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Research Article

Consumer Behavior towards Agri-Food Products during the COVID-19 Crisis: An Empirical Study

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Abstract

The COVID-19 pandemic has significantly impacted the behavior of consumers of agri-food products. Consumers have developed new consumption and purchasing habits. These behavioral changes were driven by the fear of disease and death, as well as the government-imposed regulations. Naturally, factors such as gender, age, and living environment have also influenced changes in consumer behavior. This analysis is based on a survey conducted in Romania during the period of isolation imposed in the context of COVID-19. The survey provides valuable insights into how consumers of agri-food products behaved during the mandated isolation period. The findings are discussed in the results and conclusions sections. These findings can help inform the emergence and future development of new strategies to address consumer demands for agri-food products during crises similar to COVID-19. These strategies should prioritize the assurance of high-quality agri-food products while considering the consumers' living environment, gender, age, and frequency of purchase, placing the well-being and health of individuals at the forefront.

Keywords: COVID-19, consumer behavior, agri-foods products, empirical research

Introduction

Nothing is more unpredictable than human behavior when influenced by fear.

Human behavior can change in a crisis.

A crisis is unpredictable and can even surprise the best-trained individuals and the best strategies designed to fight it. It is synonymous with chaos, anxiety, desperation, and desolation.

The COVID-19 pandemic exhibits these characteristics of a crisis.

This crisis was surprisingly brutal and has caused chaos, anxiety, and continues to do so. The COVID-19 pandemic has resulted in deaths, fear, illness, poverty, and loneliness, fundamentally changing the way we live. Its impact can still be felt three years after it first appeared.

The COVID-19 pandemic also brought about positive changes in many areas.

During the first few months of the COVID-19 pandemic, fear was the prevailing emotion in people's minds, albeit to varying degrees. Fear can change human behavior, acting like a

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powerful ingredient. It can make people irrational and impulsive (Woodside, 2012). Fear can influence people during crises to change their behavior significantly and act irrationally. As a result, people may adopt impulsive behavior in such situations (Dittmar, 2005).

Consumption and purchasing behaviors of people may change partially or entirely due to fear during crises. For example, everything was different in the first few months of the COVID-19 pandemic compared to the period before.

Consumers changed their purchasing habits, the quantities of some products bought, and payment methods during this time. Consumers were also more careful about new aspects of products, such as their quality, properties, or place of origin.

This article aims to contribute to the study of consumer behavior towards agro-food products during crises through three research directions.

The first direction is to define and understand the meaning of the term crisis. This direction also studies the influence of the COVID-19 pandemic on the food system, the consumption of agro-food products, and consumer behavior towards agro-food products during the lockdown period.

The second direction pursued by this article is the methodological part, consisting of a multiple linear regression analysis. This analysis aims to observe changes in consumer behavior towards agri-food products during the lockdown period in Romania.

The results, conclusions and limitations of the study represent the last part of this article.

The influence of the Covid-19 Pandemic on the food system and on the consumption of agri-food products during the lockdown (March-June 2020)

The global population was very scared in the first weeks of the COVID-19 pandemic. Authorities imposed restrictions due to the fast spread of SARS-CoV-2. The main activity of people was to search for, find, and buy agro-food products.

This activity was manifested by emptying the shelves of some food shops and buying large quantities of agri-food products. As a result, consumers created stocks of staple foods and agro-food products (FAO, 2020).

The COVID-19 pandemic has revolutionized the food system, with fast effects on the delivery of food. That accentuated the delivery of the products to the customer's home or the appearance of the new delivery ways of products with more efficiency. This pandemic has also favored buying local products and the appearance of a new market of high-quality agro-food products that can be sold online and delivered to home (Galloway, 2020).

During the first weeks of the COVID-19 pandemic, consumers had to fear the lack of agri-food products due to historical evidence of pandemics and epidemics leading to a lack of food and hunger for people. The oldest writings related to the effects of illness on agriculture report that "the fields were left uncultivated, and no one cultivated them" (Strnadt, 1790).

In many cases, diseases were the most important cause of food and hunger during pandemics and epidemics. This led to farmers and workers in agriculture being affected by the disease and, as they did not have appropriate treatment, they could not work, which partially or totally interrupted production processes (Roubík et al., 2022).

The COVID-19 pandemic has resulted in a critical situation of food insecurity for 320 million people, leading to health problems and death. Additionally, 124 million people are living in extreme poverty due to the pandemic, surviving on just 1.90 $/day (Lakner et al., 2021) and enduring other consequences of poverty. Due to food insecurity arising from the COVID-19 crisis, several million more people have been exposed to malnutrition and diseases caused by a lack of food (FAO, 2020; Laborde et al., 2020; Osendarp et al., 2021).

The situation brought about by the COVID-19 pandemic has been dramatic, but it has also had a beneficial effect on society. It has allowed us to observe the vulnerabilities and weaknesses of the current food public system and the global agricultural system, as well as the abilities of the people within these systems, due to the restrictions imposed by the pandemic (Building, 2020).

The pandemic has created the need to establish a new, updated agro-food political system for the present, which will bring about changes in the post-pandemic period (Sarkis et al., 2020). Moreover, it has provided an opportunity to analyze and review consumer habits, allowing consumers to rediscover moderation and common-sense food choices (Roubík et al., 2022).

The crisis caused by the COVID-19 virus has also provided an opportunity to discover and fix problems related to the logistics and distribution of food products. This crisis was the perfect moment to test new ways to transport food (Cullen, 2020; Roubík et al., 2022).

Experts studying the food subject in the context created by the COVID-19 pandemic have suggested reducing the difference between local agriculture using local farms and workers and global agricultural businesses that involve international workers. Therefore, consumers are expected to turn towards local manufacturers and local agro-food products that are available and close to their houses to maintain their health (Darnhofer, 2020; Dickinson, 2020; Polanyi, 2001).

Many factors can influence our health. The food is one of them (Rockström et al., 2009). If we consume foods that have many vitamins and maintain a balanced diet, we can stay healthy and prevent illness (Jayawardena and Misra, 2020). The proprieties of aliments strengthen our body and help to fight, for example, against viruses (Gibson et al., 2012; Naik et al., 2010). In this mode, the foods influence people's health during their life (Leroy et al., 2020).

The researchers effectuated numerous types of research about consumer behavior during the health crisis before the COVID-19 pandemic. These have analyzed the attitudes, perceptions, and motivations underlying user behavior at that moment during the studies (Amin Ul Haq and Abbasi, 2016).

Consumer behavior has been analyzed in the context of the swine flu and Ebola epidemic, the recent health crisis from the twenty-first century (Rubin et al., 2009). It was discovered that all health crises affect healthy people (Brinkman et al., 2010), and the most vulnerable persons are children and older people (Osendarp et al., 2021).

The COVID-19 pandemic is very different compared to all medical crises from this century; this being of the intensity of the Spanish flu or perhaps even surpassing it (Laato et al., 2020).

Although there are few similarities between the COVID-19 pandemic and other health crises of the twenty-first century, they do share similarities in terms of how people behave towards agri-food products during these times.

Studies have shown that during health crises, individuals adopt habits of personal protection, including consuming a healthy diet with high-quality foods and maintaining a regular meal schedule (Galanakis, 2020; Jordà et al., 2022; Sheth and Kellstadt, 2021). This emphasizes the importance of adopting healthy behaviors during these times, as food plays a crucial role in maintaining our overall health and well-being.

The SARS-CoV-2 virus has been shown to be influenced by consumers' health status, lifestyle, and diet quality. Diets of individuals around the world have contributed to the severity of illness, disease manifestation, and geographic spread of COVID-19 (Janssen et al., 2021; Jayawardena and Misra, 2020).

During the initial months of the COVID-19 pandemic, many countries implemented safety measures to prevent infection with SARS-CoV-2, including lockdowns - temporary travel restrictions that isolated the population. This measure led consumers to purchase significant quantities of high-quality agro-food products to naturally combat the virus (FAO, 2020a).

The World Health Organization responded to the pandemic by creating a food guide that provided advice on healthy eating to maintain a strong immune system. The guide recommends daily consumption of five fruits and vegetables (World Health Organization, 2020). However, the pandemic has also had negative effects on the agro-food industry (Galanakis, 2020). The restriction of transport and mobility has increased the risk of food shortages due to the deterioration of global production processes and food supply ("Food in a time of COVID-19", 2020).

During the early stages of the pandemic, there were various challenges in the agri-food sector such as sanitary, production, managerial, and logistical issues. In addition, other factors contributed to consumer decision-making in relation to agri-food products. The significant decrease in purchasing power, job losses, and reduced income due to lockdowns, as well as the

high prices of fruits and vegetables, were the main factors affecting consumer behavior towards agri-food products. Several studies (Cullen, 2020; Stephens et al., 2020) have identified these factors as key influencers.

Another issue that emerged during the lockdown period was food waste. Many fresh agri-food products, including fruits and vegetables, were discarded due to spoilage, leading to a significant amount of food waste. Studies have highlighted this problem (Dou et al., 2020; Stephens et al., 2020).

The COVID-19 pandemic has exposed many problems in the global food system. It is imperative that local, regional, or national food systems adopt measures to be prepared for future shocks caused by pandemics (Béné, 2020; FAO, 2020a; Koopmans et al., 2003; Webb et al., 2021). It is essential to ensure that everyone has access to food, and this right is secured for every individual worldwide (HLPE, 2020).

Producers and traders must implement changes to ensure that necessary quantities of agro-food products are available to meet consumer demands during crises. By understanding and adapting to consumer behaviors caused by fear and insecurity during these times, traders can expand their customer base and attract new buyers (Eger et al., 2021).

However, these measures must be accompanied by specific actions that promote sustainable consumption of agro-food products for present and future crises. This requires analyzing economic, environmental, and social criteria that influence consumer behavior (Conrad and Blackstone, 2021).

To actively involve consumers in sustainable consumption practices, it is essential to educate them about the advantages of sustainable purchases (Achón et al., 2017). Consumers must be encouraged to apply these principles to reduce food waste (Gollnhofer et al., 2019; Katzeff et al., 2019), and use these practices consistently, even beyond crises like the COVID-19 pandemic, to prepare for potential future emergencies (Hansen, 2022; Messner et al., 2020).

The consumer behavior of agro-food products during the COVID-19 lockdown (March - June 2020)

The consumer's behavior is influenced by the spatial and temporal coordinates in which they are located (Sheth, 2020).

During crises, such as the COVID-19 pandemic, consumer behavior changes significantly (Hendrickx, 2012) and is usually influenced by their reaction and adaptation to the newly emerged context (Kirk and Rifkin, 2020).

Today, consumer behavior is determined by their purchase decisions and choices, which are based on the pros and cons related to their requirements and needs, and influenced by their affectivity towards certain products and selectivity (Addo et al., 2020; Mcdaniel and Zeithaml, 1984).

Since the COVID-19 crisis began, consumers have partially or massively changed their purchasing and consumption behavior regarding agro-food products.

During the COVID-19 crisis, consumers have had to adapt to lockdowns and other safety measures imposed to control the spread of the virus (Mallory, 2021). To meet their needs for agri-food products, they have started to explore different ways of procuring and managing these products, such as online shopping, home delivery, direct store pick-up, and mobile payments (Bae and Shin, 2020; Pantano et al., 2020).

The pandemic has also given consumers the opportunity to analyze their basic needs for agro-food products and rediscover the advantages of consuming quality products (He and Harris, 2020). As a result, the quantity of high-quality agro-food products purchased by consumers has changed significantly (Jo et al., 2021).

As consumers adapted to the new situation created by the pandemic and understood their social responsibility, they accepted the idea of the security measures implemented to prevent the spread of the virus (Kirk and Rifkin, 2020).

The implementation of health security measures during the COVID-19 pandemic caused panic among consumers (Abd-Alrazaq et al., 2020), resulting in impulsive buying behavior driven by perceived risks associated with SARS-CoV-2 (Addo et al., 2020; Janssen et al., 2021). This panic significantly impacted consumer behavior as impulsive buyers do not always make rational decisions, leading to the purchase of large

quantities of agri-food products and disrupting the supply chain and marketing system (Ngoc Long and Khoi, 2020).

During the period of isolation (March - June 2020), the overall percentage of impulsive consumers increased significantly (Chinazzi et al., 2020; Kim, 2020; Wiranata and Hananto, 2020). To combat this, supermarkets and retailers employed various methods to reduce the percentage of impulsive fear shoppers. For example, they constantly sent messages assuring consumers of sufficient stocks of agri-food products. However, these efforts were not always effective (Abd-Alrazaq et al., 2020).

Due to the consumer-driven situation and the rapid increase in COVID-19 infections, consumers have made changes to their agri-food purchasing behavior, forming new habits and reconsidering certain purchases (Sheth, 2020). Movement restrictions have led consumers to turn to local retailers, while problems faced by transporters and distributors have sometimes forced them to accept lower-quality agri-food products (Stephens et al., 2020).

Concerned about the potential consequences of the COVID-19 pandemic on their health, consumers of agri-food products have adopted a defensive behavior to fight the disease. They have started to stockpile agri-food products to minimize their trips to public places and ensure their food needs are met. Stockpiling involves accumulating a high quantity of products when consumers perceive a threat to the availability and supply of those products (Sterman and Dogan, 2015).

The consumers were afraid that their food needs would not be satisfied according to their requirements for an indefinite period due to the COVID-19 pandemic and its consequences. They were used to having products available anytime (He and Harris, 2020), but during those days, many problems arose, resulting in a shortage of agro-food products. This type of agro-food stockpiling behavior can be attributed to the influences of irrational buying and consumer decisions (Sterman and Dogan, 2015), which can be driven by psychological factors such as fears and anxieties about the exhaustion of stocks of agro-food products. Many times, this stock behavior manifests collectively through herd behavior (Ngoc Long and Khoi, 2020).

As a result, consumers bought many agro-food products to stock up in the first months of the COVID-19 pandemic. Governments tried to reassure the population that there would be no problems with food shortages. However, some countries adopted nationalistic policies regarding trade in some agro-food products, such as Serbia, China, Kazakhstan, and countries in South East Asia, which were not fair and did not respect international rules. Unfortunately, these efforts were in vain, as consumer behavior remained unchanged (Isis and de Sousa, 2020).

Methodology

The objective of this study was to investigate consumer behavior towards agro-food products in Romania during the COVID-19 pandemic lockdown period from March to June 2020.

The research aimed to identify consumer habits, factors influencing the purchase of agro-food products, and events that triggered changes in consumer behavior through a survey of individuals aged 18 and above who are consumers of agri-food products in Romania.

Non-random (non-probability) sampling was used to select the participants.

The questionnaire used for the survey comprised closed and mixed questions, including dichotomous and multiple-choice questions, and questions with linear scales. The survey was distributed online on social media platforms, and participation was voluntary and anonymous. A sample size of 422 individuals participated in the survey, out of which 404 were eligible for analysis.

The collected data were analyzed using multiple linear regression, a statistical method commonly used in marketing research to analyze relationships between a continuous target and multiple predictors (Cătoiu et al., 2009). The multiple regression analysis aimed to explain and predict the dependent variable's variation through its covariation with independent variables measured on any scale (IBM, 2021).

The general form of a regression model is as follows:

$$\hat{Y}=\hat{a}+\hat{\beta}_1X_1+\hat{\beta}_2X_2+...+\hat{\beta}_iX_i+...+\hat{\beta}_nX_n$$

where:

$\hat{Y}$- is the estimated value of the dependent variable;

$\hat{a}$ – parameter expressing the estimated value of the start;

$\hat{\beta}_1$ – the estimated value of the parameter expressing the relationship between Y and X_i;

X_i- an independent variable;

n – number of independent variables (Cătoiu et al., 2009)

The model parameters, â, which express the links between the independent variables and the dependent variable, are estimates made by statistical-mathematical methods (Cătoiu et al., 2009).

Predictors can be continuous, categorical, or derived fields, so nonlinear relationships are also supported. The model is linear because it consists of additive terms, each term being a predictor that is multiplied by an estimated coefficient. A constant term (the intercept) is also usually added to this model (IBM, 2021).

The multiple regression method allows the definition of a function that minimizes the sum of squares of the differences between the actual and estimated values of the dependent variable (Cătoiu et al., 2009). Regression analysis can be stepwise or simultaneous; in the first case, the independent variables are introduced into the model one by one, according to their ability to explain the variation of the dependent variable. This ability is assessed using statistical tests; simultaneous regression involves using all independent variables from the beginning, regardless of their explanatory ability (Cătoiu et al., 2009).

Linear regression is used to generate insights for plots containing at least two continuous fields, one being the target and the other the predictor. In addition, a categorical predictor field and two auxiliary continuous fields can be specified for a diagram, which is used to generate the corresponding regression model (IBM, 2021).

This regression that we conducted aims to demonstrate the existence of a functional relationship between certain variables.

The dependent variable in this analysis, see Table I, is the increase in the allocation of income/material resources to purchased agri-food products during the lockdown period (March - June 2020) caused by the COVID-19 pandemic.

The independent variables, see Table I, in the present analysis, are: the gender of respondents, the age category they fall into, and the environment in which respondents live.

Table I – Variables Entered

Variables Entered	The environment in which respondents live; Gender; Age category

Source: author's own processing

Two hypotheses have been made to validate or invalidate the theory for which this analysis was carried out:

Hypothesis 0 or null hypothesis - depending on the gender of the respondents, the environment they live in, and the age category they belong to, the degree of increase in the allocation of income/material resources to agro-food products purchased during the lockdown period (March - June 2020) caused by the COVID-19 pandemic did not increase, did not change significantly, there is no relationship between variables.

Hypothesis 1 or alternative hypothesis - depending on the respondents' gender, environment, and age category, the degree of increase in allocation of income/material

resources to agro-food products purchased during the lockdown period (March - June 2020) caused by the COVID-19 pandemic increased, changed significantly, there is a relationship between variables.

Results and Discussions

Multiple linear regression gave the following results:

The R-value of 0.956, see Table II, shows a high correlation between the independent variables and the dependent variable. Also, the value of R Square / R2 shows us that 91.4% of the variation in the performance of the increase in the allocation of material resources or income for agri-food products purchased during the lockdown period (March - June 2020) caused by the COVID-19 pandemic had been determined by the three variables: gender of consumers, the environment in which they live and the age category they belong to.

"Adjusted R Square" is a correction to R2 determined by the number of predictors and subjects. The larger these are, the higher the coefficient of determination tends to be. For the regression performed, Adjusted R Square obtained a value of .913, see Table II.

"Standard error of estimate" represents the estimated standard error for the present regression and indicates the accuracy of the prediction model. The smaller the error of the estimate, the more reliable the prediction. We obtained an estimated standard error of 0.336 for this analysis, which is a best result, see Table II.

Table II: Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
.956a	.914	.913	.366	.914	1416.919	3	400	<.001
a. Predictors: (Constant), The environment in which respondents live, Gender, Age category								

Source: author's own processing

According to the significance analysis of the regression coefficients, see Table III, the null hypothesis, in this case, is not valid because its value is not equal to 0.

Hypothesis 1 or the alternative hypothesis assumes that the value of these coefficients is greater than 0 and the values they register are greater than 0.

As for the analysis of the regression equation performed, the three coefficients have significant values, (Sig < 0.05), and all the values obtained have a value of < 0.001, see Table III. Thus, it can state that all three predictor variables or all three independent variables are significant for the estimation of the dependent variable or criterion variable.

In other words, the gender of the survey participants or buyers, the age category of the respondents, as well as the place where they live determined the degree of allocation of income/material resources for agri-food products during the lockdown period (March - June 2020) caused by the COVID-19 pandemic.

Regarding some of the results to be taken into account when interpreting the analyses of variance / ANOVA test, see Table IV, the value of F and the value of the level of significance, Sig. These values give us the possibility to confirm or reject the null hypothesis, respectively the alternative hypothesis.

The value of F obtained in this regression was 1416.919 and the significance level is less than 0.001, Sig <0.001. The values obtained reject hypothesis 0 and confirm hypothesis 1, i.e., there is a relationship between the independent variables and the dependent variable.

Table III – Coefficients

Variables Entered	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error			
Gender	.828	.056	.293	14.731	<.001
Age category	.698	.034	.607	20.325	<.001
The environment in which respondents live	.464	.067	.170	6.883	<.001
Dependent Variable: *The increase in the allocation of income/material resources to purchased agri-food products during the lockdown period (March - June 2020) caused by the COVID-19 pandemic*					

Source: author's own processing

Table IV: ANOVA Test

Analysis	Sum of Squares	df	Mean Square	F	Sig.
Regression	568.540	3	189.513	1416.919	<.001
Residual	53.500	400	.134		
Total	622.040	403			
a. Dependent Variable: The increase in the allocation of income/material resources to purchased agri-food products during the lockdown period (March - June 2020) caused by the COVID-19 pandemic					
b. Predictors: (Constant), The environment in which respondents live, Gender, Age category					

Source: author's own processing

The multiple regression analysis conducted looked at the influence of gender, age, and the environment in which survey respondents live as consumers of agri-food products on whether they allocate a higher share of income/material resources to purchase agri-food products during the lockdown (March 2020 - June 2022) caused by the COVID-19 pandemic.

The regression equation obtained a linear relationship between the independent variables and the dependent variable: F = 1416.919 and Sig <0.001. The multiple correlation coefficient was R=.956, and 91.4% of the variation in performance is the success variation of the 3 independent variables versus the contribution to the influence of the dependent variable.

Allocation of a higher share of income/material resources to agri-food products during the lockdown (March 2020 - June 2022) caused by the COVID-19 pandemic was influenced by gender, age, and living environment of survey respondents, consumers in their usual life.

Conclusions

This research investigates how gender, age, and living environment of respondents affect their allocation of income/material resources towards purchasing agri-food products during the COVID-19 lockdown period (March - June 2020).

By examining how demographic factors such as gender, age, and living environment affect consumers' allocation of income towards agri-food products, the research sheds light on how individuals make purchasing decisions in times of uncertainty and adversity.

The study found significant results, indicating that these independent variables impact purchasing decisions during times of crisis.

This research is crucial to understand how consumers adapt to the crisis and whether they display different behaviors.

Understanding how consumers adapt to crises and display different behaviors can have important implications for policymakers, researchers, and businesses. By analyzing whether consumers are acting rationally or influenced by emotional factors, the research can help inform interventions and strategies that support consumer decision-making and ensure access to essential goods during difficult times.

Future research directions

In future research, I aim to explore whether a consumer's standard of living or way of life also affects their behavior.

Furthermore, I plan to conduct another quantitative study comparing the behavior of agri-food product consumers in 2022, 2021, and 2020, the years of the COVID-19 pandemic.

Overall, the research presents clear objectives for future studies, indicating a desire to expand knowledge and investigate new variables that may affect consumer behavior.

The proposed quantitative study comparing the behavior of agri-food product consumers over the past three years demonstrates a comprehensive approach to understanding consumer behavior in different contexts.

Additionally, the potential to identify gaps in current research and suggest new directions for future studies indicates a commitment to contributing to the field. Finally, the proposal to implement the research's conclusions in real-life situations and develop new strategies underscores the potential practical applications of the findings.

Limitations

This research has some limitations. These limitations are the availability of statistical data, the type of products included in the analysis, the type of research, and the limitations of time and resources.

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