www.foodandfeed.fins.uns.ac.rs
FOOD AND FEED RESEARCH
Journal of the Institute of Food Technology – FINS
University of Novi Sad
ISSN:
2217-5369 (print),
2217-5660 (online)

UDK 659.117.3:633.842(497.11)

Original research paper

DOI: 10.5937/ffr48-34434

PREFERENCES OF SERBIAN CONSUMERS TOWARDS DIFFERENT PEPPER FRUITS

Dario Đ. Danojević[*1], Svetlana K. Glogovac[1], Đorđe Ž. Moravčević[2], Slađana S. Medić Pap[1]

[1]Institute of Field and Vegetable Crops, 21000 Novi Sad, Maksima Gorkog 30, Serbia
[2]University of Belgrade, Faculty of Agriculture, 11080 Zemun, Nemanjina 6, Serbia

Abstract: Pepper (*Capsicum annuum* L.) is one of the major vegetable species in the world. In Balkan cuisines, as well as in Serbia, pepper has a very diverse use. Knowledge about consumer preferences is of great importance for a breeding process as well as in the market-orientated production. Because of the lack of information about consumer preferences towards pepper types, in the Serbian market, the present research was conducted. Four hundred and two participants, classified into groups, according to gender, age and education, answered the survey questions. According to this research, the most preferred pepper type in Serbia is kapia, while the bell pepper is the second chosen type. Also, it was revealed that the most favourite colour of pepper fruit is red. There is a tendency for higher importance of fruit type rather than fruit colour. The highest percentage of hot pepper consumers prefers medium hot peppers. The obtained trend shows that women generally prefer less spicy pepper fruits than men.

Key words: *capsicum, habits, fruit type, colour, hotness*

INTRODUCTION

Since the pepper was introduced into the Old world, from the highland of Mexico (Bosland, 1996), it has been cultivated in various environments and different fruit types have been developed (Zewdie & Zeven, 1997). Therefore, different ways of pepper consumption, some of them specific to a region, have resulted from variability in types, colours, and size (Danojević, Medić-Pap & Červenski, 2017). Nowadays, pepper (*Capsicum annuum* L.) is one of the major vegetable species with the world total cultivation of almost 2 million hectares in 2019. Compared to other vegetable crops (excluding potato) it ranks first in Serbia with 10.097 ha in 2019 (FAOSTAT, 2021). Additionally, peppers have a very diverse use in the cuisines of many Balkan countries. Pepper fruits are consumed fresh as a salad or as the main ingredient in many traditional dishes and processed foods such as stuffed peppers, pickled peppers, pepper in sour cream, ajvar, pinđur, ljutenica, trljenica and many others.

The phenomenon of globalization is having a major impact on food systems around the world (Kennedy, Nantel & Shetty, 2004). Globalization as a process is speeding in the last decades and leading to a reduction in cultural and biological diversity (Soleri, Cleveland & Aragón Cuevas, 2008) therefore it is very important to preserve specific local products, habits and tastes. However, in the era of travelling, migrations, and trade, people find novel fruit types/colours/varieties and spread new trends to other people and regions.

Corresponding author: Phone: +381214898352 Fax: +381214898356
E-mail address: dario.danojevic@ifvcns.ns.ac.rs

Different kinds of factors affect consumer behaviour, some of which are very difficult to measure. Three main factors with a great influence on consumer behaviour, as stated by Boca (2021) are personal, psychological and social. In choosing a particular vegetable besides personal preferences, a consumer is led by the way of use, market offer and recently by the awareness of the positive effects on human health.

Hence, knowledge about consumer preferences is of great importance in the breeding process as well as in the market-orientated production. Both groups need information about market demands, breeders to optimize the breeding process and select required types of fruits and producers and merchants to understand market trends and anticipate buyers' requirements.

On the other hand plant breeding for improved taste, has already contributed to increased consumption of many vegetables with the development of products such as yellow and orange peppers, cherry and pear tomatoes, baby carrots, seedless watermelons, and lettuces with different colours, textures and flavours (Dias & Ryder, 2011).

As stated by Frank, Nelson, Simonne, Behe and Simonne (2001), US citizens commonly consume green peppers. However, based on empirical data, green peppers are not very popular in the Serbian market. Pepper producers should be familiar with consumer preferences because fruit and vegetable visual attributes are of great importance in the European market (Moser, Raffaelli & Thilmany-McFadden, 2011). According to the authors' knowledge, there is little data in the literature about consumer preferences in terms of pepper fruit shape and colour, especially in the region of southeast Europe and Serbia. Ubiparip Samek et al. (2021) pointed out that there is a lack of scientific research related to fruit and vegetable consumption in Serbia. These authors stated that the most frequent reasons for specific pepper consumption in northern Serbia are healthy 25.7%, tasty 19.1% and good for salad 12.5%. However, the mentioned research did not include pepper fruit type or colour preferences. Therefore, the purpose of this study was to determine consumer preferences towards pepper by different fruit types, colours, and hotness among adults in the Serbian market to optimize the pepper breeding program.

MATERIALS AND METHODS

An online survey in order to collect primary data regarding consumer preferences was conducted from 1st of December 2018 until 28th of February 2019 via Google forms. The anonymous questionnaire is designed to be easily and independently completed. Images of pepper fruit types were provided in the survey. Potential respondents were informed about the survey via the authors' social media groups and e-mail. Contacted persons were asked to circulate the link to the questionnaire (snowballing procedure) to increase the number of participants in the survey. The survey was conducted among 420 randomly selected consumers in the whole of Serbia (northern, central and southern part). The sample consisted of 52% females and 48% males.

Table 1.
Structure of the sample

Variable	**Category/ Description**	**Frequency** (n=402)	**Percentage** (%)
Gender	Male	194	48.26
	Female	208	51.74
Age	18 - 25	46	11.44
	25 - 45	259	64.43
	45 - 65	86	21.39
	Over 65 years	11	2.74
Education Level	Primary school	6	1.49
	High school	93	23.13
	Associate and Bachelor's	174	43.28
	Master's	85	21.15
	Doctorate	44	10.95

In the questionnaire, participants were asked about basic personal data: gender, education level, and age. Questions regarding their preferences were: *Do you eat fresh peppers?*; *What type of pepper fruit do you usually eat?*; *What colour of pepper fruit do you usually eat*?, *Do you eat hot peppers?*; *Level of hotness?*; *Level of colour importance?; Level of fruit type importance?*

The level of hotness ranged from 1-3 (1-mild hot, 2- medium hot, 3-very hot), while the level of colour importance and level of fruit type importance ranged from 1-5 (1- not at all important, 5- very important). After excluding questionnaires with incomplete answers, 402 questionnaires were used for the final statistical analysis (Table 1).

The structure of the sample was represented according to gender, age, and education level. Data about pepper fruit preference were represented in the form of a per cent by a pie chart or histogram in Excel. Statistica13.2 for Kruskal Wallis-test was used for the level of hotness comparison.

RESULTS AND DISCUSSION

The preferences of pepper consumption within the Serbian population are presented through the conducted survey. In the Serbian market, the most common pepper fruit types are bell pepper, kapia, tomato shaped, conical and shipka (elongate hot type). According to this research, the most preferred pepper type in Serbia is kapia, while the bell pepper is the second one (Fig. 1A). Conical and elongate fruits are preferred by almost 15% of respondents. Conversely, conical fruit shape with white or light yellow colour is the most popular type in organic production in neighbouring Hungary (Divéky-Ertsey et al., 2016). The lowest share of respondents in Serbia prefers tomato-shaped peppers. Although it is the least popular fruit type, it should not be excluded from further breeding programs. Namely, this type of fruit is used a lot for pickling, and less for fresh consumption. According to obtained results for fruit type importance, the highest frequency for this trait had marks 4 (fairly important) and 3 (important) (Fig. 1B). Those results indicate the high importance of this pepper fruit trait.

The survey showed that the most preferred colour of pepper fruit is red. Light yellow and yellow peppers are preferred by a quarter of consumers, light green and green by 17.4% and orange by only 1.0% (Fig. 2A). Such low consumer preference for orange pepper is probably caused by the absence or poor offer of orange pepper fruits in the Serbian market. Data collected in Copenhagen revealed that school children prefer more red than yellow or green pepper (Olsen, Ritz, Kramer & Møller, 2012). Similar results from 24 trained panel subjects in the Netherlands showed that the acceptance for red bell pepper was higher than green pepper (van Stokkom, de Graaf, Wang, van Kooten & Stieger, 2019). On the contrary in the USA, the market share is 80% for green pepper, 10% for red, and 8% for yellow colour (Simonne, Kemble & Boozer, 1997).

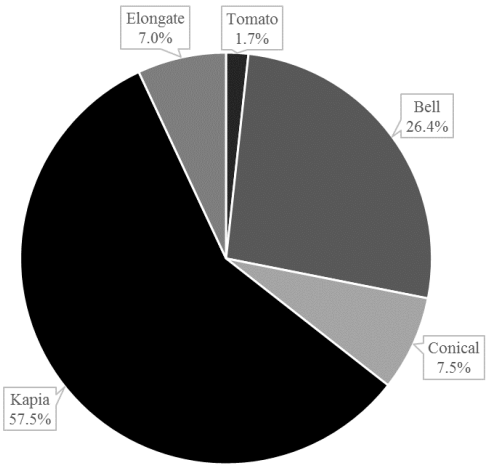

Figure 1A. Per cent of respondents in the survey of Serbian pepper consumers toward fruit type

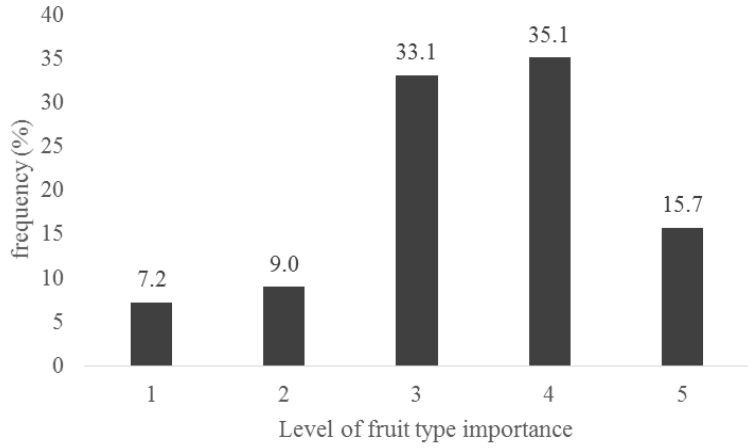

Figure 1B. Per cent of respondents in the survey of the Serbian pepper consumers toward a level of fruit type importance (1- not at all important, 5- very important)

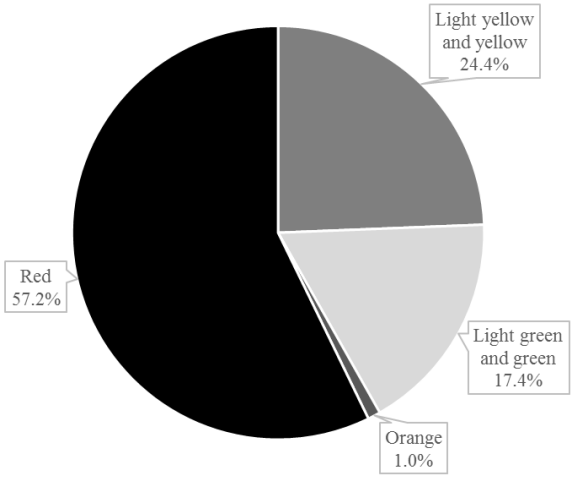

Figure 2A. Per cent of respondents in the survey of Serbian pepper consumers toward fruit colour

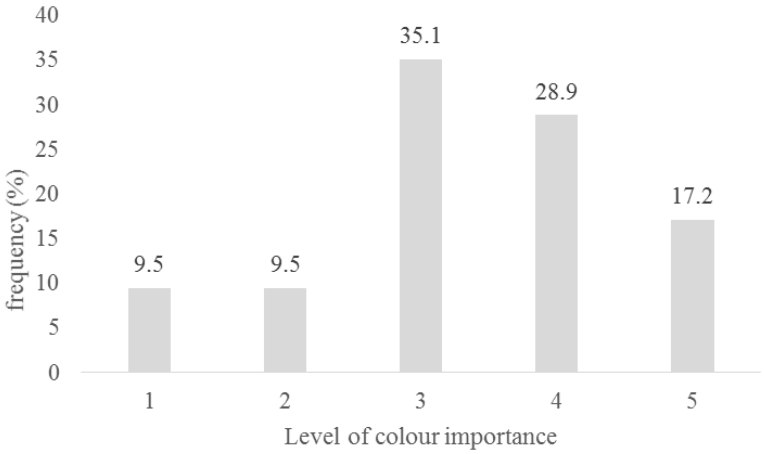

Figure 2B. Per cent of respondents in the survey of Serbian pepper consumers toward a level of colour importance (1- not at all important, 5- very important)

The importance of fruit colour is also confirmed through the answers gained by the questionnaire conducted in this research. More than 60% of respondents marked fruit colour as important (3) and fairly important (4) (Fig. 2B).

The obtained result can be explained by the fact that most of the respondents stated that they prefer the kapia type of peppers, which are usually red. Red peppers, except for fresh consumption, are also the main ingredient of many widespread dishes like roasted peppers, ajvar, pinđur and this makes them more popular than peppers of other colours. Increasing consumer awareness of the positive effects of natural antioxidants, such as carotenoids, on human health, can affect consumer greater preference for red fruit peppers. A higher percentage of light yellow and yellow pepper consumption in relation to green and orange is a consequence of the high consumption of bell-type peppers, which are usually light yellow. In general, red and light yellow are the most common colours on the pepper market in Serbia, which is reflected in their higher consumption. Specifically, colour preference can vary for each region. For example, in Northwest Europe, consumers like bright red colour peppers, while in the south, they prefer darker red (Treena, 2007). Schifferstein, Wehrle and Carbon (2019) stated that colour hue has a substantial impact on consumer expectations about sensory and functional properties, including freshness and nutritional value in the case of red pepper reflected by high ratings for spiciness.

Numerous studies (Shankaranarayanan, Arunkanth & Dinesh, 2018; Elvira-Torales, García-Alonso & Periago-Castón, 2019; Ramya & Priya, 2019) indicate the importance of consuming peppers and other types of orange fruits due to the content of β-carotene and its health benefits. For that reason, it is necessary to increase consumers' awareness of the importance of consuming such peppers and thus increase the demand and creation of new varieties and hybrids of orange fruit.

Comparing the importance of fruit type and colour, there is a tendency in higher importance of fruit type (mark 4 and 5) (Fig. 1B and 2B). The information should indicate that the introduction of new fruit colours will be more easily accepted by the customers, than new fruit types. It can be assumed that the fruit type is more important to people than the colour because it determines, to a greater extent, the purpose and way of consuming peppers.

Although most respondents like hot peppers, they demonstrate distinct preferences regarding the level of hotness. The highest percentage of hot pepper consumers prefer medium hot peppers, while a smaller share do not consume hot peppers at all (Fig. 3).

There is a tendency, at the margin of the significance $p=0.0678$, that women generally prefer less spicy pepper fruits than men (Fig. 4A). In the research from the USA, women were noted to be „non-likers" of spicy foods unlike men (Lillywhite, Simonsen & Uchanski, 2013).

When we compared preferences about the level of hotness with age, we noticed that participants between 18-25 and 45-65 like hot more than other age groups (Fig. 4B).

Although numerous studies (Yoshioka et al., 1999; Westerterp-Plantenga, Smeets & Lejeune, 2005; Ludy, Moore & Mattes, 2012; Chakrabarty, Mominul Islam & Aminul Islam, 2017; Guzman & Bosland, 2017) indicate that capsaicin intake has several health benefits, the effect of burning and stinging it causes, influence the avoidance of such foods in a certain number of people (Byrnes & Hayes, 2015).

Some reasons can affect a greater or lesser preference for spicy foods. Those factors include social influences, repeated exposure to capsaicin, physiological differences in chemosensation, and personality (Byrnes & Hayes, 2013).

The same authors stated that repeated exposure to capsaicin and chillies can result in chronic desensitization. The results of Byrnes & Hayes (2015) suggested that different mechanisms in men and women affect the intake of spicy foods, with the assumption that men may respond more to extrinsic factors, while women may respond more to intrinsic factors. They also emphasized that further research is necessary to investigate any possible biological differences in neurological response to capsaicin that may have a role in liking or disliking capsaicin-containing foods.

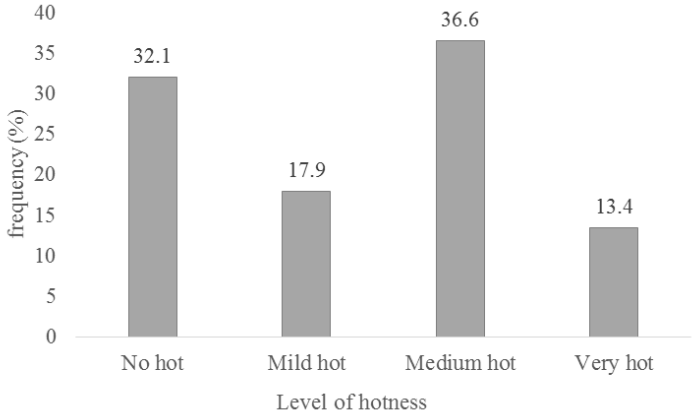

Figure 3. Per cent of respondents toward the level of hotness in the survey of Serbian pepper consumers

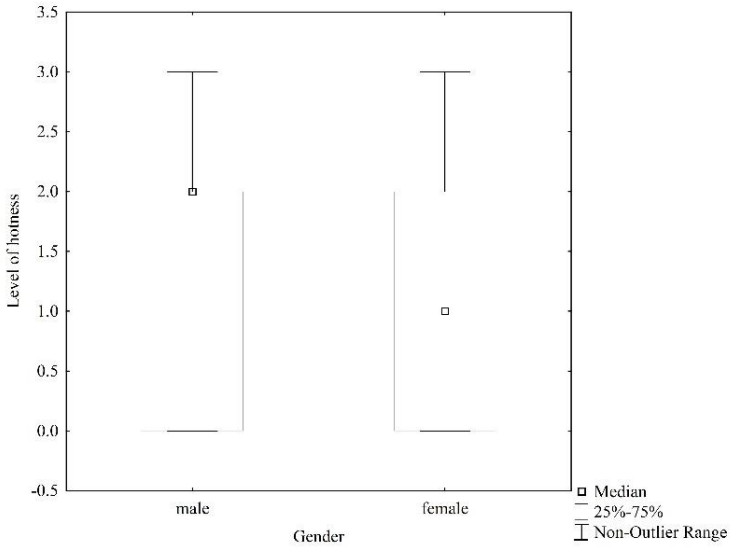

Figure 4A. Relationship between gender (KW-test, p = 0.0678) of Serbian pepper consumers and level of hotness (0-sweet, 1-mild hot, 2-medium hot, 3-very hot)

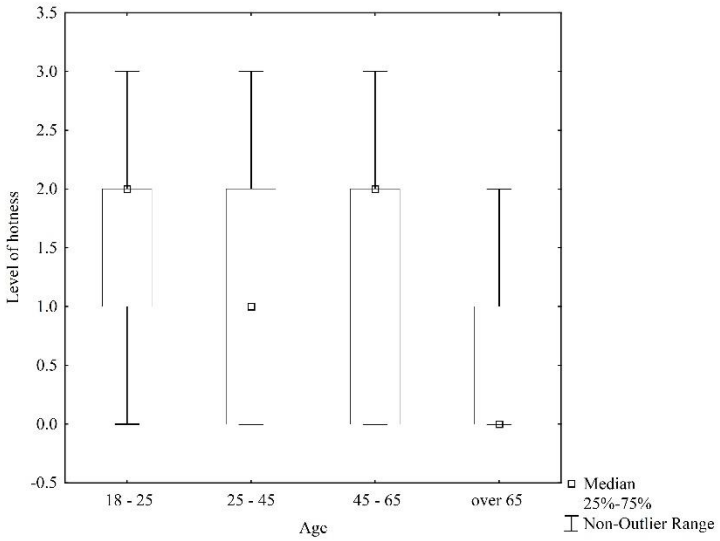

Figure 4B. Relationship between age (KW-test, p = 0.0291) of Serbian pepper consumers and level of hotness (0-sweet, 1-mild hot, 2-medium hot, 3-very hot)

CONCLUSIONS

Research results have shown that the most preferable type of pepper fruit is kapia, while the most desirable colour is red. Due to the fact that ajvar, pinđur and roasted pepper are traditional Serbian dishes made from red kapia type peppers, this type of fruit will probably remain dominant for a long time. Additionally, there is a slight advance in the importance of fruit type compared to fruit colour. More than half of respondents eat hot peppers and most of them like mild ones. Generally, all the information indicates the Serbian pepper market as traditional, without big changes in preferences in pepper consumption. From the producers and merchants point of view, there is still a justified reason for production and market supply with the most preferable pepper types. On the other hand, a wider offer in pepper markets, in terms of fruit types and colours, could lead to some changes in consumer preferences. The presence of traditional consumers, as well as those who are more prone to dietary innovations, is of great importance because they ensure the existence of product diversity on the market through the preservation of traditional but also the creation of new products. Hence the future research proposal should be de-signed to gain a deeper understanding of consumer preferences. Furthermore, future studies should evaluate the influence of pepper market diversification on the changes in consumer choice and explain their reasons for accepting or rejecting a certain pepper type in their diet. This information could be useful for breeders, producers and merchants to meet consumer demands and show future perspectives in the development of the Serbian pepper market.

ACKNOWLEDGEMENTS

Supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, grant number: 451-03-68/2020-14/200032

REFERENCES

Boca, G. D. (2021). Factors influencing consumer behavior in sustainable fruit and vegetable consumption in Maramures County, Romania. *Sustainability, 13*, 1812. https://doi.org/10.3390/su13041812

Bosland, P. W. (1996). Capsicums innovative uses of an ancient crop. In J. Janick (Ed.), *Progress in New Crops* (pp. 479-487). Alexandria, USA: ASHS Press.

Byrnes, N. K., & Hayes, J. E. (2015). Gender differences in the influence of personality traits on spicy food liking and intake. *Food Quality and Preference, 42*, 12-19. https://doi.org/10.1016/j.foodqual.2015.01.002

Byrnes, N. K., & Hayes, J. E. (2013). Personality factors predict spicy food liking and intake. *Food Quality and Preference*, *28*(1), 213-221. https://doi.org/10.1016/j.foodqual.2012.09.008

Chakrabarty, S., Mominul Islam, A. K. M., & Aminul Islam, A. K. M. (2017). Nutritional benefits and pharmaceutical potentialities of chili: A review. *Fundamental and Applied Agriculture*, *2*(2), 227-232. http://dx.doi.org/10.5455/faa

Danojević, D., Medić-Pap, S., & Červenski, J. (2017). NS pepper varieties in a multivariate fruit analysis. In *Proceedings of the VIII International Scientific Agriculture Symposium "AGROSYM 2017*" (pp. 495-500). Jahorina mountain, Bosnia and Herzegovina. http://agrosym.ues.rs.ba/article/showpdf/BOOK_OF_PROCEEDINGS_2017_FINAL.pdf

Dias, J. S., & Ryder, E. J. (2011). World vegetable industry: production, breeding, trends. In J. Janick (Ed.), *Horticultural Reviews* 38 (pp. 299-356). New Jersey, Wiley-Blackwell, John Wiley & Sons, Inc.

Divéky-Ertsey, A., Csambalik, L., Madaras, K., Gál, I., Szalai, Z., & Pusztai P. (2016). Variety and seed use of organic sweet pepper production in Hungary. In *Proceedings XVI Eucarpia Capsicum and Eggplant Meeting* (pp. 299-356). Kecskemet, Hungary. https://zenodo.org/record/1255303#.YVF-NVUzaUk

Elvira-Torales, L. I., García-Alonso, J., & Periago-Castón, M. J. (2019). Nutritional importance of carotenoids and their effect on liver health: A review. *Antioxidants*, *8*(7), 229. https://doi.org/10.3390/antiox8070229

FAOSTAT. (2021). Food and Agriculture Organisation of the United Nations. http://www.fao.org/faostat/en/#data/QC

Frank, C. A., Nelson, R. G., Simonne, E. H., Behe, B. K., & Simonne, A. H. (2001). Consumer preferences for color, price, and vitamin C content of bell peppers. *HortScience 36*(4), 795-800. http://dx.doi.org/10.21273/HORTSCI.36.4.795

Guzmán, I., & Bosland, P. W. (2017). Sensory properties of chile pepper heat and its importance to food quality and cultural preference. *Appetite*, *117*, 186-190. https://doi.org/10.1016/j.appet.2017.06.026

Kennedy, G., Nantel, G., & Shetty, P. (2004). Globalization of food systems in developing countries: a synthesis of country case studies. *FAO Food and Nutrition paper*, *83*, 1-26. http://www.fao.org/3/y5736e/y5736e.pdf

Lillywhite, J. M., Simonsen, J. E., & Uchanski, M. E. (2013). Spicy pepper consumption and preferences in the United States. *HortTechnology, 23*(6), 868-876. https://doi.org/10.21273/HORTTECH.23.6.868

Ludy, M. J., Moore, G. E., & Mattes, R. D. (2012). The effects of capsaicin and capsiate on energy balance: critical review and meta-analyses of studies in humans. *Chemical Senses*, *37*(2), 103-121. https://doi.org/10.1093/chemse/bjr100

Moser, R., Raffaelli, R., & Thilmany-McFadden, D. (2011). Consumer preferences for fruit and vegetables with credence-based attributes: A review. *International Food and Agribusiness Management Review*, *14*(2), 121-142.

Olsen, A., Ritz, C., Kramer, L., & Møller, P. (2012). Serving styles of raw snack vegetables. What do children want? *Appetite*, *59*(2), 556-562. https://doi.org/10.1016/j.appet.2012.07.002

Ramya, V., & Priya, P. (2019). Health benefits of vegetables. *International Journal of Chemical Studies*, *7*(2), 82-87.

Schifferstein, H., Wehrle, T., & Carbon, C. (2019). Consumer expectations for vegetables with typical and atypical colors: The case of carrots. *Food Quality and Preference*, *72*, 98-108. https://doi.org/10.1016/j.foodqual.2018.10.002

Shankaranarayanan, J., Arunkanth, K., & Dinesh, K. C. (2018). Beta Carotene -therapeutic potential and strategies to enhance its bioavailability. *Nutrition and Food Science International Journal*, *7*(4), ID.555716. https://juniperpublishers.com/nfsij/pdf/NFSIJ.MS.ID.555716.pdf

Simonne, E., Kemble, J., & Boozer, R. (1997). Varieties for the Alabama vegetable industry and the southeast. *Alabama Agricultural Experiment Station Bulletin, 632*, 25-29.

Soleri, D., Cleveland, A. D., & Aragón Cuevas, F. (2008). Food globalization and local diversity: The case of Tejate. *Current Anthropology*, *49*(2), 281-290. https://doi.org/10.1086/527562

Treena, H. (2007). A closer look at sweet pepper breeding and its challenges. Europeanseed. Retrieved from https://european-seed.com/2017/11/closer-look-sweet-pepper-breeding-challenges/

Ubiparip Samek, D. N., Bajić, A. R., Pezo, L. L., Kovač, R. M., Mastilović, J. S., Zoranović, T. S., & Vlahović, B. I. (2021). Exploring consumer preferences and factors associated with vegetable consumption. *Food and Feed Research*, *48*(1), 57-68. https://doi.org/10.5937/ffr48-32587

van Stokkom, V. L., de Graaf, C., Wang, S., van Kooten, O., & Stieger, M. (2019). Combinations of vegetables can be more accepted than individual vegetables. *Food Quality and Preference*, *72*, 147-158. https://doi.org/10.1016/j.foodqual.2018.10.009

Westerterp-Plantenga, M., Smeets, A., & Lejeune, M. (2005). Sensory and gastrointestinal satiety effects of capsaicin on food intake. *International Journal of Obesity*, *29*(6), 682-688. https://doi.org/10.1038/sj.ijo.0802862

Yoshioka, M., St-Pierre, S., Drapeau, V., Dionne, I., Doucet, E., Suzuki, M., & Tremblay, A. (1999). Effects of red pepper on appetite and energy intake. *British Journal of Nutrition*, *82*(2), 115-123. https://doi.org/10.1017/S0007114599001269

Zewdie, Y., & Zeven, A. C. (1997). Variation in Yugoslavian hot pepper (*Capsicum annuum* L.) accessions. *Euphytica*, *97*, 81-89. https://doi.org/10.1023/A:1003028703431

NAVIKE POTROŠAČA U SRBIJI PRI IZBORU PLODOVA PAPRIKE

Dario Đ. Danojević[*1], Svetlana K. Glogovac[1], Đorđe Ž. Moravčević[2], Slađana S. Medić Pap[1]

[1]Institut za ratarstvo i povrtarstvo, 21000 Novi Sad, Maksima Gorkog 30, Srbija
[2]Univerzitet u Beogradu, Poljoprivredni fakultet, 11080 Zemun, Nemanjina 6, Srbija

Sažetak: Paprika (*Capsicum annuum* L.) je jedna od najznačajnijih povrtarskih vrsta u svetu. U kuhinjama balkanskih zemalja, pa i Srbije, paprika ima veoma raznovrsnu upotrebu. Poznavanje navika potrošača od velikog je značaja za proces oplemenjivanja, kao i za tržišno orijentisanu proizvodnju. Zbog nedostatka informacija o navikama potrošača, ovo istraživanje imalo je za cilj da utvrdi koja svojstva plodova potrošači paprike u Srbiji najčeće odabiraju. Anketom je obuhvaćeno četiri stotine i dva učesnika koji su svrstani u grupe prema polu, godinama starosti i obrazovanju. Dobijeni rezultati istraživanja pokazali su da je u Srbiji najpopularniji tip paprike kapija, dok je babura drugi izabrani tip, a omiljena boja ploda je crvena. Ustanovljeno je da za potrošače veći značaj ima tip ploda u odnosu na boju ploda. Najveći procenat potrošača ljute paprike preferira srednje ljute plodove. U ispitivanju ljutine, trend pokazuje da žene uglavnom vole manje ljutu papriku u odnosu na muškarce.

Ključne reči: *capsicum, navike, tip ploda, boja, ljutina*

Received: *26 October 2021/* ***Received in revised form:*** *29 November 2021/* ***Accepted:*** *03 December 2021*

Available online: *December 2021*