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# A Case Study of Consumer's Attitudes towards Agro-Food Markets in Danube Microregion in COVID-19 Pandemic

**Dario Iljkić [1,*], Olgica Klepač [2], Dubravka Užar [3], Ionel Samfira [4], Dušan Dunđerski [5], Daniel Haman [6], Catalin Zoican [7], Ivana Majić [8] and Ivana Varga [1]**

1 Department of Plant Production and Biotechnology, Faculty of Agrobiotechnical Sciences Osijek, Josip Juraj Strossmayer University of Osijek, 31000 Osijek, Croatia; ivana.varga@fazos.hr
2 Department for Bioeconomy and Rural Development, Faculty of Agrobiotechnical Sciences Osijek, Josip Juraj Strossmayer University of Osijek, 31000 Osijek, Croatia; oklepac@fazos.hr
3 Department of Agricultural Economics and Rural Development, Faculty of Agriculture, University of Novi Sad, 21000 Novi Sad, Serbia; dubravkauzar@gmail.com
4 Faculty of Agriculture, University of Life Sciences "King Mihail I" from Timisoara, 300645 Timisoara, Romania; ionelsamfira@usab-tm.ro
5 Institute of Field and Vegetable Crops, 21000 Novi Sad, Serbia; dundjerskid@gmail.com
6 International Relations and Projects Office, Faculty of Agrobiotechnical Sciences Osijek, Josip Juraj Strossmayer University of Osijek, 31000 Osijek, Croatia; dhaman@fazos.hr
7 Faculty of Bioengineering and Animal Resources, University of Life Sciences "King Mihail I" from Timisoara, 300645 Timisoara, Romania; zoicane@yahoo.com
8 Department of Phytomedicine, Faculty of Agrobiotechnical Sciences Osijek, Josip Juraj Strossmayer University of Osijek, 31000 Osijek, Croatia; imajic@fazos.hr
* Correspondence: diljkic@fazos.hr

**Abstract:** The COVID-19 pandemic affected many aspects of human life including consumer behavior. The main aim of this paper was to identify basic patterns of changes in consumer attitudes towards agri-food products under the influence of the 2020 pandemic and to better understand to what extent and what kind of food market problems appeared for the inhabitants of the Danube microregion. For this purpose, an explorative study was elaborated. Assuming that the experience of COVID-19 affected consumer attitudes and sense of food security, a hybrid survey was conducted in the Danube microregion (Croatia, Serbia and Romania) during 2022. Data collected from a total of 903 respondents were statistically analyzed in SPSS. Descriptive statistics, PCA, ANOVA and *t*-Test were employed. The main results have shown that although the surveyed population of the Danube microregion during the pandemic in 2020 was generally not afraid of food shortages, food was in most part available for their families and their shopping habits have not changed to a large degree, the experience of the pandemic has raised the level of awareness about some issues related to food and specifically the prices of food products. Also, three different patterns of attitude and behavior towards food and agriculture, which emerged as a result of the experience of the pandemic in 2020, were identified. These patterns also proved to be different for different segments of the population. The findings suggest the need for stronger support for the development of locally affordable food systems with the use of ICT as a coping mechanism in crises.

**Keywords:** COVID-19 pandemic; Danube microregion; survey; affectedness; consumer attitudes



**Citation:** Iljkić, D.; Klepač, O.; Užar, D.; Samfira, I.; Dunđerski, D.; Haman, D.; Zoican, C.; Majić, I.; Varga, I. A Case Study of Consumer's Attitudes towards Agro-Food Markets in Danube Microregion in COVID-19 Pandemic. *COVID* **2024**, *4*, 409–428. https://doi.org/10.3390/covid4030027

Academic Editor: Martin Thomas Falk

Received: 13 February 2024
Revised: 9 March 2024
Accepted: 14 March 2024
Published: 15 March 2024



## 1. Introduction

In recent history, there have been many challenging periods for humankind, directly and indirectly influencing everyday life. Despite these challenges, healthcare has always remained a primary concern. In the last century, humankind has faced multiple disease outbreaks, yet only a few, such as Spanish flu, Asian flu, Hong Kong flu and Ebola, have reached pandemic levels [1,2]. During the 1980s, a new and deadly viral disease known as AIDS emerged, and in the early 21st century, SARS and Swine flu also emerged.

Excluding AIDS, these pandemics resulted in an estimated 22 to 104 million deaths [3]. In December 2019, a new pandemic caused by SARS-CoV-2 or COVID-19 emerged in Wuhan province, China [4]. While pandemics are not a new phenomenon, governments and people were initially unprepared to effectively suppress the spread of the virus. Consequently, COVID-19 brought significant changes and behavioral patterns that continue to evolve daily [5,6]. Thus, the pandemic period also determined significant changes in consumer behavior towards food, whereby many specificities between countries were observed [7,8].

The negative effects of the pandemic on the economy, trade, human health, society, environment, tourism, culture, education and more are now well-documented [9–15]. According to the World Health Organization [16], globally there have been 775 million confirmed cases, including 7.03 million deaths in more than 210 countries, and the International Monetary Fund [17] estimates that the global economy shrunk by 4.4% in 2020, which is the biggest decline since the Great Depression of the 1930s. Furthermore, the World Food Program [18] reports that the number of severely food-insecure people has increased from 135 million in 53 countries (pre-pandemic) to 345 million in 82 countries (post-pandemic) in just two years, due to various stressors including the pandemic. While conflict, climate change, economic downturns and ecosystem disruption are also significant factors in food insecurity [19], Gundersen et al. emphasize that the rising issue of food insecurity stems from increasing unemployment and poverty, not solely the agricultural sector [20]. On the other hand, some authors have highlighted positive effects of the pandemic, such as strengthened family relationships, improved social well-being, digitalization of work and education, enhanced teamwork, improved personal lives and environmental benefits [21–23]. A notable reduction in harmful gas and air pollutant levels was observed during lockdowns worldwide [24,25].

During the challenging times of the pandemic and lockdowns, the agriculture and food sector faced significant exposure due to the complexities of primary food production, processing and distribution [26–28]. The goal of every country/government is to provide a sufficient amount of food for the population, which is achieved by their own production (self-sufficiency) and/or by importing food that is not produced in sufficient quantities or cannot be produced due to mostly climate reasons. However, COVID-19 has affected both the production and import of food as well as the processing and distribution of agricultural products by cutting the connections between producers (farmers) and food markets. Additionally, panic buying has created temporary shortages, causing both food suppliers and consumers to experience artificial scarcity and insecurity [29,30]. Ali et al. [31] confirm that rumors, government strategies, fear, anxiety and health security significantly affect consumers' panic buying behaviors. Overall, a pandemic clearly demonstrates how consumer behavior depends heavily on the situation, as well as product and consumer characteristics. The analysis conducted by Górka-Chowaniec and Sikora proved that COVID-19 is rapidly affecting changes in consumer behaviors and the way of thinking [32]. In Serbia, for example, the pandemic significantly impacted online commerce, with many consumers turning to online food purchases [33], while digital marketing in west Java, Indonesia, increased during the pandemic compared to before the pandemic and had a significant effect on consumer purchasing decisions [34].

While agriculture is one of the most crucial branches of human life, providing vital subsistence through raw and processed materials, the COVID-19 pandemic exposed the fragility of the food chain system [35–37]. Alabi and Ngwenyama [38] point out that the COVID-19 pandemic has disrupted the global food supply chains in the following ways: poor economy, limitation to food accessibility, shortage of farm workers, changes in the demands of consumers, restriction in the transportation of farm commodities, the shutdown of food production facilities, the uncertainty of food quality and safety, food trade policy restrictions, delays in the transportation of food products, etc. Additionally, COVID-19 exerted its effect on the economy, agriculture and food security of Iran, corresponding to a 30% decrease in the purchasing power parity in 2020 [39] However, there are differing opinions. Hailu [40] notes that the Canadian food processing sector proved to be relatively

stable during the pandemic—food was still processed and delivered to consumers and food price increases were minimal in most cases given the scale of the shock. Similarly, Gonzalez-Martinez et al. [41] confirm that the agriculture sector in the European Union (EU) was quite resilient during the pandemic.

Before the COVID-19 pandemic, the European Commission (EC) adopted a very challenging initiative called the European Green Deal (EGD) and one of the agendas is a fair, healthy and environmentally acceptable food system. According to Tyczewska et al. [42], recent events, such as the pandemic, inflation and war, have greatly impacted the feasibility and consequences of the strategy so the EC has adopted new strategies which are a fundamental component of the EU's recovery plan post-COVID-19. This strategy is vital for safe-guarding both EU and global food safety.

The Danube region (DR) is one of the four macro-regions defined by the EU, composed of nine EU countries (two regions in Germany), four non-EU countries and south-western and southern regions of Ukraine [43]. Croatia, Serbia and Romania present one Danube microregion, for the purposes of this paper the so-called CroSeRo, that occupies approximately 34.4% territory and one-quarter of the population of the Danube region. The gross domestic product (GDP) in the EU, DR and CroSeRo widely differ. Although COVID-19 strongly hit the economy, with a decline of −5.9% (EU), −5.5% (DR), −8.1% (Croatia), −3.9% (Romania) and −0.9% (Serbia) in 2020, economies of all countries and regions rapidly recovered in 2021. Generally, countries that experienced the starkest economic decline in 2020 displayed the highest economic growth in 2021, which may point to a better standard of citizens and companies and consequently greater resistance to extreme situations.

Considering that food is a basic human need, the main hypotheses of this paper were (i) the population of the CroSeRo microregion was faced with food problems due to the pandemic in 2020; (ii) the population of the microregion has changed its food procurement habits; and (iii) the population's experiences after the 2020 pandemic led to changes in awareness, concerns, interests and practices related to agri-food issues.

Based on these three hypotheses, the main objectives of this study were (i) to describe the availability of food and the level of fear of food shortages in the CroSeRo microregion during the 2020 pandemic; (ii) to analyze the changes in attitudes towards agriculture and food, food acquisition methods and concern about food issues in the microregion under the influence of the pandemic; and (iii) to identify specific patterns of changes in attitudes towards agriculture and food due to the 2020 pandemic in the CroSeRo microregion.

## 2. Materials and Methods

### *2.1. Research Implementation*

An explorative study was elaborated for the purposes of answering the questions about the extent and the kind of food-related problems that have arisen for the residents of the CroSeRo Danube microregion and the patterns of changes in attitudes towards agri-food products influenced by the 2020 pandemic.

A hybrid (online and on-site) survey of public opinion was conducted in the area of eastern Croatia, northern Serbia and western Romania (CroSeRo mikroregion) during September and October of 2022. Firstly, a survey questionnaire consisting of 63 variables was constructed by the international team of researchers from Croatia, Serbia and Romania. After that, the teams of each partner country translated it into their national languages and questions were loaded into the Google form. A link to the Google form was sent to the addresses of local public, private and civil society organizations with an extended letter about the research and with a request to share information and the link to the survey among their members. Also, for the recruitment, a series of messages were prepared and shared on social networks through the researchers' accounts and the data collection was promoted through partnering institutions' mailing lists and snowball sampling. The collection process was monitored. To combat the possibility of sampling bias and also to achieve the goal of about 300 fully completed questionnaires per partner country, individuals were approached with a physical questionnaire. Data collected in that way were subsequently entered into

the database. This stage of the research was conducted by the researchers in public spaces (i.e., markets) during December of 2022 after screening of the received questionnaires.

Before accessing the survey, all respondents were informed about the objectives of the study and gave their informed consent. The participants were guaranteed anonymity and they were able to leave the survey at any moment.

The questionnaire was divided into two main sections: (i) socio-demographic characteristics (gender, age, type of settlement, monthly household income, place of residency) and (ii) items related to food consumption during the COVID-19 pandemic.

### *2.2. Measures*

Gender. Respondents indicated their gender by choosing either 1 = female or 2 = male.

Age. Respondents entered their age in years. These data were then categorized into four groups: 1 = up to 30 years, 2 = 31 to 40 years, 3 = 41 to 50 years, and 4 = over 51 years old.

Residential settlement. Respondents recorded whether they live in a 1 = rural or 2 = urban settlement.

Agricultural experience. With a simple choice between 0 = no and 1 = yes, respondents recorded whether they had any agricultural experience (formal or informal education, wage/seasonal agricultural work, help on a family farm or ownership of a family farm).

Average monthly household income before the 2020 pandemic. Respondents were asked to estimate what their average monthly household income before the 2020 pandemic was, and they could choose between the following categories: 1 = up to €500, 2 = €501 to €1000, 3 = €1001 to €1500, 4 = €1501 to €2000, 5 = €2001 to €2500, 6 = €2501 to €3000 and 7 = more than €3001. The number of categories was subsequently reduced, and the results were distributed as follows: 1 = up to €1000, 2 = €1001 to €2000 and 3 = more than €2001.

Average monthly household income during the 2020 pandemic. Respondents recorded whether their average monthly household income during the 2020 pandemic was 1 = lower than the period before the 2020 pandemic, 2 = the same as before the 2020 pandemic, 3 = higher than the period before the 2020 pandemic.

Fear of food shortages during the 2020 pandemic. On a 5-point Likert scale where 1 is not at all afraid and 5 is extremely afraid, respondents estimated the level of their fear of food shortages during the 2020 pandemic.

Impact of food shortages. On a scale of 5 degrees, where 1 is not at all and 5 is markedly affected, the respondents assessed the degree of their families and their regions being affected by the food shortage.

Availability of foods. On a 5-point Likert scale (1 was not available at all and 5was completely available), the respondents estimated how much each of 10 food products (1 = flour, 2 = sugar, 3 = oil, 4 = canned food, 5 =yeast, 6 = pasta, 7 = meat, 8 = dairy, 9 = eggs, 10 = vegetables and fruit) were available in stores during the 2020 pandemic.

Frequency of purchases from different sources. On a 5-point Likert scale (1, not at all to 5, very often), the respondents estimated how often they got food by choosing the following sources: 1 = supermarkets, 2 = small shops, 3 = local farms, 4 = markets, 5 = specialized food stores, 6 = internet market/shops, 7 = fairs and 8 = from friends/relatives.

Changes in shopping habits during the 2020 pandemic. For 10 different foods (1 = flour, 2 = sugar, 3 = oil, 4 = canned food, 5 = yeast, 6 = pasta, 7 = meat, 8 = dairy products, 9 = eggs, 10 = vegetables and fruit), respondents evaluated changes in their shopping habits during the 2020 pandemic by choosing among the possible answers: 1, I was buying less, 2, I was buying the same amount or 3, I was buying more.

Factors affecting food consumption during the 2020 pandemic. On a 5-point Likert scale (1, not affected at all up to 5, completely affected), respondents assessed how much each of the following aspects affected their food consumption during the 2020 pandemic: 1, High prices of local producers' food products, 2, High prices of food products in stores, 3, Distance to stores, 4, Distance to local producers, 5, Insufficient supply in stores,

6, Insufficient supply from domestic producers, 7, Underdeveloped delivery services in the region.

Reliance on one's own food sources. Respondents answered the question whether they relied on their own sources of food during the 2020 pandemic, with three different options: 1, Own production on a farm, 2, Production in one's own garden and 3, Previously produced food supplies; they choose 0 = no or 1 = yes. Subsequently, the results of those three variables were added up to create the summative variable SUM_own food (value range 0–3) in order to obtain a clearer picture of the proportion of respondents who have or do not have their own sources of food that can be relied on in situations of food shortage.

Changes in attitudes towards agriculture and food as a consequence of the 2020 pandemic. The research focused on how the 2020 pandemic influenced people's attitudes and practices regarding agriculture and food. To measure this, a 15-statement instrument was developed, asking respondents to rate the extent to which each statement applies to them on a 5-point scale ranging from 1 (does not apply to me at all) to 5 (extremely applies to me).

### *2.3. Analyses and Data Processing*

To achieve the first two goals of the paper related to the description of the food supply situation during the 2020 pandemic and its consequences, the analyses used included descriptive statistics of the results on individual variables (display of frequencies and percentages, central tendency measures and Standard Deviation). Principal component analysis (PCA) with Varimax rotation was used to achieve the third objective related to detecting basic patterns of changes in attitudes towards agriculture and food resulting from the 2020 pandemic. The dimensionality of the instrument with 15 statements of different attitudes towards agriculture and food that were a possible response to experiencing the pandemic in 2020 was analyzed. This PCA analysis helped create new combined variables (SUM) by adding up the results of the variables that formed individual components. Finally, in order to obtain a more detailed picture of the patterns of changes in attitudes toward agriculture and food under the influence of the 2020 pandemic, several analyses of the differences in average scores on the newly created variables of attitudes toward agriculture and food between different groups with regard to gender, age, economic situation, agricultural experience and residential status were carried out (*t*-Test, ANOVA). All analyses were performed in the statistical data software SPSS version 25 (IBM company).

### *2.4. Structure of the Sample*

Using the random sampling method, a sample size of 903 was determined. The questionnaires were filled out by an equal number of respondents from each country (301 each, or 33.3%), resulting in a balanced sample across Croatia, Serbia and Romania (Table 1).

Sex distribution. The total sample of respondents from the Danube microregion is largely gender balanced—50.4% of the sample is female, and 49.6% is male.

Age distribution. The average age of the entire sample of respondents is 33 years, ranging from 16 to 96 years of age. The majority of the sample (53.5%) consists of respondents under 30 years old, while another third (35%) are between 31 and 50 years old. The sample includes 11% of those older than 51 years.

Residential settlement. According to the type of settlement where respondents of the CroSeRo microregion live, 39% of the sample respondents are from rural areas, while 61% are from urban settlements.

Agricultural experience. Overall, 39% of the sample respondents have no agricultural experience, which means that 61.2% of the respondents recorded at least one of the following possible forms of experience in agriculture: formal or informal education, wage/seasonal agricultural work, help on the family farm or ownership of the family farm.

**Table 1.** The structure of the examined sample in numbers and percentages.

| Sample Structure (CroSeRo) | Total Pattern | |
|---|---|---|
| | f | % |
| Countries | | |
| Croatia | 301 | 33.3 |
| Serbia | 301 | 33.3 |
| Romania | 301 | 33.3 |
| Gender | | |
| Female | 455 | 50.4 |
| Male | 448 | 49.6 |
| Age (REK) | | |
| up to 30 years | 483 | 53.5 |
| 31 to 40 years | 164 | 18.2 |
| 41 to 50 years | 153 | 16.9 |
| more than 51 years | 103 | 11.4 |
| Type of settlement | | |
| Rural | 353 | 39.1 |
| Urban | 550 | 60.9 |
| Agricultural experience | | |
| No | 350 | 38.8 |
| Yes | 553 | 61.2 |
| Average monthly household income BEFORE the 2020 pandemic | | |
| to €1000 | 315 | 34.9 |
| €1001 to €2000 | 361 | 40.0 |
| more than €2001 | 227 | 25.1 |
| Average monthly household income DURING the 2020 pandemic | | |
| Lower than the period before the 2020 pandemic | 185 | 20.5 |
| The same as before the 2020 pandemic | 596 | 66.0 |
| Higher than the period before the 2020 pandemic | 122 | 13.5 |

Family economic situation before the pandemic in 2020. The largest number of respondents (40%) had an average monthly family income of up to €1000. An additional 35% of respondents had slightly higher average monthly family income in the range of €1000 to €2000. Respondents with a monthly income of more than €2001 per month make up 25% of the sample.

Family economic situation during the pandemic in 2020. The described economic situation for the largest part of the total sample—two-thirds (66%) did not change during the pandemic. On the other hand, 13.5% of respondents noted that their situation improved during the pandemic. However, for a significant share, of 20.5%, of the sample, the pandemic also meant a decrease in average monthly income.

## 3. Results and Discussion

### *3.1. Description of the Situation in the CroSeRo during the 2020 Pandemic*

Based on the conducted survey, the first objective was to describe the situation in the CroSeRo during the 2020 pandemic with regard to the feeling of fear related to food shortages and real affectedness by the food shortages and food availability.

#### 3.1.1. Fear of Food Shortages during Pandemic of 2020

According to the definition, fear is an intense and unpleasant negative feeling that a person experiences when he sees or expects danger, be it real or unrealistic [44]. Contrary to the hypothesis about a high level of fear and major food problems, the results of the research,

shown in Figure 1, indicate that the fear of food shortages during the 2020 pandemic was not strongly expressed, with an average value (M) of 2.2. The distribution of the frequencies of individual respondents' answers indicates that only 5% of the sample respondents were "very afraid" and another 9% of the respondents were "afraid" of food shortages. Over one-third of respondents (37%) stated that they were "not afraid of food shortages at all" during the 2020 pandemic (Figure 1).

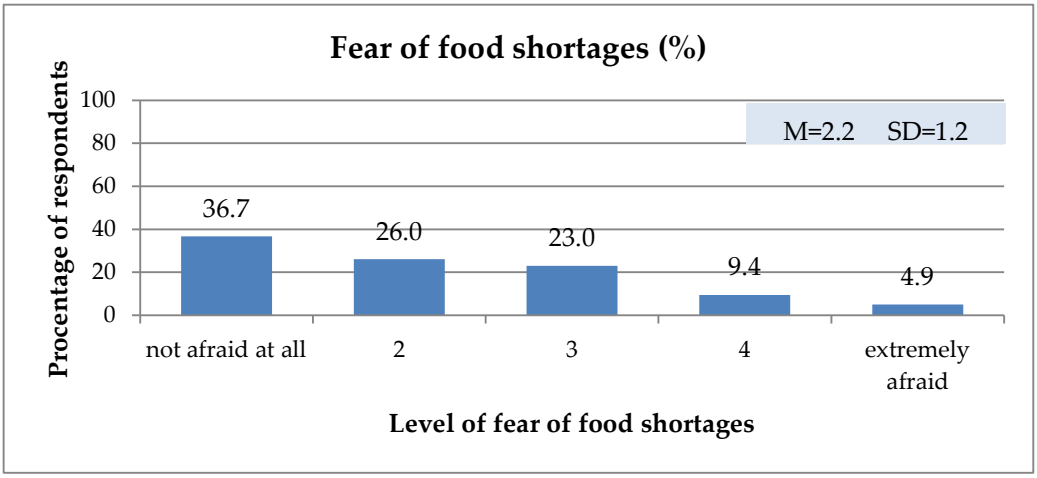


**Figure 1.** Distribution of the respondents in level categories of fear of food shortages (note: M = Mean, SD = Standard Deviation).

3.1.2. Food Shortage and Availability of Foods

The reported low fear of food shortages during the 2020 pandemic might be partly explained by the data on the level of food shortages that respondents estimated for their families and region (Figure 2).

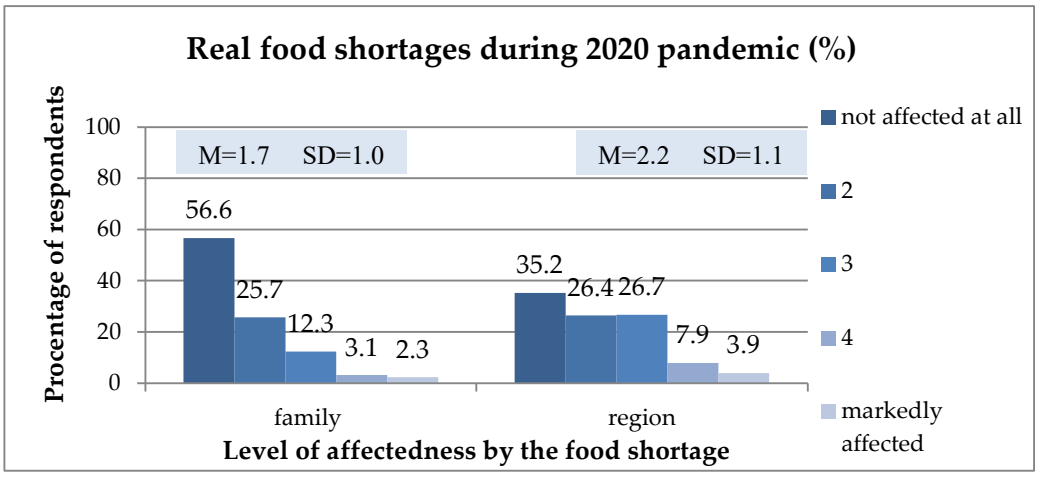


**Figure 2.** Distribution of the respondents in regard to their estimation of the level of impact of food shortages on their families and the region (note: M = Mean, SD = Standard Deviation).

Respondents assessed the level of impact from food shortages as slightly higher for their region than for their own families. Over half (57%) of respondents reported their families were not affected by food shortages during the pandemic, while only 5.4% stated their families were affected (2.3% extremely affected and 3.1% affected). The above can mean that food was available (e.g., in supermarkets), they had enough money in the household budget to buy food or they had sources of their own food (Tables 1 and 2). Contrarily, based on a survey of 10,545 respondents in China, 26.9% of participants experienced food

shortages during the COVID-19 outbreak and they dramatically changed daily lifestyles and behaviors [45].

**Table 2.** Structure of respondents with sources of their own food.

| SUM_Own Food | F | % |
|---|---|---|
| I have no food sources of my own food | 306 | 33.9 |
| 1 source of own food | 216 | 23.9 |
| 2 sources of own food | 189 | 20.9 |
| 3 sources of own food | 192 | 21.3 |
| Total | 903 | 100.0 |

When it comes to the region being affected by food shortages, over a third (35%) of respondents estimated that their region was not affected by food shortages at all, while food shortages were considered a problem for the region during the 2020 pandemic by 11.8% of respondents. In general, the inhabitants of the CroSeRo microregion did not have strong personal feelings or experiences of being affected by food shortages during the 2020 pandemic. According to the Organization for Economic Cooperation and Development (OECD), the production of agri-food products in most countries of southeast Europe, which includes CroSeRo, is based on national and close inter-regional consumption [46]. The above can be confirmed by Brankov et al.'s [47] research. The authors indicate that the CroSeRo microregion demonstrates stability in food self-sufficiency (FSS) as measured by five key indicators: GDP per capita, yield, population density, trade openness and political stability. The microregion's average self-sufficiency rates fall between 100 and 150%. Although the hypothesis was that the population of the CroSeRo microregion was affected by food shortages during the pandemic, the data do not support this.

According to the respondents' estimations about the availability of certain foods in stores, it is possible to distinguish between two groups of foods. On average, the most available foods in stores during the 2020 pandemic were fruits and vegetables (M = 3.9), followed by canned food, pasta, meat and eggs (M = 3.8) and dairy products (M = 3.7), all of which between 59% and 65% of respondents found to be available or completely available in stores during the pandemic of 2020, which probably indicates the fact that consumers bought them to a lesser extent (Figure 3). On the other hand, the greatest shortage, although in value rank 3, was assessed by the respondents for yeast (M = 3), flour (M = 3.2), oil (M = 3.3) and sugar (M = 3.4), i.e., foods that are more important for the preparation of meals and have a longer shelf life. However, the relatively good availability of food can be explained by the fact that agricultural activities were exempted from the lockdown in order to ensure the stability of food production and supply [48].

### *3.2. Description of Basic Changes in Attitudes toward Agriculture and Food as a Result of the 2020 Pandemic*

The second part of the results refers to the changes in people's attitudes and practices toward agriculture and food during the 2020 pandemic. In general, consumer buying behavior under the COVID-19 pandemic has been well documented [49–52]. Gordon-Wilson [53] emphasizes that COVID-19 affected consumer self-control, leading to changes in shopping habits and types of goods purchased.

#### 3.2.1. Source and Factors of Purchase of Agricultural Products

During the pandemic, supermarkets were the predominant source of food (M = 3.8), with 65% of the sample reporting frequent or very frequent purchases, followed by small shops (M = 3.3) used frequently or very frequently by 45% of respondents. Markets (M = 2.6) and receiving food from friends and/or relatives (M = 2.5) were also common sources of food for respondents, ranking at an average level (value rank 3). These sources of food appeared as frequent or very frequent and were important for 26% of respondents (Figure 4).

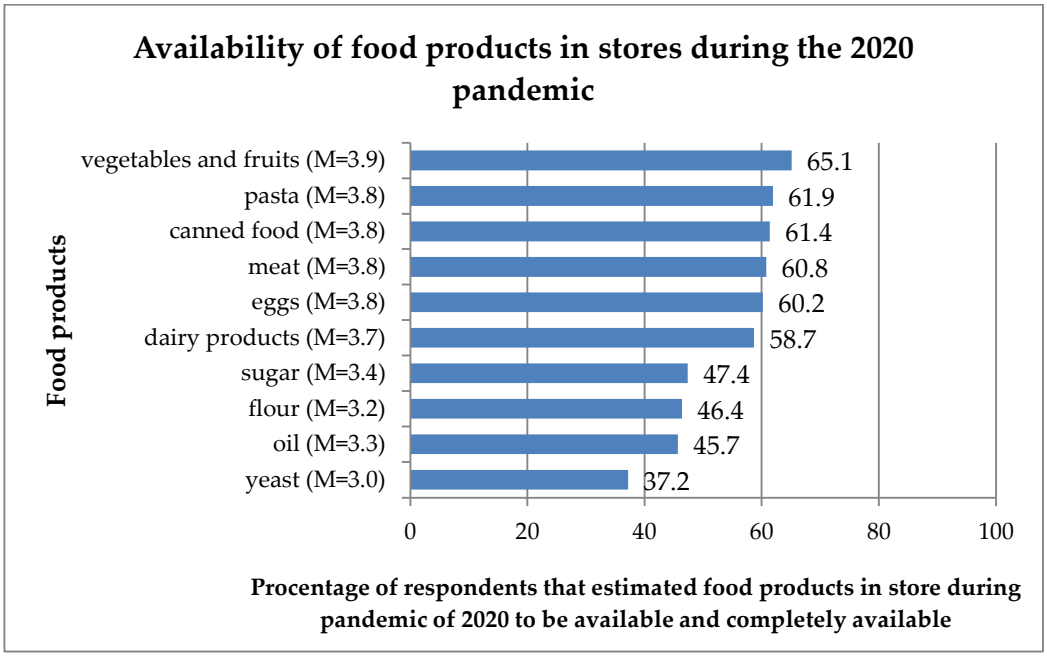


**Figure 3.** Availability of food products in stores during the 2020 pandemic (note: M = Mean).

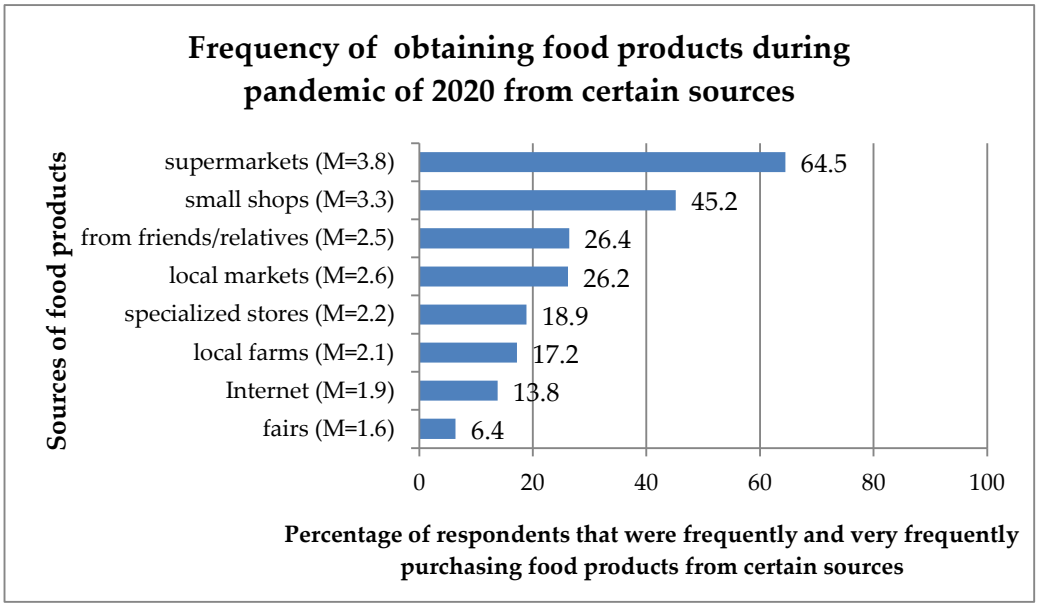


**Figure 4.** Source of supply/purchase of food during the 2020 pandemic (note: M = Mean).

During the 2020 pandemic, respondents purchased food at fairs to a very limited extent (M = 1.6). More than two-thirds of the sample (67%) reported that they did not shop at fairs at all, likely due to restrictions on events.

Contrary to expectations and the literature [54,55], online food ordering was the least common way to procure food during the pandemic, with an average score of M = 1.9. Nearly 58% of respondents never used the internet for groceries, while only 14% did so frequently. Finally, a surprisingly large number—almost half—of the sample did not buy products from local producers—47% of them at all. However, even in this case, there is an important minority of 17% of the sample for whom this practice was extremely frequent or frequent. The assumption was that buying from farms and/or online would be encouraged under the influence of the pandemic. Specifically, there are recorded positive examples of the bottom-up created- and web shop and delivery service-supported short supply chain

of organic agricultural products precisely during the 2020 pandemic in one of the partner countries, specifically in the area around city of Osijek [56]. But these data indicate that these ways of procuring food products did not gain greater relevance during the pandemic in 2020 and are important only for a small number of respondents from the CroSeRo microregion. Some of the reasons may be simply attached to the lack of a habit of buying from farms and/or online and, to some extent, to prices since the following data show that it cannot be explained by underdevelopment of networks for ordering and delivering food from local farms and other sources or by distance and/or insufficient supply from local producers.

As shown in Figure 5, the major factor in the purchase of food products during the 2020 pandemic, according to respondents' answers, was the prices in stores (M = 3.2) and those of local producers (M = 2.9). Although in general, the respondents estimate this impact of prices on their purchasing habits as "moderate" (value rank 3), the prices of food products in stores were especially highlighted by almost a quarter of the respondents (24%) as having an extremely strong impact on their shopping during the 2020 pandemic. Considering that the GDP of the CroSeRo microregion countries is lower, compared to the EU average, the cost price of the product plays an exceptional role. Changes in food consumption behavior and habits due to the pandemic were related to price increase concerns, but also stockpiling, awareness of food waste, safety of and excessive food access concerns, natural/organic food preferences and packaging of foods [57,58].

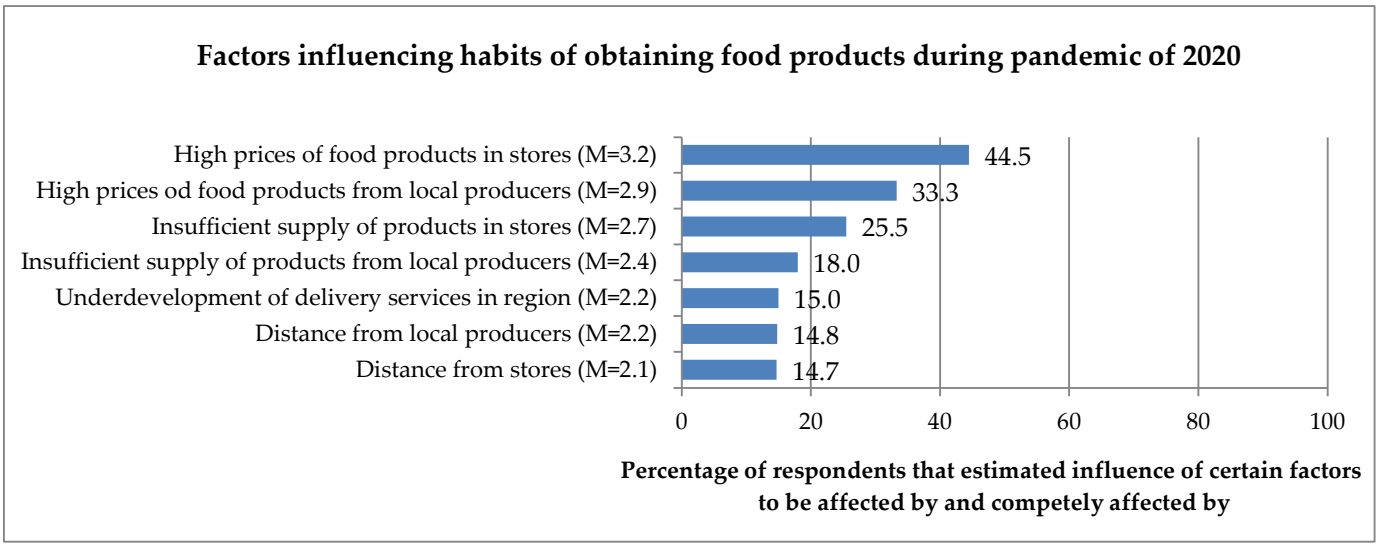


**Figure 5.** Factors of purchasing food products during the 2020 pandemic (note: M = Mean).

Respondents rated the aspects of distance, either of stores (M = 2.1) or producers (M = 2.2), as having the least influence on the purchase of food products during the 2020 pandemic. Around 44% of respondents estimate that these aspects did not affect the purchase at all.

Finally, the questionnaire captured data on the possession of their own food that individuals could rely on during the 2020 pandemic. One-third of the sample reported having no personal food stocks, while others possessed large homegrown and preserved food supplies (Table 2), which may be one of the reasons for the low degree of fear among respondents in the CroSeRo microregion.

### 3.2.2. Changing Food Shopping Habits

In this research, between two-thirds and three-quarters of respondents, depending on the food product, did not change their shopping habits during the 2020 pandemic. Despite the daily negative information from the media creating a general sense of fear, Rhodes [59] suggests that emphasizing fear in public service announcements (PSAs) does not necessarily

result in the desired change in behavior. However, in this research, consumers to a greater extent did not change their habits when it comes to food of animal origin: eggs (76%), dairy products (75%) and meat (74%). On the other hand, the greatest degree of change in the purchase of food products was recorded when it comes to flour and yeast, for 37% and 35% of respondents, respectively, and oil for 34% of respondents (Figure 6). Generally, consumers did not change their habits when it comes to food that has a shorter shelf life and spoils more easily, while the habits of buying products that can be stored longer were more variable. Flour, yeast and oil are very likely to be considered significant by consumers as their habits of buying these products have changed at most due to the pandemic in 2020. Based on a total 7514 respondents from Spain, Rodríguez-Pérez et al. [60] outlined healthier dietary behaviors during the pandemic in comparison to previous times and similar conclusions were drawn by Scarmozzino and Visioli [61] on the territory of Italy.

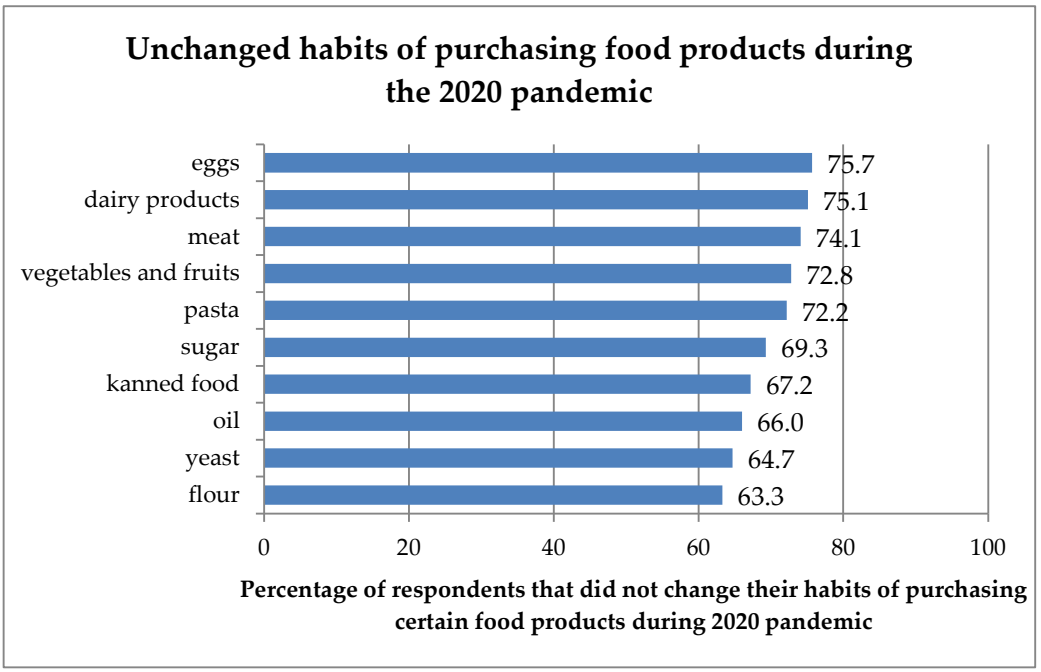


**Figure 6.** Unchanged habits of purchasing food products during the 2020 pandemic—share of respondents that did not change their purchasing habits of buying certain food products.

We can confirm the above data with Figure 7. The foods that the largest number of respondents were buying in larger quantities during the 2020 pandemic, compared to the period before the 2020 pandemic, were flour for 29%, oil for 27% and yeast for 25% of respondents, shown in Figure 6. Although only a minority of respondents—up to 11%—changed their shopping habits by buying certain food products to a lesser extent, this practice applied the most to the following products: fruits and vegetables (6%), pasta (6%) and eggs (6%).

### *3.3. Detection of Basic Patterns of Changes in Attitudes toward Agriculture and Food under the Influence of the 2020 Pandemic*

The questionnaire included 15 statements exploring how people's attitudes and practices towards agriculture and food changed due to their experiences during the 2020 pandemic (Figure 8). To the greatest extent (between 50 and 52% of them and with average values of M = 3.5), respondents agreed with the statements "I am more aware of the problem of insufficient domestic production", "I value food producers more", "I am worried about the possibility of food price increases", and "I have to allocate more of the household budget for agricultural/food products". Additionally, the statement "I think

more about the quality of food products" had a high level of agreement, with an average value of M = 3.4.

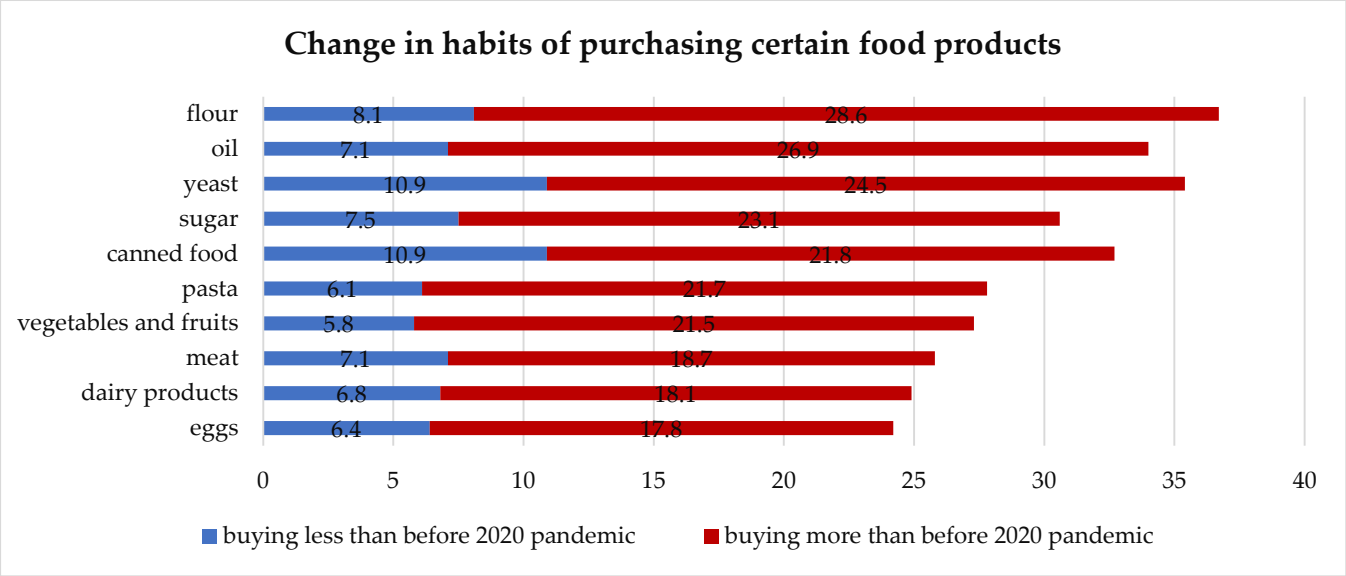


**Figure 7.** Change in food product purchasing habits during the 2020 pandemic.

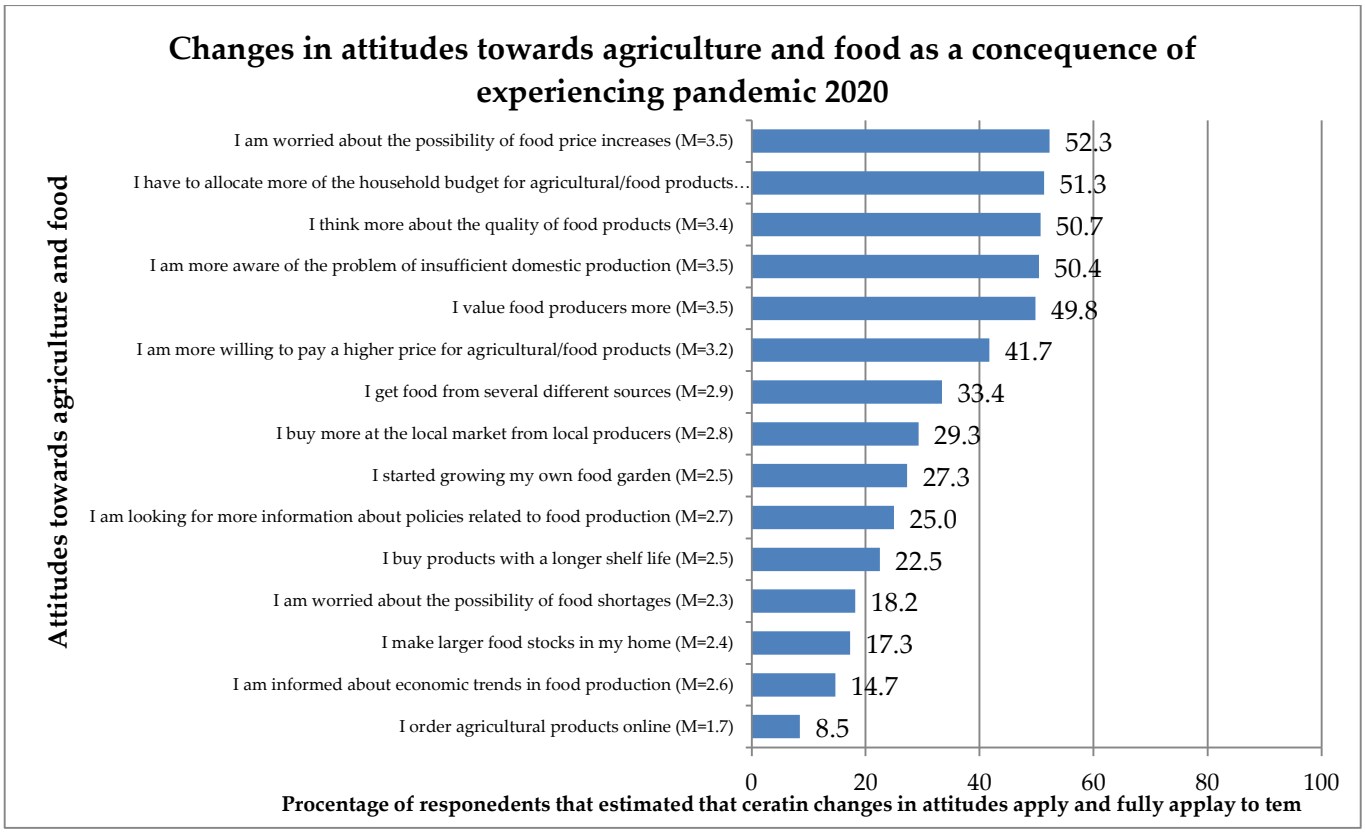


**Figure 8.** Changes in attitudes towards agriculture and food (note: M = Mean).

Thus, the experience of the 2020 pandemic showed its impact on changing people's awareness of the importance of domestic production and producers, as well as the quality of food products, but also raised awareness and concerns about the prices of food products.

On the other hand, the statements with which the largest number of respondents did not agree are related to the practices of shopping, growing food and stockpiling and the fear of food shortages. Interestingly, as many as 63% of respondents reject the statement "I order agricultural products online", as one that applies to them (M = 1.7). This finding is in accordance with the previously described result. A larger number also disagreed with the statements that, as a result of the pandemic experience, "I make larger food stocks in my home" (M = 2.4), "I started growing my own food garden" (M = 2.5) and "I buy products with a longer shelf life" (M = 2.5). The experience of the pandemic did not raise levels of fear of food shortages, and for the statement, "I am worried about the possibility of food shortages" (M = 2.3), 55% of respondents estimate that it does not apply or does not apply to them at all.

Thus, the results of descriptive statistics on the 15 statements of the instrument "Changes in attitudes towards agriculture and food" as a consequence of the 2020 pandemic indicate that the experience of the pandemic has raised the level of awareness of some issues related to food and concerns about the prices of food products. The experience of the pandemic, however, did not act in the direction of significantly raising the fear of food shortages or developing alternative practices of buying food from a wider range of sources, growing one's own food or creating food stocks.

In order to confirm the last hypothesis about how there are several distinct patterns of attitudes towards agriculture and food that have developed in response to the experiences of the 2020 pandemic, a principal component analysis (PCA) of the aforementioned instrument was carried out. It was shown that the structure of changes in attitudes towards agriculture and food as a result of the 2020 pandemic is consisted of three components, which explains 64% of the variance of the instrument (Figure 9). A reliability check was made for all components, and the result was satisfactory with Cronbach α values ranging from 0.69 to 0.78.

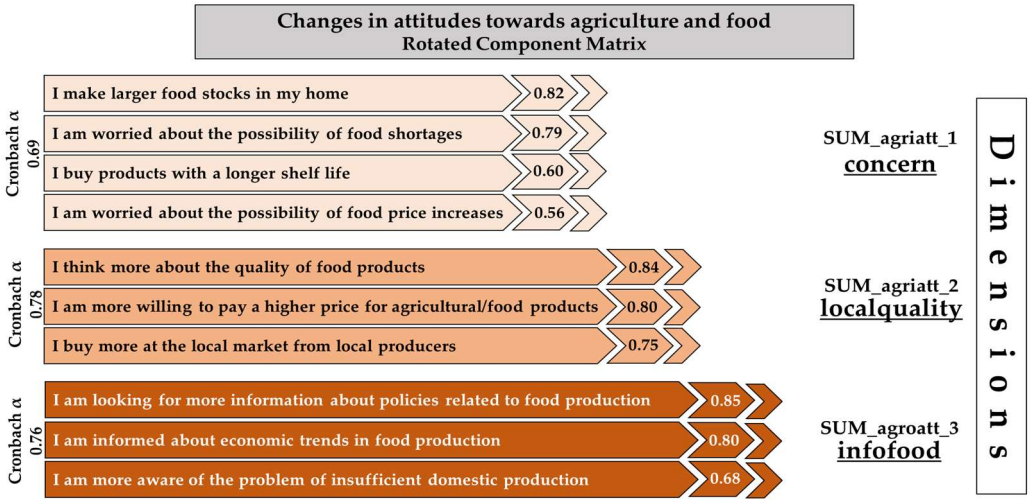


**Figure 9.** Factor analysis of changes in attitudes towards agriculture and food.

The first component was saturated by the variables "I make larger food stocks in my home" (λ = 0.82), "I am worried about the possibility of food shortages" (λ = 0.79), "I buy products with a longer shelf life" (λ = 0.6) and "I am worried about the possibility of food price increases" (λ = 0.56). This dimension is called *SUM_agriatt_1_concern* and captures anxiety about food security (e.g., worrying about shortages and price increases) and related stockpiling behaviors (e.g., creating larger food stocks and buying longer-lasting products).

The second component was created by the three variables *I think more about the quality of food products* (λ = 0.84), *I am more willing to pay a higher price for agricultural/food products* (λ = 0.8) and *I buy more at the local market from local producers* (λ = 0.75). The newly created component is *SUM_agriatt_2_localquality* because it reflects a growing emphasis on food quality, with respondents expressing a willingness to pay more for high-quality products

and support local producers by buying from local markets. These two components reflect the main core of the investigation. Luo et al. [62] also confirm that the COVID-19 pandemic has strengthened consumers' awareness of the traceability system throughout the supply chain, gradually changing consumers' consumption concepts and patterns.

The third created component is called *SUM_agriatt_3_infofood*. It consists of the variables "I am looking for more information about policies related to food production" (λ = 0.85), "I am informed about economic trends in food production" (λ = 0.8) and "I am more aware of the problem of insufficient domestic production" (λ = 0.68). This component of the attitudes towards agriculture and food reflects the raising awareness about the problems of food production and the desire to be more informed about the political and economic aspects of food production. Similarly, the importance of information regarding the concern of food products during a pandemic is emphasized by Wojciechowska-Solis et al. [63]. The authors state that respondents mostly trust information that comes from experts, followed by families and social media and institutions' websites.

Finally, we wanted to answer the question of whether there are differences in certain patterns of attitudes towards agriculture and food as a result of living through the 2020 pandemic, with regard to gender, age, residential status, agricultural experience and the economic situation of the respondents. The detailed results are presented in Tables 3 and 4.

**Table 3.** Results of the conducted *t*-test on components according to sex, residential status and agricultural experience.

| **Sex** | **UK** | | **(1) Female** | | **(2) Male** | | ***t*-Test** |
|---|---|---|---|---|---|---|---|
| | **M** | **SD** | **M** | **SD** | **M** | **SD** | |
| SUM_agriatt_1_concers | 2.7 | 0.9 | 2.64 | 0.93 | 2.69 | 0.91 | t(901) = −0.69 |
| SUM_agriatt_2_localquality | 3.1 | 1.1 | 3.16 | 1.11 | 3.13 | 1.03 | t(901) = 0.49 |
| SUM_agroatt_3_infofood | 2.9 | 1.1 | 2.92 | 1.13 | 2.90 | 1.03 | t(895) = 0.27 |
| **Residential Status** | **UK** | | **(1) Rural Settlement** | | **(2) Urban Settlement** | | ***t*-Test** |
| | **M** | **SD** | **M** | **SD** | **M** | **SD** | |
| SUM_agriatt_1_concers | 2.7 | 0.9 | 2.68 | 0.93 | 2.65 | 0.91 | t(901) = 0.53 |
| SUM_agriatt_2_localquality | 3.1 | 1.1 | 3.11 | 1.03 | 3.00 | 1.10 | t(901) = −0.86 |
| SUM_agroatt_3_infofood | 2.9 | 1.1 | 3.00 | 1.10 | 2.86 | 1.09 | t(901) = 1.87 |
| **Agricultural Experience** | **UK** | | **(1) Yes** | | **(2) No** | | ***t*-Test** |
| | **M** | **SD** | **M** | **SD** | **M** | **SD** | |
| SUM_agriatt_1_concers | 2.7 | 0.9 | 2.73 | 0.93 | 2.26 | 0.90 | t(901) = 2.83 * |
| SUM_agriatt_2_localquality | 3.1 | 1.1 | 3.18 | 1.08 | 3.09 | 1.06 | t(901) = 1.30 |
| SUM_agroatt_3_infofood | 2.9 | 1.1 | 3.06 | 1.06 | 2.68 | 1.08 | t(901) = 5.28 * |

* $p < 0.05$; note: M = Mean, SD = Standard Deviation.

*t*-Tests that were used to analyze the difference between the average values on the components of attitudes towards agriculture and food due to the 2020 pandemic based on the gender and residential group of respondents revealed no statistically significant differences (Table 3). However, the result of the *t*-Test between the average results of groups with different agricultural experiences was statistically significant. It has been shown that respondents with agricultural experience are more likely to show an attitude towards agriculture and food that reflects a greater fear of food shortages and rising prices and the practice of creating food stocks, but also a stronger awareness of the problems of food production and therefore a desire for deeper information about political and economic aspects of food production. This result is expected since they are more aware of problems in agricultural production.

**Table 4.** Results of the conducted ANOVA test on dimensions according to monthly household income.

| Average Monthly Household Income before the 2020 Pandemic | UK | | (1) Up to €1000 | | (2) €1001–€2000 | | (3) More than €2001 | | ANOVA | Post Hoc Test |
|---|---|---|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD | M | SD | | |
| SUM_agriatt_1_concers | 2.7 | 0.9 | 2.7 | 0.9 | 2.6 | 0.9 | 2.6 | 1.0 | F(2/900) = 0.78 | - |
| SUM_agriatt_2_localquality | 3.1 | 1.1 | 3.0 | 1.0 | 3.2 | 1.1 | 3.2 | 1.0 | F(2/900) = 5.89 * | 1–2 *, 1–3 * |
| SUM_agroatt_3_infofood | 2.9 | 1.1 | 2.8 | 1.1 | 2.9 | 1.1 | 3.0 | 1.1 | F(2/900) = 1.74 | - |
| **Average Monthly Household Income during the 2020 Pandemic** | **UK** | | **(1) Up to €1000** | | **(2) €1001–€2000** | | **(3) More than €2001** | | **ANOVA** | **Post hoc Test** |
| | **M** | **SD** | **M** | **SD** | **M** | **SD** | **M** | **SD** | | |
| SUM_agriatt_1_concers | 2.7 | 0.9 | 2.7 | 0.9 | 2.6 | 0.9 | 2.7 | 1.0 | F(2/900) = 0.92 | - |
| SUM_agriatt_2_localquality | 3.1 | 1.1 | 3.0 | 1.0 | 3.2 | 1.1 | 3.4 | 1.1 | F(2/900) = 3.96 * | 1–3 * |
| SUM_agroatt_3_infofood | 2.9 | 1.1 | 2.9 | 1.1 | 2.9 | 1.1 | 3.1 | 1.1 | F(2/899) = 2.39 | - |

* $p < 0.05$.

The ANOVA test that analyzed the differences in the average values for different age groups on the variables of different attitudes towards agriculture was not clear because although the statistical significance of the differences between different age groups was shown with regard to their results on the variables SUM_agriatt_1_concers and SUM_agroatt_3_infofood, the post hoc test did not confirm that finding and did not indicate among which age groups there is a difference in the average score. Therefore, an alternative correlation test was performed with the original interval variable with data on the age of the subjects. Correlation analysis showed that age is statistically significantly and positively related to the variable SUM_agroatt_3_infofood (r = 0.10 ** $p < 0.05$), indicating that the older the respondents, the more likely they are to show an attitude towards agriculture and food that characterizes a deeper awareness of food problems, which is accompanied by a desire for deeper information about the political and economic aspects of food production. Similar findings were shown by Zamková et al. [64]. The authors declared that, generally, younger respondents (under 25 year) are not too interested in topics related to food procurement, while interest increases with age and education level. From the producer's point of view, it is important to have information on which category of customers should be paid attention to.

The other ANOVA analysis also indicated that the economic situation during and after the 2020 pandemic made certain attitudes toward agriculture and food more likely. Respondents with a monthly household income of up to €1000 before the 2020 pandemic are more likely to have a lower score on the variable attitude towards agriculture and food, which is characterized by considerations of food quality and buying local food, despite the higher price, compared to other economic categories of respondents (Table 4).

Additionally, respondents who experienced an increase in their average monthly family incomes during the 2020 pandemic are more likely to prioritize food quality and buying local food, despite the higher price, compared to those whose average monthly incomes decreased.

In general, three patterns of attitudes and behavior towards agriculture, as a consequence of experiencing the pandemic in 2020, were shown. The most prominent one (M = 3.1) was the pattern of attitudes characterized by concerns about the quality of the food and willingness to pay more and buy food from local producers to procure food of a higher quality (localquality). Additional tests have shown that socio-demographic characteristics like age, sex or agricultural experience do not make change towards this attitude more or less likely, but economic characteristics do. It is less likely for those within lower economic categories to change their attitudes and behaviors towards food in this manner, and it is specifically unlikely for those whose incomes were negatively affected during the pandemic of 2020. On the other side, the economic status and economic impact of the respondents in the 2020 pandemic was not proven to be a factor that makes it more or

less likely to take on two other patterns of attitudes and behaviors towards agriculture and food. The same goes for sex. The age of the respondents and their agricultural experience were factors that made certain patterns of behaviors more likely during the pandemic.

Under the pressures of the 2020 pandemic, deeper concerns about food issues, like the possibility of food shortages and increased prices of food and more stockpiling-like behaviors (concern) were in general the least presented (M = 2.7, although in the value range of 3) but more likely to develop among those who are more experienced in agriculture. Similarly, for those more experienced in agriculture, they are also more likely to have developed, under the pressures of the 2020 pandemic, stronger awareness of the problems of domestic food production and therefore a desire for a deeper understanding of its political and economic aspects (infofood). One statistically proven difference between these two responses is related to age. Patterns of attitudes governed by desire to gain more knowledge are also more likely to characterize older respondents, and are presumed, unlike for those with more concerned-driven attitudes and behaviors about agro-food issues, for those with specific kinds of agricultural experience, e.g., having a formal agricultural education. So, the difference between those two possible responses, it is presumed, is in the difference in the type of acquired agricultural experiences that unfortunately was not part of this analysis.

Generally, the crisis caused by the COVID-19 pandemic had an undeniably large impact on many aspects of human life worldwide and the CroSeRo microregion and has shown weaknesses in the system. In an attempt to balance people's lives and the economy, governments have reacted, more or less successfully. In the context of the availability of agricultural food products, the countries were not equally affected by the pandemic and the affectedness depended on the level of development, imports, self-sufficiency, and distribution system. According to some scenarios [65], global food self-sufficiency is likely to decline despite increased food production through sustainable agricultural intensification since projected food demand exceeds potential production. With the end of the pandemic, the system must be improved and many measures revised in order for us to be better prepared for new challenges. For example, Vittuari et al. [66] recommended supporting innovative and localized food production, the use of information and communication technology for food production and distribution, the promotion of cooperation among regional food systems and improved education about food systems.

The findings of this research, contextually bonded to the part of the Danube region at the border of three countries (CroSeRo—Croatia, Serbia and Romania), also indicate the need for this kind of support in this microregion. It has been shown that the desire for local shopping and awareness of the quality of locally produced food has increased due to the crisis situation but is demarcated along economic lines. Therefore, it is necessary to support the development of local short chains with economically available food as a mechanism of resistance in times of crises. Additionally, greater efforts should be made on the use of digital technologies for the dissemination of information and better functioning of local supply in dealing with crisis situations, because the practices of using ICT during the pandemic proved to be of very little reach in the CroSeRo microregion during the pandemic. Also, given that consumers are more attentive and aware of the problems associated with the food sector, all stakeholders in the food production and distribution system are required to continuously monitor consumer behavior in order to minimize concerns, especially since the 2020 pandemic was quickly followed by other crisis situations such as rising inflation and war conflicts affecting the entire EU and posing new threats to food (and energy) security.

## 4. Conclusions

To better understand to what extent and what kind of food problems appeared for the inhabitants of the Danube microregion during the pandemic in 2020 and how the changes affected their practices related to food procurement, feelings of concern and/or fear of food shortages and general attitudes towards agriculture and food, a questionnaire

survey was carried out during 2022. Although the mentioned microregion is less developed compared to Western Europe, the surveyed population of the Danube microregion was mainly not afraid of food shortages, food was available for their family/region and they did not change their shopping habits to a large degree. Analysis of the survey data revealed consumers' reactions after the pandemic in three dimensions. Firstly, there is a response characterized by a stronger degree of concern about food issues more likely for those with certain agricultural experiences; secondly, there is a response characterized by a readiness to pay a higher price and buy local products to acquire quality food, which is more likely for those with higher paying power; and thirdly, there is a response governed by the desire for better understanding of food issues by acquiring more information about food production, which is more likely for those with specific agricultural experiences and older respondents. In general, consumer concerns in the context of food production and self-sufficiency should be a guiding thread for governments to find solutions and be stronger, more clever and more resilient to future challenges. The findings of this research suggest that the best way to do that is by providing support for the development of locally affordable food systems with the use of ICT as a coping mechanism in crises.

*Limitation of the Study*

The main limitations of the study are related to the main procedure of the online survey and the exploratory nature of the study, which are, by themselves, related to the difficulties of implementing an international project with limited financial and time resources. Although alternative strategies to eliminate biases of the online surveys were implemented, the final sample that the project team had to run with was still not representative of the population. The questionnaire is entirely the result of the project teams' conceptualization and has never been tested before. Therefore, the findings of this research point to further possibilities for the use of the created measures and their adaptation in research on changes in behavior and attitudes towards agricultural and food products in different contexts and with regard to different crisis situations.

**Author Contributions:** Conceptualization, D.I. and D.H.; methodology, D.I., O.K., D.U. and I.S.; validation, D.I. and O.K.; formal analysis, O.K., D.D. and D.U.; investigation, I.S., C.Z., D.D., D.U., I.M., I.V. and D.H.; writing—original draft preparation, O.K. and D.I.; writing—review and editing, D.D., D.H., D.U., I.S. and I.V.; visualization, D.I. and O.K.; supervision, D.I.; project administration, D.I.; funding acquisition, D.I. and D.H. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by CASEE association—the ICA Regional Network for Central and South Eastern Europe through the project "The effect of pandemic on agriculture products in Danube region—how safe we are (2022-3)".

**Institutional Review Board Statement:** Ethical review and approval were waived for this study, due to the fact that participation was voluntary and all data were anonymous.

**Informed Consent Statement:** Informed consent was obtained from all participants in the study.

**Data Availability Statement:** The data presented in this study are available upon request from the corresponding author.

**Acknowledgments:** The authors want to thank the all respondents who participated in the present study.

**Conflicts of Interest:** The authors declare no conflicts of interest.

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