooling of milk after milking, it effectively inhibits the growth of microorganisms, but they multiply during transport in a mode of inadequate cooling or during inappropriate conditions of purchase. If the milk is kept at a temperature of 1-2 ° C, an increase in the number of microorganisms may slow down, but not unlimited for a long time (Murphy SC and Boor KJ (2000). In order for milk to be suitable for further processing, the growth of microorganisms in raw milk should be prevented. The growth of microorganisms in raw milk is achieved by cooling the raw milk in two ways. If the milk is collected for less than two hours it must be cooled down to 8 ° C or less in the case of daily collection, or at a temperature of 6 ° C if collection is not happening on daily basis (Regulation (EC) No 853/200 4).

Raw cow milk, which will be thermally processed in further processing, in terms of the number of microorganisms must meet the criteria, this means that it has have ≤100,000 CFU / ml.

The number of microorganisms is calculated from the individual results obtained for a period of one month, with at least two samples per month, using the standard method for determining the number of microorganisms (ISO 4833: 2003). In many countries, milk buyers use exclusively flow cytometry to determine the total number of microorganisms in raw milk. Most dairy producers in the EU produce milk with a small number of microorganisms of 100,000 CFU/ml without major problems. The national average is very often less than 10 000 CFU/ml (Hillerton JE and Berry EA (2004)). For evaluation of the milk based on the number of microorganisms, there are valuation standards ranging from 20,000 CFU/ml in Austria and the United Kingdom, up to 300,000 CFU/ml in Japan, and the most frequently selected number is between 100,000 and 300,000 CFU/ml.

The number of somatic cells in milk (SCC) is a key measure of milk quality, reflecting the health status of the mammary gland and the risk of non-physiological changes in the composition of milk (Hamann, 2005). As a result of the increase of somatic cells and changes in the chemical structure, the milk has decreased technological quality, the yield of cheese has decreased, the shelf life of pasteurized milk is shortened and undesired scents with these products can occur. (Trajkovska B., et al. 2011). As a result of the increase in the number of somatic cells, milk has decreased technological quality, the yield and quality of cheese is reduced, the pasteurized shelf life of milk is shortened, and with these products there may be unwanted odors (Kochoski L., et al. 2011).

It is reduced and they consist mainly of epithelial cells of the udder and cells originating from the blood (leucocytes). Of the total number of 70% are epithelial cells of the udder (skin, alveoli, milk canals and milk cisterns), and the rest of 30% make the cells from the blood and other cells. The normal number of somatic cells in healthy udder is on average 20,000 in ml. Any increase in the number of somatic cells above 250,000 or 300,000 in ml of milk is considered as an indicator of mastitis. In the study of the pathology of the mammary gland and the diagnosis of infected udder is used to determine the number of somatic cells in milk. This parameter is considered the best indicator for the health of the mammary gland.

2. TEST OBJECTIVES

The purpose of this research is to evaluate the quality of raw milk and the conditions of raw milk on the basis of the obtained results from the main chemical components and the total number of microorganisms and the number of somatic cells of raw cow milk for a period of one year in two dairies from Tetovo region was assessed the quality of raw milk and hygienic conditions in the production process.

3. MATERIAL AND METHODS

3. 1. Material

The research of the raw milk tests was conducted during the period from September 2017 to September 2018. The data from raw cow milk come from 2 dairy farms who collect milk from the territory of the municipality of Tetovo. One is located on the east side and the other on the western side of the city of Tetovo. To determine the number of microorganisms, 6379 samples were used, and 6229 of raw milk obtained from individual producers were used to determine the number of somatic cells. In dairy farm 1, samples of raw milk were taken from one collection line.

Sampling is carried out at least two samples per month, from dozens of collection points, three times a month. The samples were collected in sterile plastic bottles in which Azidiol preservative was added and transported to the laboratory for the quantity of raw milk at the Faculty of Veterinary Medicine in Skopje, kept at a temperature of + 4°C. It is common practice for samples to be tested no later than 72 hours after taking the subcontractors.

3. 2. Test methods

Laboratory tests of the samples were carried out at the Faculty of Veterinary Medicine in Skopje. The laboratory is accredited according to ISO 17025: 2005 standard. The BactoScan instrument was used to count the total number of microorganisms, by using the procedure according to the ISO 21187: 2004 standard. For the counting of somatic cells, the Fossomatic 5000 was used, while the procedure for counting somatic cells was performed in accordance with the standard ISO 13366-2: 2006.

Within the microbiological criteria for raw milk, in the rulebook on raw milk and the rulebook on quality requirements for raw milk foresees mandatory control of raw milk that will be further processed thermally. With this procedure, raw milk should meet the requirements for the number of microorganisms and the number of somatic cells. The examinations and the examination for fulfilling the requirements for raw milk were carried out in an authorized accredited laboratory at the Faculty of Veterinary Medicine in Skopje in accordance with the Law on Veterinary Health.

According to the Rulebook on requirements for safety and hygiene "Official Gazette of the Republic of Macedonia" No. 197/2016, for the number of microorganisms and the number of somatic cells, in raw cow milk the number of columns at 30°C (per ml) should be ≤100,000, while the number of somatic cells is ≤400,000. Examination of samples of raw milk was monitored from September 2017 to September 2018. In September, 539 samples were taken from both dairies, in October 519, in November 524, in December 558, in January 511, in February 493, in March 504, in April 546, in May 547, in June 531, in July 541 and in August 566 copies. In the period from September 2017 to September 2018, a total of 6379 samples of raw milk were taken, and the test was carried out to determine the total number of microorganisms in raw milk.

4. RESULTS AND DISCUSSION

4. 1. Number of microorganisms

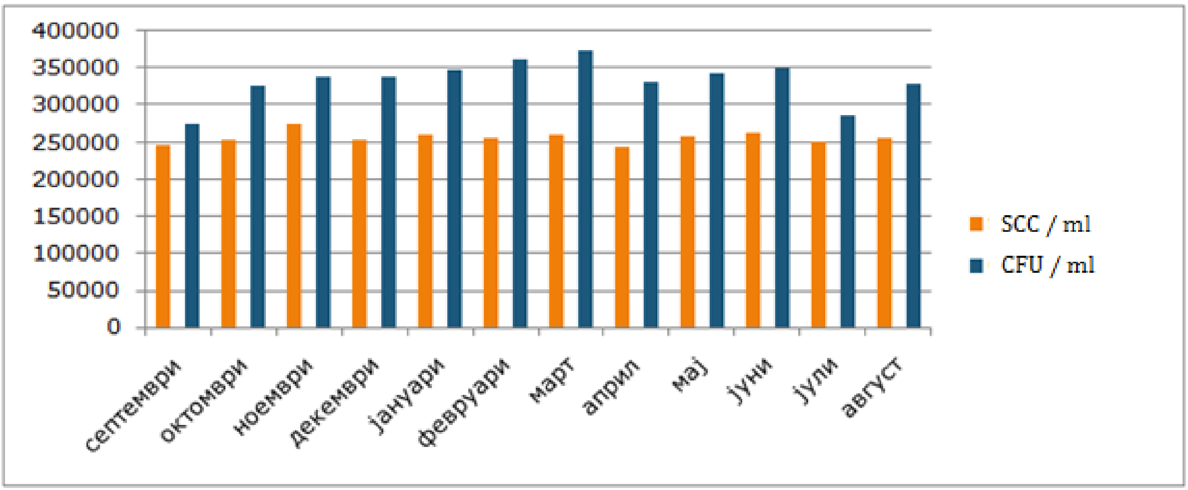
Regarding the number of microorganisms in raw milk, in both dairies for twelve months, starting from September 2017 to September 2018, 6379 samples were tested, from which the following results were obtained. Of all the examined samples (N = 6379), we noticed that the lowest number of microorganisms in raw milk was found in May 2018, amounting to 101500 CFU/ml, and the highest number of microorganisms was found in March 2018, amounting to 789500 CFU/ml. While the results of the average number of microorganisms are shown in Table 1. In all the samples tested, the results do not vary a lot. The average number is the lowest in September 2017, amounting to 275476 CFU/ml, and the highest in March 2018, being 375019 CFU/ml.

Table 1 - Average values of the number of microorganisms andthe number of somatic cells in raw milk

Month	CFU /mL	SCC /mL
2017		
September	275476	246540
October	325560	252230
November	338748	274081
December	339247	254428
2018		
January	347776	259899
February	361585	255259
March	375019	261081
April	332148	243956

May	342264	258219
June	349832	263249
July	285323	250079
August	328610	255650

Chart 1 - Average values of the number of microorganisms and the number of somatic cells in raw milk



Regarding the number of somatic cells in raw milk, during the twelve-month period, starting from September 2017 to September 2018, 6229 samples were tested, and the following results were obtained. The lowest number of somatic cells in raw milk, out of all test samples, was founded in May 2018 and it amounted to 11500 SCC/ml, and the highest number of somatic cells was found in May 2018, at 73100 SCC/ml.In Table 1, the average number of somatic cells is reported by months. Of all tested samples, the number of somatic cells is not very variable. The average number is lowest in April 2018, amounting to 243956 SCC/ml, and the highest in November 2017, being 274081 SCC/ml.

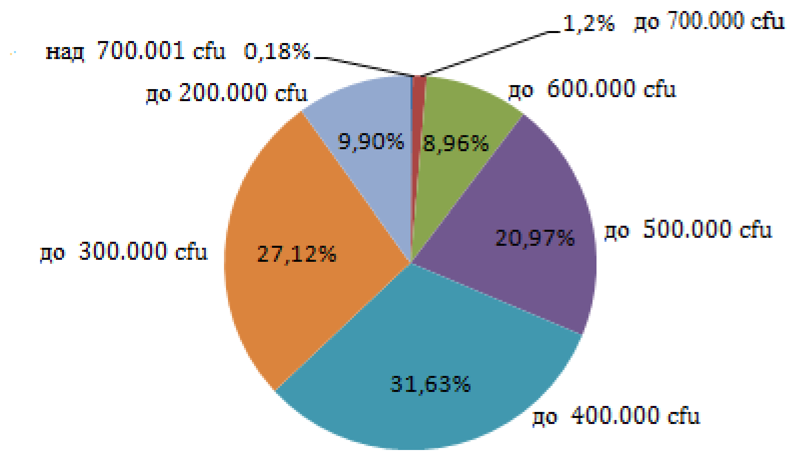
From Table 2 it can be concluded that from the total number of tested samples of 6379, that in relation to the number of microorganisms (≤100,000 CFU/ml) no sample meets the criteria of the Rulebook on safety and hygiene requirements "Official Gazette of the Republic of Macedonia" RM "26/2012 and the criteria of the European Union (Council Directive 92/46 EEC).

Table 2 - The obtained results for the number of microorganisms and number of samples by category and according to the Rulebook

Number of microorganism CFU/ml	Sample number	%
over 700.001	12	0.18
up to 700.000	77	1.20
up to 600.000	572	8.96
up to500.000	1338	20.97
up to 400.000	2018	31.63
up to 300.000	1730	27.12
up to 200.000	632	9.90

Graph 2 - Percentage share of samples according to the number of microorganisms given in the Rulebook expressed in percentage 103

Up to 200,000 CFU/ml has 632 samples or 9.90% that meets the criteria according to the criteria required in 2011. Up to 400,000 CFU/ml has 3748 samples or 58.75%, which is the highest number that meets the requirements under the 2010 rulebook.



According to our findings, the reasons for not meeting the criteria required in 2012 are insufficient hygiene of the udder, poor hygiene of milking appliances, and most importantly, this is the lack of lactofreezersfor storing milk in a large number of individual milk producers collecting raw milk before transport.

Deficiency of the lactofreezer, i.e. a milk cooling device for storing milk before transport, especially during the summer months, leads to further contamination of raw milk, and an increase in the number of microorganisms that can spoil the milk and make it inappropriate for further processing. Our recommendation for individual milk producers is to improve the hygiene of the udder, milking and lactofreezing equipment in order to avoid additional contamination of raw milk. Operators collecting or processing milk shall control milk-producing breeders to create conditions for hygienic collection and storage of raw milk before it is transported for processing in a dairy.

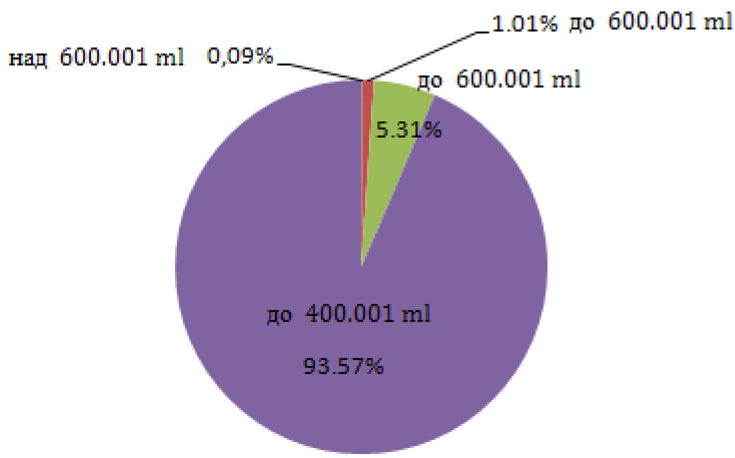
4. 2. Number of somatic cells

From the obtained results of the number of somatic cells, it can be concluded that the bulk of tested samples meets the criteria of the Rulebook on safety and hygiene requirements "Official Gazette of the Republic of Macedonia" 26/2012 and the criteria of the European Union (Council Directive 92/46 EEC) in terms of the number of somatic cells in milk. From Table 3 it can be conclude that a large number of samples 5829, or 93.57%, meet the criteria for the maximum number of somatic cells, while on the opposite side only 400 samples or 6.41% are more than 400.000 somatic cells per ml. From this it can be concluded that in terms of the number of somatic cells, the tested raw milk, in hygienic aspect meets all the criteria for further processing.

Table 3 - Results obtained for the number of somatic cells and the number of samples by category and according to the Rulebook

Number of somatic cells per ml	Sample number	%
over 600.001	6	0.09
500.000 to 600.000	63	1.01
400.000 to 500.000	331	5.31
up to 400.000	5829	93.57
Total	6229	99.98

Chart 2 - Percentage sample participation according to the number of somatic cells given in the Rulebook, expressed in percentage



Analyzing both parameters, i.e. the total number of microorganisms and the number of somatic cells in raw milk from bothtested dairies, we came to the conclusion that from the aspect of the number of somatic cells, a large number of samples of raw cow milk meets the requirements of the Rulebook on safety and hygiene requirements, which means that they have ≤400,000 somatic cells per ml.

Within the microbiological criteria for raw milk, the rules (Rulebook on requirements for quality of raw milk "Official Gazette of RM", No. 96, 2011) foresee mandatory control of raw milk which will be further processed thermally. With this criterion, the number of microorganisms is determined in raw milk. The results of the examination of separate samples of raw milk in relation to the limit value of the number of microorganisms determined by the said rules for each month are shown in Table 4.

Table 4 - Results of the testing of individual samples of raw milk in relation to the limit value of the number of microorganisms

Month	**Samples with ≤100,000 CFU/ml**		**Samples with>100,000 CFU/ml**	
	n	%	n	%
Janaury	5	10,20	44	89,80
February	2	7,69	24	92,30
March	2	7,69	24	92,30
April	7	10,30	61	89,70
May	6	9, 38	58	90,62
June	3	11,54	23	88,46
July	3	6,98	40	93,02
August	3	4,69	61	95,31

The results of the testing of the individual samples of raw milk per month are as follows: in January, 10.20% samples of raw milk had a number of microorganisms in milk ≤100,000 CFU / ml, in February 7.69%, in March 7.69% in April 10.29%, May 9.35%, and in June 11.53%, in July 6.97%, and in August 4.69% samples. During the eight-month period of testing samples of raw milk, each month over 88% of the samples had a number of microorganisms> 100,000 CFU / ml. A total of 31 samples, or 8.56% of the samples, had a number of microorganisms ≤100,000 CFU / ml. The results obtained do not comply with the results of tests for the number of microorganisms in raw milk of the EU milk producers. As a recommendation to milk producers and dairies, they should improve the hygiene of milking, hygiene of the containers for keeping raw milk before transport.

The results of the chemical tests are shown in Table 5, and the chemical composition of the raw milk examined is in the quantities of the normal values.

Table 5. Average chemical composition of cow milk in the examined dairies

Essential ingredients	**Quantity in milk %**	**Variations %**
Water	88,76	85,3-88,7

Dry matter	7,96	7,9-10,0
Milk fat	3,96	2,5-5,5
Proteins	2.96	2,3-4,4
Lactose	4,32	3,8-5,3
Specific weight	27,38	25,15-29,55

Although milk fat is the most variable component in milk, the tests carried out in both dairies have an average of 3.96%, and have a low index of variation. The average protein value in raw milk was 2.96%. The non-greasy dry matter of all tests according to the amount in raw milk was in variable form. The average quantity is within the legal minimum, which amounts to 7.96%. Some samples amounted to a low percentage of dry matter up to 6.99%. The amount of protein in the milk samples was 2.96%, which in all tests was within the limits of the normal values. Milk sugar or lactose in samples of raw milk amounted to 4.32%, which is within the limits of the normal value for cow milk. The specific weight of the milk measured with lactodensimeter at a temperature of 15°C was 27.38, with variations of 25.15-29, 55, indicating that it varies during lactation and is affected by the relationship between the fat component and the fat-free component.

Conclusion

Analyzing the two parameters, i.e. the total number of microorganisms and the number of somatic cells in raw milk from both tested dairies we concluded that from the aspect of the number of total microorganisms, all tested samples do not meet the criteria of the Rulebook on milk safety and hygiene requirements, which means that they have ≤100,000 CFU/ml. On the other hand, with regard to the number of somatic cells in a large number of samples of raw cow milk, they meet the criteria of the Rulebook on safety and hygiene requirements, which means that they have ≤400,000 somatic cells per ml. This shows that the milk is produced from healthy udder without signs of mastitis or some other infections of the udder, i.e. hygienic milking, but after milking and collection, the number of microorganisms increases enormously. In our opinion, the increase of the number of microorganisms is due to poor hygiene in farming facilities, non-hygienic milking, poor personal hygiene of the milker, and lack of adequate equipment for longer milk storage, i.e. due to a lack of lactofreezers that store the milk at an optimum temperature of 4-6°C until the moment it is to be transported to the dairy.

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