

## A New Usage of Capsicum (*Capsicum annuum*) in the Food Industry. Sweet Products

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### Abstract

Capsicum is one of the most widely consumed vegetable. It can be eaten raw or heat cooked and minced in combination with other vegetables. In general the dishes made with capsicum are salted. Nowadays sweetness is no longer linked to the idea of making comfitures, but it is rather a result of innovation and the desire to bring something new to the market.

The present study refers to the realization of a new product, capsicum jam, in three distinct varieties: made from fresh, roasted or vinegar-preserved peppers. The capsicum and the jam were characterized by the following physical, chemical and technological properties: total, volatile acidity, solids content, refractive index, salt content, moisture, reducing, unreducing and overall sugar content, technological losses. If, in terms of raw material, the highest value in solids content is found in the roasted capsicum (28.6%), as far as the end product is concerned, the highest value of solids content belongs to the red capsicum in vinegar jam (76%). The highest humidity of the raw material is 91.4% (raw capsicums) or 31.4% to the roasted capsicum jam. The raw capsicum is the richest in sugars (12.7%/dm.), but during processing, the amount of sugar decreases. The jam made of capsicums preserved in vinegar has the lowest sugar content: 50%/dm. Its salt content is 0.15% and its acidity is increased (0.4% total acidity and 0.3% volatile acidity). As a result of a taste test conducted on 55 people, it was concluded that the consumers mostly prefer the raw capsicum jam.

**Keywords:** *Capsicum annuum*, red capsicum jam, sensory analysis, physical and chemical characteristics jam

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### 1. Introduction

The red bell pepper (*Capsicum annuum*) belongs to the *Solanaceae* Family, along with the potato, the tomato and the eggplant. It is native to Central America, South America and the Caribbean, being domesticated 5,000 years ago. The *Capsicum annuum* peppers have grown in many varieties (sweet and spicy, green peppers, red peppers) that are now cultivated worldwide [1]. The use of pepper for different dishes with a strong regional characteristic is due to taste, color and nutritional value. It can also be eaten fresh or dried [2,3].

It is consumed as a paste combined with other vegetables such as tomatoes, olives, onions, in sweet or spicy sauces, pickled, or as a vegetable appetizer. These are salty dishes. Pepper is also used to obtain kitchen ingredients such as paprika or chilli and sweet red pepper powder. This powder is used as a coloring agent and for extra flavor in sauces, soups, processed meat, candies and alcoholic drinks [4]. Dried pepper foods change the consumer's perception on using additives as red dyes: natural additives are safer and healthier [5]. Some varieties of pepper have been used as ornaments, mostly to be

cultivated in indoors pots. These varieties have small, colorful fruit with a longer lifespan [6].

The Capsaicin obtained from the *Capsicum annuum* pepper species causes eye irritation, reason for which it is used to make self-defense sprays. It has therapeutic benefits, being used to treat muscle pain, skin rashes, rheumatism, or as an anti-inflammatory substance. New medical research shows that the Capsaicin can be used with an antibacterial or antifungal purpose, but there are ongoing studies on its use to treat cancer [6].

According to Codex Alimentarius, "jam" is the product brought to a suitable consistency, made from the whole fruit, pieces of fruit, the unconcentrated and/or concentrated fruit pulp or fruit puree, of one or more kinds of fruit, which is mixed with foodstuffs with sweetening properties, with or without the addition of water [7]. According to the mandatory requirements of quality, food safety, presentation, labeling and identification of products in Romania, jam is a product made of one or more species of fruit, whole or sliced, boiled in sugar syrup, without added pectin, slightly concentrated, semisolid, preserved by physical or chemical methods [8]. In the present research, the new product we obtained from capsicum will be called "jam" in accordance with the international requirements. Therefore, it is defined as a product made of sweet fruit. This study will focus on a product made of sweet vegetables, namely of red capsicums. This is actually the fruit, the morphological part of the plant which is consumed. In terms of physical-chemical valid properties for jam, the mass fraction of soluble solids for such a product is minimum 60-70%, and the mass fraction of fruit related to the net mass for jams ranges between minimum 20-45% [8]. Jam is one of the most famous foods due to its low cost price, validity and preserving of organoleptic properties for a relatively long period of time (1 year). Traditionally, the jam was the result of the effort to preserve fruit beyond the shelf life, but with a lower nutritional value than the fresh fruit. There are also culinary creative producers who make jam from eggplant with cloves, chilli red pepper with ripe tomatoes, red onion, pumpkin with buckthorn, beetroot, eggplant with nuts, cucumber with pineapple and sesame, olives with oranges, green

tomatoes with walnuts, celery with apples, chilli pepper jam remaining the favorite [9].

The reason why capsicum is eaten is also for its chemical composition. The most important constituents of *Capsicum annuum* are pungent phenol compounds (0.05-1.5%), the most prominent is capsaicin (0.14%), the vanillyl amide of isodecenoic acid. The vitamin and mineral content (per 100g) is: calcium (29 mg), phosphorus (78 mg), iron (1.2 mg), potassium (374 mg), beta-carotene (12.960 IU), thiamine (0.22 mg), riboflavin (0.36 mg) and niacin (4.4 mg). *Capsicum annuum* is rich in carotenoid pigments, including capsanthin, capsorubrin, carotene, luteine, zeaxanthin [10-12]. Capsicum is also rich in fats (9-17%) and protein (12-15%) and is an excellent source of vitamin C (~370 mg/100 g) and vitamin A (77.000 IU/100 g) [13].

Given the marketing research, the objectives of this study are divided into two categories. It mainly aims to promote a new product: "red capsicum jam". As secondary objectives, we shall try to obtain it in three flavors, made of: 1- fresh red capsicums, 2- roasted red capsicums, and 3- red capsicums in vinegar. Physical and chemical analyses will be performed, both on the raw material and on the finished product. We shall conduct comparative studies (sensory and descriptive-affective analyses) between the three types of jam, in order to choose the one most preferred by the consumers.

## 2. Materials and methods

### 2.1. Materials

The raw material used in this study was red pepper(capsicum), bought from market. Sugar, salt, acetic acid (vinegar food) were purchased from the trade. It has pursued the use of pepper variety, *Enza Zaden*, excellent quality, class I, without injury and peel intact. The water used in the washing and cleaning of peppers and used as a raw material is drinking water. Drinking water must be sanogen and clean, free of micro-organisms, parasites or substances which by number or concentration, constitute a potential danger to human health [14]. Sugar (obtained from the processing of sugar beet) used in the manufacture of the product was quality I, complying with the characteristics necessary for them [15]. The raw material used for the variant in the

study is: fresh (raw) peppers (capsicum) (P<sub>1</sub>), roasted peppers red jam (P<sub>2</sub>) and peppers red in vinegar jam (P<sub>3</sub>).

## 2.2 Methods

### 2.2.1. Obtaining peppers in vinegar, through artificial conservation

Preserve peppers in vinegar was prepared according to own recipe. To preserve in vinegar used salt and acetic acid from market. After three months it was used preserved peppers in the preparation of jam.

### 2.2.2. Getting roasted peppers

Heat treatment of the whole peppers, washed and sorted was carried out at the same rule: surface heat treatment(180 °C) sudden cooling, cleaning and waxing.

### 2.2.3 Preparation jam

The jam (comfiture, sweet product), all three types, from fresh peppers jam (J<sub>1</sub>), roasted pepper jam (J<sub>2</sub>) and peppers in vinegar jam (J<sub>3</sub>) was carried out in accordance with the same recipes. Both raw and the roasted peppers or preserved were put in an amount equal to that of sugar (1:1). Raw material cut strips of length pepper, thin and approximately 3 mm. The amount of water used in the recipe was three times lower than the amount of sugar (raport sugar: water is 3:1). Technological scheme used was common, as the stage for all kinds of jam. The concentration was carried out at atmospheric pressure in open pots. Appreciation of the end of the operation was given by the amount of dry matter content controlled refractive (using extreme thermal treatment, the mix is concentrated to acquire the necessary total soluble solid content) [16]. As a result of its outcome "of the delicious substance that possesses sufficient storage capabilities". Therefore, and due to the fact that the packaging is done at a temperature concentration, the dosed product in the packaging has not undergone a heat treatment.

### 2.2.4. Physico chemical analysis

Appropriate choice of analyses was made so as to clearly show the quality indicators that change the

most. Analyses were undertaken for the raw material, the control production on phase as well and for the finished product. Determinations were performed: titratable acidity (%) [17]; acidity(volatile)(%) (steam distillation apparatus, *Alcotest Raypa*, Spain) [18]; soluble solid content, dry matter,(dm)(%) and refractive index (nD) (refractometer *Krüßs*, Germany) [19] connected to a bathroom ultrathermostated (*Brookfield*, Germany) with the outer circulation; sodium chloride content (%) [20], moisture (u)(%) (100-dm)[20] (oven *ESAC-50*, Romania); reducing sugar and total sugar content (%), anreducing sugar (sugar-reducing sugar) (%) [21]; weight drained (sieve with square openings 1 x 1 mm, *Zelmer type technical balance*, 34Z051, China) [22]; and total technological losses(gravimetric determination). Experiments were performed in the laboratory of technology of the Faculty of Agricultural Sciences Food Industry and Environmental Protection within the "*Lucian Blaga*" University of Sibiu.

### 2.2.5. The sensory analysis for Jam

It was realized the sensory analysis to choose the range of jam that satisfies most consumer. Have used sensory analysis sheets, 55 tasters, having aged between 18-25 years, boys and girls, students of the Faculty of Agricultural Food Industry and Environment Protection within the "*Lucian Blaga*" University of Sibiu. The method is based on determination by means of the senses (sight, smell, taste, touch) the following characteristics: appearance and shape, taste, smell, colour, consistency. Evaluation of the sensory characteristics performed using ladder to 0 ... 5 points. It sums the values of the scores and calculated the mean value of the individual score. The score is determined based on *organoleptic quality level* of the product, by comparison with other similar product level [23].

Generally, the hedonic test shows the degree of acceptance of the product by the consumer, but also the extent to which the consumer is satisfied with this product. It is a preferred method and shows a high degree of subjectivity. It evaluates each attribute (appearance, color, smell and taste) of the finished product [23].

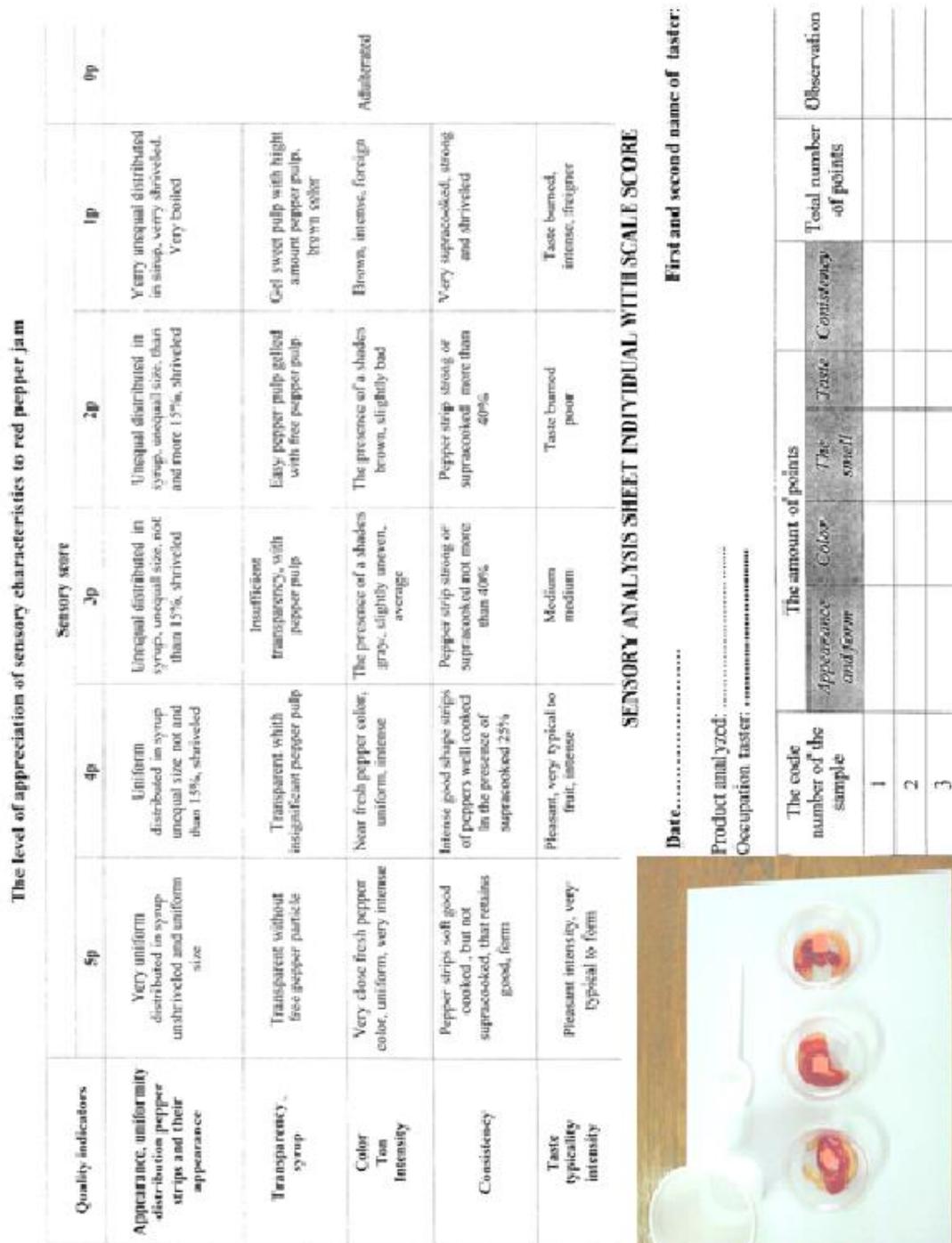


Figure 1. Presentation means of quantification (questionnaires) to sensory appreciation for jam (sheet 1 The level of sensory characteristics to red peppers (capsicum) jam; sheet 2-Individual sensory analysis with scale score): fresh red pepper jam (1-J<sub>1</sub>), roasted red pepper jam (2-J<sub>2</sub>), and red pepper in vinegar jam (3-J<sub>3</sub>)

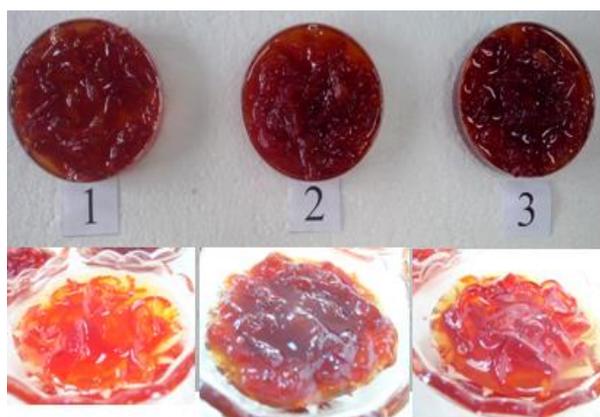
The level of appreciation of the feature will be made after a hedonic scale of 1 to 9, as follows: 1-like extremely; 2-like very much; 3-like moderately; 4-like slightly; 5-neither like cloud dislike; 6-dislike slightly; 7-dislike moderately; 8-dislike very much; 9-dislike extremely. Analyzed samples were encoded (1-J<sub>1</sub>; 2-J<sub>2</sub>; 3-J<sub>3</sub>) (Figure 1) and presented for tasting in the spectrum in sealed containers, transparent. Assessments tasters were recorded on worksheets designed specifically for the jam of the peppers (Figure 1).

### 2.2.6. Statistical analysis

Values were obtained for each parameter determined were statistically analyzed using *OriginPro 932 software*. All experiments were conducted in triplicate. It was used for the statistical analysis *Descriptive OriginPro 932*. Graphics and bar graphics have been done the program *Excel*.

## 3. Results and discussion

In accordance with the objectives of the proposed jam was obtained from raw peppers 1-J<sub>1</sub>, 2-J<sub>2</sub> roasted pepper, pepper in vinegar 3-J<sub>3</sub>. These new products, with which team participated in *the Fair Christmas, Second Edition "Relayrace between generations" 2014-2015*, in Sibiu had a very good impact on the consumer. Are shown in figure 2.



**Figure 2.** Presentation of the macroscopic characteristics (colour, appearance) to the jam of red peppers in three variants: 1-J<sub>1</sub> from raw peppers; 2-J<sub>2</sub> from roasted pepper; 3-J<sub>3</sub> from peppers in vinegar

### 3.1. Physico-chemical and analysis of technological indicators

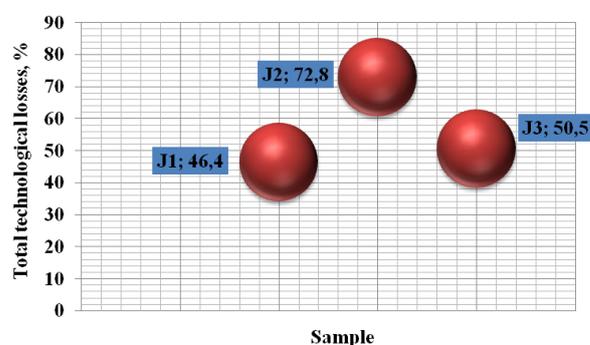
#### Technological losses

Total technological losses are shown in Figure 3. They represent the sum of losses from washing, sorting, cleaning, roasting, cutting, concentrating, packaging and cooling. The largest total losses were obtained for jam of pepper roasted (72.8%) of which 40% there were just cooking (roasting) and cleaning pepper. The smallest losses are the jam of raw peppers (46.4%). Technological losses are a factor of influence for the price of the finished product.

#### Physical and chemical indicators

The real dry matter (Table 1) and humidity had different values in the raw material in relation to the finished product. Values are influenced by the degree of processing of the peppers. We can observe a decrease in the humidity of the finished product (jam) and an increase of the real dry matter, thanks to sugar content added under formulation. Initial moisture content of the raw material is different. It is less he roasted pepper due to roasting loss and water evaporation availability. Method of water binding in analyte is changed due to the heat treatment applied.

Peppers preserved in vinegar has a lower water content due to the fact that it has been replaced by volatile components (acetic acid) which evaporates at lower temperatures (ambient temperature) and before weighing. The values obtained of moisture jam (24-31.4%) are close to those of other similar products (31.23 - 33.36%) [24]. Roselle jam, for example, contain between 33% and 34% [25].



**Figure 3.** Technological Losses total (%) of the technological process of manufacture of jam (sample): from fresh red peppers (J<sub>1</sub>), roasted red pepper (J<sub>2</sub>) and red peppers in vinegar (J<sub>3</sub>)

Low moisture content indicates that the jams have a long shelf life. Also, the amount of moisture (humidity), affect the activity of micro-organisms, namely the product of their attack strength.

Dry matter soluble is a measure of appreciation at the end concentration to the production control phase of jam.

**Table 1.** Physico-chemical base characteristics of the raw material (the pepper) and the finished product (the jam)

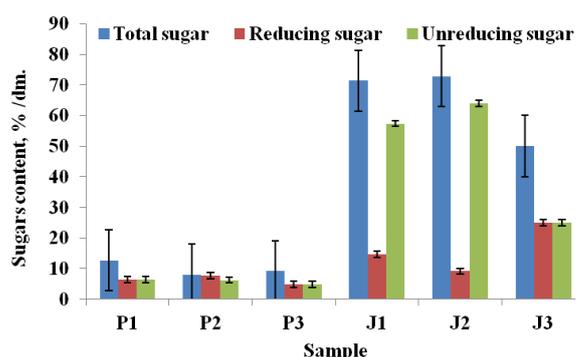
Quality indicators	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	J <sub>1</sub>	J <sub>2</sub>	J <sub>3</sub>
dm. real, (%)	8.6 ±1,15	28.6±0,5	10.1±0,51	72.6±0,5	68.6±0,5	76±1
u, (%)	91.4±0,4	71.4±0,4	89.9±0,62	27.4±0,5	31.4±0,2	24±1,5
dm. soluble ( °Bx)	7±0.36	10.7±0.37	9.5±0.36	67.4±0.4	62.9±0.62	67.4±0.21

**Note:** fresh pepper (P<sub>1</sub>), roasted pepper (P<sub>2</sub>) and peppers in vinegar (P<sub>3</sub>); the jam from the peppers raw(J<sub>1</sub>); from roasted pepper (J<sub>2</sub>) and peppers in vinegar (J<sub>3</sub>). Significant for p 0.05, < (n = 3).

#### Analysis of the evolution of sugar content

The content of total sugars, reducing and un-reducing sugar from raw, roasted peppers and pepper in vinegar and jam prepared are shown in Figure 4. Are quality indicators determined and calculated, that evolves during the processing of the raw material and have the variable values. It has been observed an increase in the total sugar content in jam (J<sub>1</sub>; J<sub>2</sub>; J<sub>3</sub>) compared to raw materials (P<sub>1</sub>; P<sub>2</sub>; P<sub>3</sub>) due to the addition of sugar, called for by the recipe. It contributes to the attainment of specific structure jam. The increase is: for sample (J<sub>1</sub>) is 462.7%, for sample (J<sub>2</sub>) is 822.8% and for sample (J<sub>3</sub>) is 449.5 %. Total sugars are formed by the un-reducing sugar and reducing sugar. From the category of un-reducing belongs and sucrose (sugar added contains 99.8% sucrose). At sample with vinegar reducing and non-reducing sugar amount is closer. This is because during the preparation of jam, due to the concentration, high temperature and of the acid pH, sucrose is inverted to glucose and fructose. Reducing sugars (glucose, fructose) and un-reducing (sucrose) are present in small amounts in peppers and are influenced by the degree of processing thereof [26]. The noticeable differences could be caused by the addition of sugar during the jam-making process [27]. The addition of sugar is essential in order to preserve the jams satisfactorily. The presence of sucrose may be attributed to its addition during the jam-making as listed on the packaging of jams analyzed.

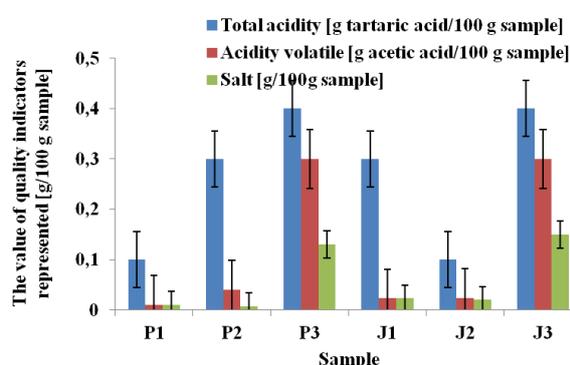
Sucrose helps in promoting pectin gelation during jam-making process, if the raw material contains pectin [28].



**Figure 4.** Evolution of sugars from raw red peppers (P<sub>1</sub>), roasted red pepper (P<sub>2</sub>) and red peppers in vinegar (P<sub>3</sub>) and the jam of raw red peppers (J<sub>1</sub>); from roasted pepper (J<sub>2</sub>) and peppers in vinegar (J<sub>3</sub>). Significant for p < 0.05 (n = 3)

#### Total acidity, volatile, salt content and refraction index

Salt content of 0.13 g/100 g of product (J<sub>3</sub>) (Figure 5) is a small value that ensures a pleasant taste (flavor potentiator). This sample contains the salt (NaCl) under formulation. Salt content is transmitted from the raw material to finished product. Raw peppers and peppers roasted salt content (0.007- 0.02 g/100 g sample) can be justified by the presence of chlorine (Cl<sup>-</sup>) ions in the waters for irrigation, washing and processing the peppers or the chemical composition of the soil.



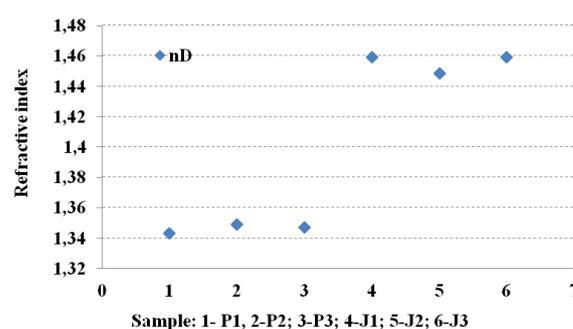
**Figure 5.** Evolution of acidity (total and volatile) and content of salt, for materials: raw red peppers (P<sub>1</sub>), roasted red pepper (P<sub>2</sub>) and red peppers in vinegar (P<sub>3</sub>) and the jam of the peppers raw (J<sub>1</sub>), of roasted pepper (J<sub>2</sub>) and peppers in vinegar (J<sub>3</sub>). Significant for p 0.05, <math>(n = 3)</math>

Total acidity (figure 5) is influenced by the degree of processing of the peppers and between 0.1- 0.2 g tartaric acid/100 g sample. In relation to fresh peppers, peppers preserved in vinegar has a much higher acidity. For sample with roasted pepper acidity increases because during heat treatment takes place by activating certain chemical compounds that peppers you with acidic groups. The values shall be maintained and after processing peppers. This quality indicator has great importance in the achievement of balance between sweet and sour taste of the jam.

Volatile acidity (figure 5) show a much higher value to the jam peppers preserved by vinegar, acetic acid is an essential component. Acetic acid is a substance of exogenous nature and is used in this study as action preservative with bacteriostatic effect [29]. However, the values from acetic acid jam obtained (0.023 - 0.24 g/100 g sample) being small can influence the taste and not more than just the scent perceived tasters.

Refractive index (nD) represented in figure 6 are quantified in values for the liquid part of the analyzed material (peppers and jam). The values represented are influenced by the degree of processing of the raw material and are between 1.343 (P<sub>1</sub>) and 1.459 (J<sub>3</sub>). Such heat treatment before to processing into jam, of the peppers, has led in an increase in the density of the substance soluble. Exogenous substances such as sucrose, salt, acid resulted in an increase in refraction index

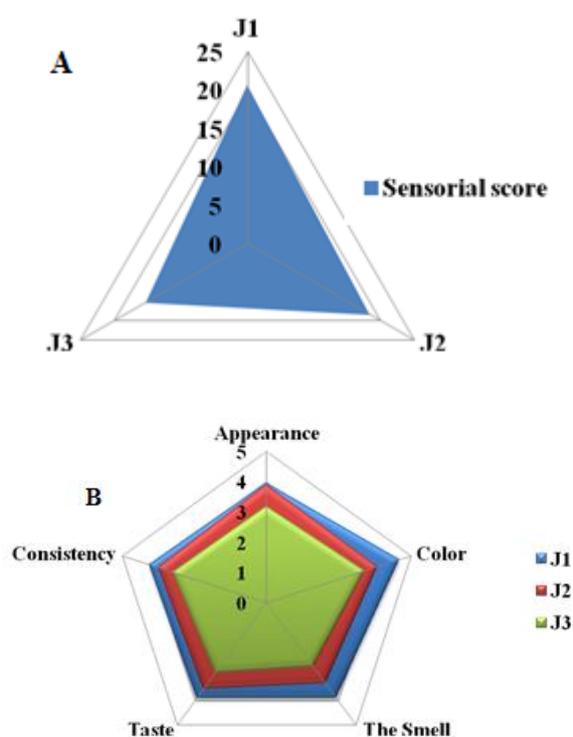
of jam, which according to the figure 6, is in the upper tier values compared to from peppers. It is observed that is consistent with the dry soluble residue content is represented in table 1. On the basis of the values of nD can be read from the tables, the apparent dry matter content.



**Figure 6.** Evolution of the refractive index (nD) for liquid fraction of raw materials: fresh red papper 1-(P<sub>1</sub>); red roasted pepper 2-(P<sub>2</sub>) and red pepper in vinegar 3-(P<sub>3</sub>) and finished products: jam of raw peppers 4 (J<sub>1</sub>); roasted pepper-5 (J<sub>2</sub>) and peppers in vinegar 6-(J<sub>3</sub>)

### 3.2. The results of the sensory analysis

Many physical and chemical indicators do not remove the consumer behavior for a particular foodstuff. There is conscious and unconscious factors which controls this behavior. Quantification of potential consumer choices has been conducted using questionnaires and the means set out in figure 1. Have the results plotted in figure 7(A; B). A result that sample J<sub>1</sub> is preferred by consumers obtaining a score of 20.67 points. By comparison the sample J<sub>2</sub> has obtained a total score of 7.5 points and J<sub>3</sub> 15.3 points. The consumer has appreciated in a special way, besides the smell, taste and appearance, the color and consistency of the product (figure 7(B)). For J<sub>2</sub> and J<sub>3</sub> have been appreciated with high score, color (3.8 respectively 3.4), appearance (3.9 respectively 3.18) and consistency (3.75 respectively 3.25). Because this product is 100% natural, and not contains additives, dyes, conservation or improvement of the quality of its results shall be considered which have delighted the consumer are an advantage of the product. Due to the appreciation of the other two characteristics (taste, smell) ordering of descending to jam according to consumer preference was: raw pepper jam, roasted jam pepper and jam peppers preserved in vinegar.



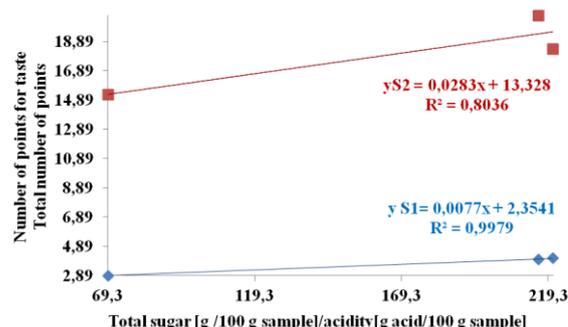
**Figure 7.** Spider plot with sensory analysis, profiles for number of total point (A-left) and number of point for sensory characteristics (B-right), to fresh red pepper jam (J<sub>1</sub>), red pepper roasted jam (J<sub>2</sub>) and red pepper in vinegar jam (J<sub>3</sub>)

Were determined by methods of quantitative chemical contents of sugars and acids of the samples analyzed, and their ratio is higher, the higher the amount of sugar in the recipe is more than (J<sub>1</sub> -216; J<sub>2</sub> -221; J<sub>3</sub> - 43.1). At this kind of sweet product (jam) there is an imbalance in terms of taste (sweet - sour), reason for consumed in small quantities. Correlations were made between this ratio (total sugars/total acidity) and the total number of points for taste (figure 8). Has been a good correlation of  $R^2 = 0.8036$ . In terms of the human senses chemical composition has been received correctly in accordance with the results of the physico-chemical. Following correlation values were obtained regression equation:

$y = 0.0283x + 13.328$ . The higher the x (the ratio) is greater than the total number of points of the sample will be higher. The sign of the coefficient of the variable x is "+" so the trend correlation is

increasing. This means that the potential consumer wants not necessarily a balance of taste but a sweet product. For the correlation between the ratio total/total sugars, acidity and the number of points obtained only for taste value is obtained  $R^2 = 0.9979$ . It is closer, stronger correlation between sensory and taste proportional basis determined chemically. The trend is the same as in the preceding example. So the taste is a feature with a high importance, even decisive.

The regression equation obtained is linear:  $y = 0.0077x + 2.3541$ , all with positive coefficients so the tendency will be to increase the values of the variable y (score for taste). It was considered appropriate to not be missing from the sensory analysis for this new product, red pepper jam, emotional test which is used as a measure of the subjectivity potential consumer. The comparison of the hedonic scale with 9 levels (1-like extremely; 2-like very much; 3-like moderately; 4-like slightly; 5-neither like nor dislike; 6-dislike slightly; 7-dislike moderately; 8- dislike very much; 9-dislike extremely), 4 sensory characteristics (appearance, color, smell, taste) was plotted by frequency of occurrences in figure 9. It is noted that the best results for all of the features of the sample are tracked 1(J<sub>1</sub>). The frequency of occurrences, according to histograms is larger in area 2 levels (like very much) and 3 (like moderately), generally for all samples. Exceptional features (like extremely) received only 1 sample (J<sub>1</sub>). What is important is that none of the products has not left indifferent to the average consumer.



**Figure 8.** Graphical representation of the correlation between the ratio of total sugars/total acidity and total number of points to the sensory (total or just for taste) analysis of fresh red pepper jam (J<sub>1</sub>), red pepper roasted jam (J<sub>2</sub>) and red pepper in vinegar jam (J<sub>3</sub>)

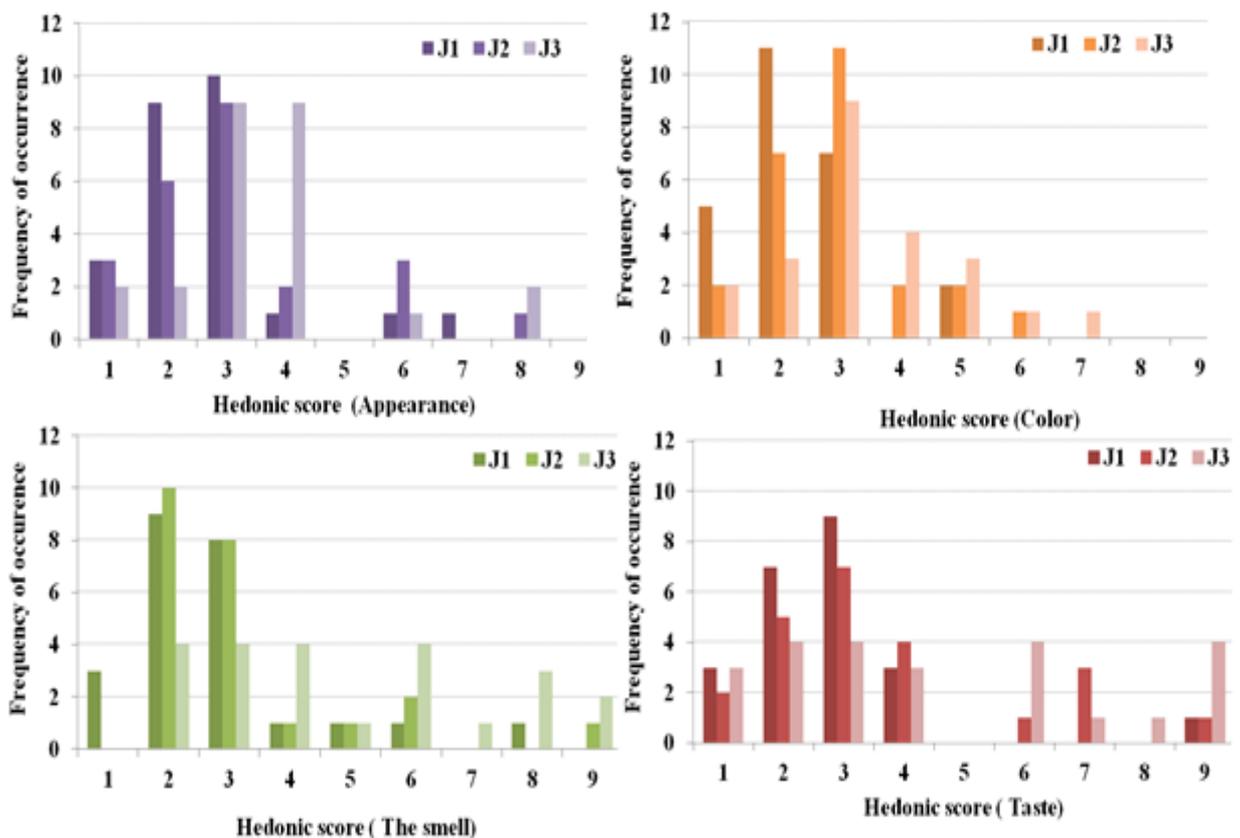
#### 4. Conclusions

The conclusions are drawn in the light of the objectives. The impact on the person eating sweet red capsicum jam was extremely positive, offering good feedback to our requirements and suggestions regarding the new product. We concluded that the raw capsicum jam, thermally and chemically unprocessed, occupied the first position in the consumers' preferences. The more elaborate the processing of the raw material, the higher the technological losses. The established quality ratios are influenced by the degree of processing. They evolve according to the additions in the recipe. The values of the quality indicators are close to the values of other products made of other raw

materials belonging to the same category of vegetal products preserved with sugar, namely jams. The industrial production is seasonal if raw capsicums are processed and it is permanent if roasted or pickled capsicums are processed.

#### Perspectives for further research

The objective in terms of technology is to make it more efficient (to reach the smallest technological losses possible). More sensitive and more competent analytical methods will be used for determining other quality indicators. We shall seek to promote a less aggressive processing method, with a smaller negative impact on the nutritional principles of the capsicum jam.



**Figure 9.** Representation of hedonic score histograms: 1-like extremely; 2- like very much; 3-like moderately; 4-like slightly; 5-neither like nor dislike; 6-dislike slightly; 7-dislike moderately; 8- dislike very much; 9-dislike extremely; for the sensory characteristics of the traced to fresh red pepper jam (J<sub>1</sub>), red pepper roasted jam (J<sub>2</sub>) and red pepper in vinegar jam (J<sub>3</sub>)

**Compliance with Ethics Requirements.** Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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