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THE RUSSIA-UKRAINE WAR AND ITS IMPACT ON GLOBAL FOOD SECURITY. ARE GMO PRODUCTS A GOOD ALTERNATIVE?

Abstract: This paper shows how governments are reluctant to take decisions to allow GMO products for human use and to change them. It also draws a comparison about the allowance and usage of GMO products between Russia and Egypt (with the United States of America representing the largest country around the world in using GMO products). The results of the study are supported by the data of a survey among certain age groups from the Russian and Egyptian populations, conducted by the authors of the paper. As a solution, the Egyptian and Russian governments should allow imports and cultivation of GMO crops under supervision by departments to guarantee their safety. The authors see that GMO products are the best solution to face the potential food shortage for most of the countries dependent on foods imported from Ukraine and Russia because of the Russia-Ukraine war.

Keywords: Russia-Ukraine war, GMO; survey; Russia; Egypt.

Introduction

Since the 1940s, scientists have been working on GMO crops to find methods to make their seeds produce higher yields. They have succeeded in that, but, at first, their inventions were faced with denial and rejection by governments. Then, some countries allowed GMO products but with specific rates either on cultivation or on imports, which have increased over time. Countries, such as the USA and Canada, have introduced some regulations to guarantee the products' safety and quality.

On the other hand, other countries are still prohibiting the cultivation of GMOs or allowing small imports, and sometimes, if they discover that just one condition has not been met, they stop importing the GMOs, such as Russia.

Since the Russia-Ukraine war has started, the Russian forces have been pressing on with their offensive to the south (most of Ukraine's wheat crop area), which caused wheat prices to hit a higher record than in 2008.

Although some countries prohibit the cultivation of GMO crops, we have found that Russians may prefer GMO foods to normal ones even if there is just a slightly lower difference in price. In Egypt, on the other hand, legislators look very hesitant by making legislations that allow trading GMO food, then cancelling them, and finally putting them back again. We have established that Egyptians may not prefer GMO food compared to normal food even if there is a big difference in price because of the type of food itself.

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We see that fully allowing the cultivation and commercialization of GMO products is the best solution for Egypt to solve a potential shortage in foods, specifically wheat, that will threaten its food security and which may likely happen. This threat is because of the Russia-Ukraine war, and no one knows when the latter will end. Farmers in Ukraine could start cultivating again, but even if the war ends soon, there would not be enough time to get a sufficient amount of wheat that could save Egypt from this threat to its food security, and that is if the Ukrainian president allows exporting wheat again.

1. Material and Methods

The research methods included a historical approach to the object of research, methods of quantitative statistical analysis, a statistical survey of respondents, an expert assessment, a comparison and examination of feasible alternative choices.

The authors conducted the online survey using the Google Forms tool to see consumers’ safety assessment of GM foods in comparison with conventional foods.

The survey was supported in 10 languages: English, Arabic, Russian, French, German, Italian, Spanish, Portuguese, Chinese (simplified), and Japanese. It started on 13 October 2021 and ended on 21 November 2021 with 169 respondents from three countries: Egypt, Russia, and Peru. The latter was suspended because it included only one respondent, which could not be representative for a specific population. With the help of a Russian professor of economics (Natalia E. Buletova, PhD, from the Russian Presidential Academy for National Economy and Public Administration, buletovanata@gmail.com), we were able to conduct the survey among Russians.

2. Results

Languages	
Russian (105)	English and Arabic (63)

We have merged the English and Arabic results because both were conducted by Egyptians.

	Age	
	Russians	Egyptians
Up to 20 years old	40%	–
21–30 years old	58%	95%
31–45 years old	2%	5%
45–60 years old	–	–
Over 60 years old	–	–

The largest sample in the survey was between 21–30 years old as this age group is most active in universities and employment.

This group could be considered the engine of markets as their opinions can reform and redirect any market.

Current Employment Status		
	Russians	Egyptians
Employed	43%	49%
Unemployed	57%	51%
Pension	–	–

If you are employed (please mention your job)

Russians	Egyptians
Employee, shop assistant, student, freelance translator, laboratory assistant, green farm worker, self-employed, freelancer, phyto designer, online university curator, 3D model builder, gardener, office manager, Cheremkhovo Meat Processing Plant worker, trainee, agronomist, orchestra artist, agricultural specialist	Marine engineer, demonstrator, international advisor, teaching assistant, student, engineer, secretary, pharmacist, therapist, programmer

The respondents included representatives of different social groups from the Russian and Egyptian populations, but the majority of them are employed in agriculture or are demonstrators and students who are most sensitive to food types and price fluctuation in terms of income proportion.

Do you have any knowledge about GMO foods?		
	Russians	Egyptians
Yes	84%	62%
No	16%	38%
What do think about GMO foods?		
	Russians	Egyptians
Safe	70%	10%
I don't know	20%	43%
Dangerous	10%	47%

The gap in knowledge about GMO foods between Russians and Egyptians is clear, especially with the people who really do not know whether GMO foods are safe or dangerous. It might be because the Russian sample included specialists in agriculture and due to the small amount of knowledge in the Egyptian education system about GMO foods which could become a part of people's lifestyle in the future.

Would you prefer to buy genetically modified groceries or regular ones if genetically modified foods were more affordable?		
	Russians	Egyptians
Genetically Modified Foods	67%	21%
Regular Foods	33%	79%

As we can see, most Russian respondents would accept GMO foods if they were more affordable than the regular ones, whereas a very high percentage of the Egyptians would choose regular foods. We think this is because of the latter's ignorance of the nature of GMO foods.

Would you prefer to buy genetically modified groceries or regular ones if genetically modified foods and regular ones had the same price?		
	Russians	Egyptians
Genetically Modified Foods	38%	16%
Regular Foods	62%	84%

It is natural for the majority of both Russians and Egyptians to prefer regular foods, because GMOs are considered a new type of food and they do not have complete knowledge about it.

Would you prefer to buy genetically modified groceries or regular ones if genetically modified foods were more accessible? (the criteria are higher availability and easiness to get from stores, such as supermarkets or grocery shops)		
	Russians	Egyptians
Genetically Modified Foods	70%	32%
Regular Foods	30%	68%

Most Russians went for GMO foods, which would make it easier for Russia to face the potential global food shortage the whole world may face in the near future unless Russia allows their cultivation or removes the barriers of importing them.

The greater part of the Egyptians chose regular foods and refused GMO ones. Thus, Egyptian legislators have not approved or refused commercialization or cultivation of GMO foods. This makes it easy for Egyptians to choose their type of food, but we think that they will not notice any change in

quantity in the markets or any new type of foods because there is already a large quantity of GMO foods in the Egyptian market without them knowing their real type.

Would you prefer to buy genetically modified groceries or regular ones if genetically modified foods were more sustainable than regular ones?		
	Russians	Egyptians
Genetically Modified Foods	67%	35%
Regular Foods	33%	65%

We think that most of the Russians sampled have chosen GMO foods as more sustainable because a high percentage of the foods available on the Russian market are either imported or frozen (not fresh), so there is no difference in taste between the GMO and the regular foods. In contrast, Egyptians preferred regular foods to GMO ones, as well as locally produced fresh foods to imported and frozen ones. And that remark is clear as illustrated in the current question.

Would you prefer to buy genetically modified groceries or regular ones if genetically modified foods had a lower price than regular ones? If you can afford both and there is a slight price difference, will you get GMO or pay this slight difference?		
	Russians	Egyptians
Genetically Modified Foods	52%	17%
Regular Foods	48%	83%

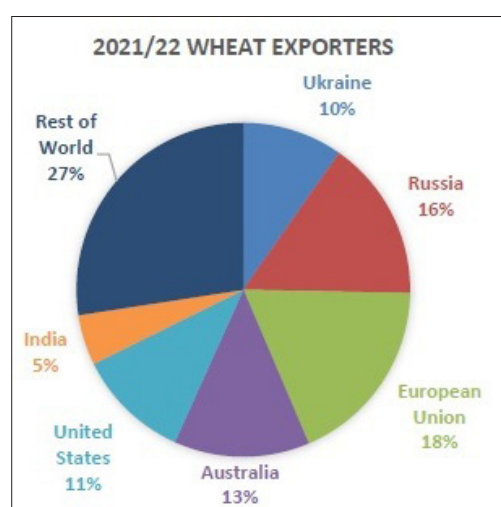
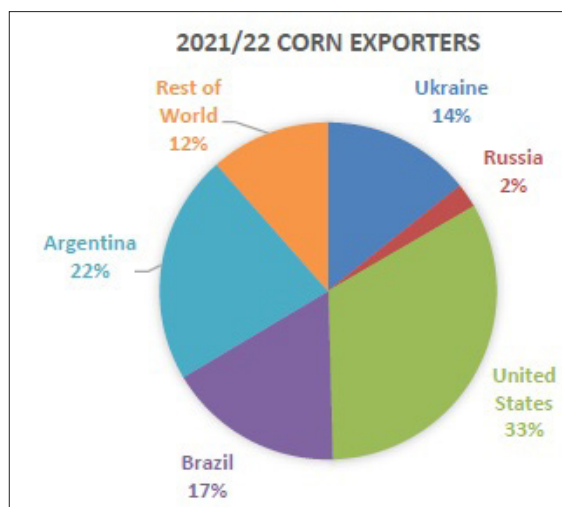
We re-asked the first question in a different way, and a larger number of both Russians and Egyptians shifted to regular foods. We think that, due to the understanding of the question itself, they were meant to answer in relation to the first question, but they thought it was related to the second question. Thus, more have chosen regular foods.

3. Discussion

3.1. The Russia-Ukraine War and Its Impact on Food Security and Inflation

Wheat and corn are strategic products around the world and they have a significant impact on food security.

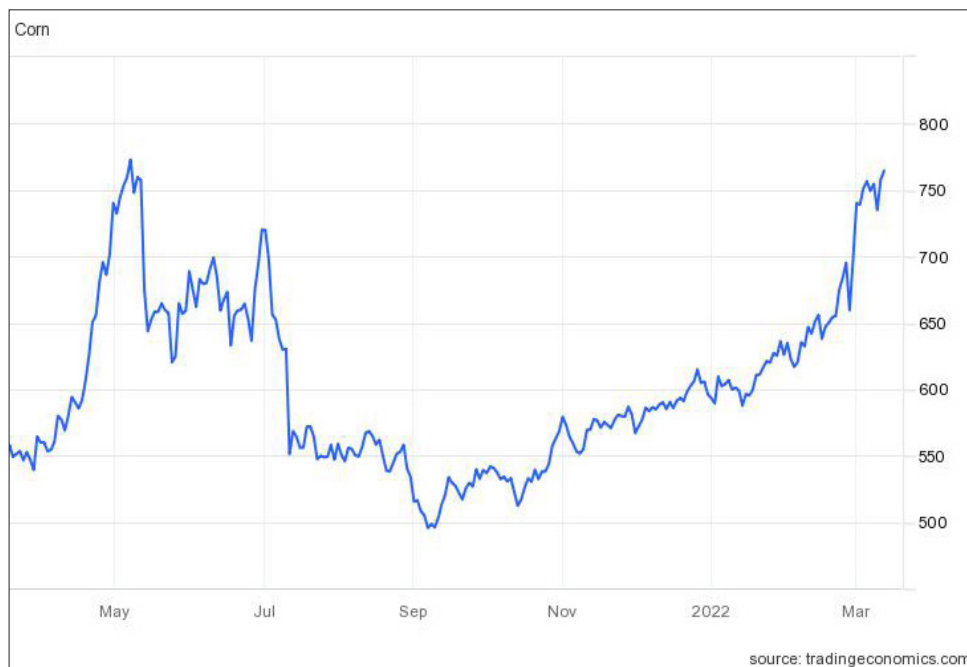
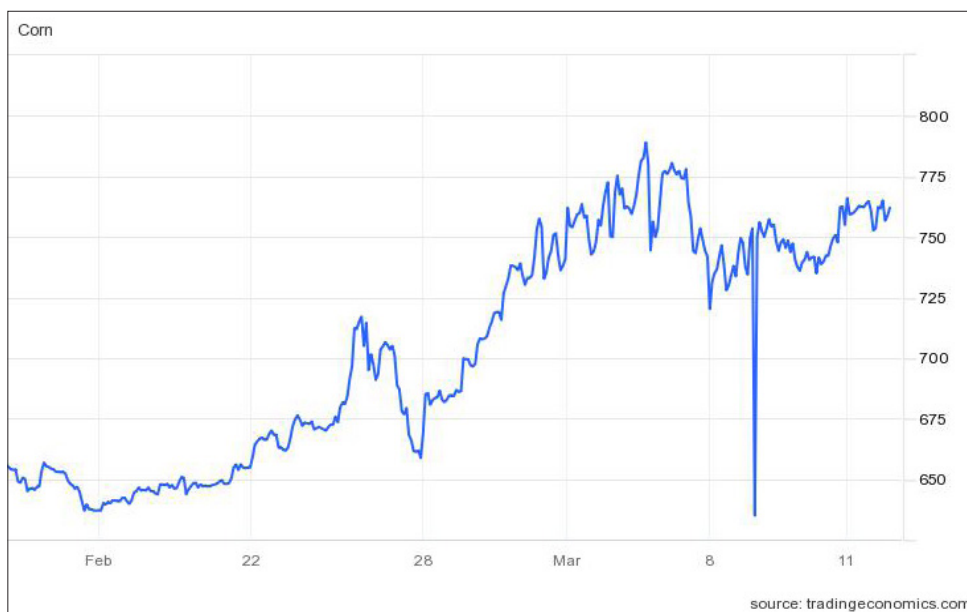
According to the United States Department of Agriculture, in March 2022, Russia and Ukraine together accounted for 26% of wheat exports (Russia 16% and Ukraine 10%) and 16% of corn exports to the world (Russia 2% and Ukraine 14%)¹.



¹ Grain: World Markets and Trade, 2021/22 Grain Trade in Flux Amid Russia-Ukraine Conflict. United States Department of Agriculture, Foreign Agricultural Service, March 2022.

It will become clear if one of these two countries (Russia and Ukraine) has any problem in exporting wheat as this will reflect on the wheat market and wheat prices. The Russian war in Ukraine led to significant instability in the wheat price till it recorded the highest rate ever on 7 March 2022: \$12.94 per bushel, which surpassed the highest record of \$12.82 per bushel set in 2008².

Since the Russia-Ukraine war has started, the same thing happened on the corn market as well. The corn price rose significantly within a month, reaching \$764.50 per bushel, which was very close to the highest record of \$772.75 per bushel within a year. It kept rising as illustrated in the next two figures³.



² Ukrainian Farmers Ask: “Plant or Not to Plant,” Even if Fighting Stops, Yields Could Suffer as Input Worries Loom. Farm Policy News, University of Illinois Urbana-Champaign, <https://farmpolicynews.illinois.edu/2022/03/ukrainian-farmers-ask-plant-or-not-to-plant-even-if-fighting-stops-yields-could-suffer-as-input-worries-loom/>.

³ Corn. Trading Economics, <https://tradingeconomics.com/commodity/corn>.

This is because most of Ukraine's wheat crops are located in the southeast, and the Russian forces press on with their offensive to the south⁴.

3.1.1. Egypt

Days after the beginning of the Russian war in Ukraine, the Egyptian trade minister decided to ban exports of all kinds of vegetable oils and corn for three months starting from 12 March⁵.

In addition, the Egyptian Prime Minister said: “The war has pushed up wheat-flour prices by 19% and vegetable oils by 10%. Consumer inflation had already accelerated to an annual 8.8% in February, driven by higher food prices. The squeeze comes at a delicate time for the Arab world as Ramadan approaches.” For that, Egypt will ban the export of key staples, including flour, lentils and wheat, as the most populous Arab nation moves to safeguard its food reserves amid the fallout from Russia's invasion of Ukraine. The ban, which also covers pasta and fava beans, will apply for three months from March 12⁶.

The government, however, announced that Egypt will have enough wheat reserves to cover eight months of the domestic market's needs after the local harvest is delivered, and that it will import wheat from alternative markets to deal with the current exceptional circumstances caused by the Russian invasion of Ukraine⁷. It did not announce any other forwarding steps to avoid any potential starvation, and wheat is considered the most important food product in Egypt.

The UN Human Rights Office has also reported a warning that a lot of countries may face famine because of the Russian war in Ukraine, including Egypt, because Egypt is considered the largest importer of wheat around the world, with 80% of its wheat imported from Russia and Ukraine⁸.

Egypt is now facing a serious threat of famine and maybe a beginning of a new revolution on its regime because of a potential shortage of food and a continuous increase in product prices, which keep rising rapidly with no prospects of decreasing.

3.1.2. Russia

Russia is considered the main reason for the global rise in wheat prices because of its war in Ukraine. It started with the southeast area of the latter, which is considered most concentrated in wheat crops used in importing⁹.

The war has also affected global oil prices significantly, hitting US\$100 per barrel and reaching US\$139, then down again but still above US\$100, thus instable with ups and downs¹⁰. These high prices affected a lot of economies positively, such as the Gulf countries whose economies depend on oil with high rates, but also negatively, such as US and Eurozone inflation rates (8.5% and 7.5% respectively for March 2022)^{11, 12}. This made the Federal Reserve raise the interest rate hike with 25 points (0.25%

⁴ Middle East Faces Severe Wheat Crisis over War in Ukraine. DW, <https://www.dw.com/en/middle-east-faces-severe-wheat-crisis-over-war-in-ukraine/a-61056418#:~:text=According%20to%20the%20US%20Department,country's%20main%20Black%20Sea%20port>.

⁵ Egypt Bans Exports of Vegoil and Corn for Three Months. Reuters, <https://www.reuters.com/article/egypt-commodities-exports/egypt-bans-exports-of-vegoil-and-corn-for-three-months-idUKC6N2S302J>.

⁶ Egypt to Ban Exports of Staple Foods to Safeguard Reserves. Bloomberg, <https://www.bloomberg.com/news/articles/2022-03-10/egypt-to-ban-exports-of-staple-foods-to-safeguard-reserves>.

⁷ Egypt's Wheat Reserves to Cover Eight Months of Domestic Needs After Local Harvest Supplied: Minister. Al-Ahram Online, <https://english.ahram.org.eg/News/462435.aspx>.

⁸ Ukraine: UN Expert Warns of Global Famine, Urges End to Russia Aggression. UN Office of the High Commissioner for Human Rights, 18 March 2022, <https://www.ohchr.org/en/press-releases/2022/03/ukraine-un-expert-warns-global-famine-urges-end-russia-aggression>.

⁹ Ukraine War in Maps: Tracking the Russian Invasion. BBC, <https://www.bbc.com/news/world-europe-60506682>.

¹⁰ Ukraine Conflict: Petrol at Fresh Record as Oil and Gas Prices Soar. BBC, <https://www.bbc.com/news/business-60642786>.

¹¹ CPI Report for March 2022 Puts Inflation at 8.5%. *The New York Times*, <https://www.nytimes.com/live/2022/04/12/business/cpi-inflation-report>.

¹² Euro Zone Inflation Hits Another Record High of 7.5% as Russia-Ukraine War Pushes up Energy Prices. CNBC, <https://www.cnbc.com/2022/04/01/euro-zone-inflation-march-2022-ecb-policy.html>.

– 0.5%), with expectations of six more interest rate rises in the next six scheduled meetings throughout 2022. The European Central Bank is also expected to raise its interest rate to face inflation^{13, 14}.

These actions affected developing countries' economies and their central banks' interest rates, such as Egypt, Saudi Arabia, Qatar, etc., and depreciated currencies like the Egyptian Pound, which lost 15% of its value against the US dollar after a surprised decision (at a non-scheduled urgent meeting) of the Central Bank of Egypt to increase interest rates.

3.2. Rules and Actions Against GMO Products

3.2.1. Russia

The Russian Federation prohibited the cultivation of GM plants and breeding of GM animals under the amendments in Federal Law No. 358-FZ on 3 July 2016, together with the recent approval of the new Food Security Doctrine in January 2020. The amendments are much like those in the EU where cultivation is prohibited, but imports of approved GM food and feed can continue (USDA FAS, 2016) despite media headlines stating the contrary (*The Moscow Times*, 2016). Influenced by the public anti-GMO campaign and strongly supported by the Minister of Agriculture (Galata Bickell, 2019), the new prohibitive position puts an end to the anticipated start of cultivation in 2023 and 2024 (USDA FAS, 2016)¹⁵.

Russia has just allowed specific quantities and specifications of GMO products that could be imported, and if the exporting country exceeded the allowed limit, GMO product trading would be banned like in the case of China. The Russian Federal Service for Surveillance on Consumer Rights and Human Welfare (Rospotrebnadzor) announced that it has blocked the importation of various Chinese food products into Russia, including noodles and corn flakes. Specifically, laboratory analyses have identified in these and many other foods that the DNA of genetically modified soy and corn in quantities was 0.9% higher than that allowed by Russian legislation, and in some samples even higher than five times the permitted. Furthermore, no reference has been made on the label regarding the content of GMOs. The control body has therefore ordered the suspension of the import of noodles and corn flakes until further notice, but also, for example, of chocolate cream desserts containing eggs with GMO traces and biscuits of various types¹⁶.

Now, Russian GMOs can be cultivated only on experimental fields. Also, only imports of certain varieties of corn, potato, soybean, rice and sugar beet (in total 22 plant lines) are allowed. However, several interlocutors of the Russian media “Vedomosti” revealed that vertically integrated agricultural holdings have already cultivated and used GMO feed crops, but unofficially¹⁷.

3.2.2. Egypt

Egypt's scientific community hailed the move, and hope grew that the nation that exported civilization to the rest of the world would embrace agricultural biotechnology and lead the rest of Africa in that direction. Thousands of hectares of the new GMO corn variety were grown in 10 provinces in Egypt. In 2012, however, the Egyptian government suspended the planting of GMO corn, citing the absence of a biosafety law governing the production and commercialization of such products. All other GMO-focused works were halted and Egypt has not returned to the technology¹⁸.

¹³ Federal Reserve, <https://www.federalreserve.gov/monetarypolicy/fomccalendars.htm>.

¹⁴ Federal Reserve Approves First Interest Rate Hike in More than Three Years, Sees Six More Ahead. CNBC, <https://www.cnbc.com/2022/03/16/federal-reserve-meeting.html>.

¹⁵ **Tumbull, C., Lillemo, M., & Hvoslef-Eide, T. A. K.** Global Regulation of Genetically Modified Crops Amid the Gene Edited Crop Boom – A Review. *Frontiers in Plant Science*, 24 February 2021.

¹⁶ Russia Closes on Imports of Some Foods from China. European Food Agency, <https://www.efanews.eu/en/item/21433-russia-closes-on-imports-of-some-foods-from-china.html>.

¹⁷ Russia to Be Allowed Cultivation of GMO Crops. All About Feed, 12/2013, <https://www.allaboutfeed.net/animal-feed/raw-materials/russia-to-be-allowed-cultivation-of-gmo-crops/>.

¹⁸ **Gakpo, J. O.** Egypt Poised to Again Lead Africa in Ag Biotech Innovation. Alliance for Science, 6 February 2019, <https://allianceforscience.cornell.edu/blog/2019/02/egypt-poised-lead-africa-ag-biotech-innovation/#:~>

In 2016, a law on GMO foods was drafted, which awaits introduction in the Parliament for approval, so that works on GMOs can resume¹⁹. However, we have not found any law or rules that allow or prohibit cultivation or commercialization of GMOs until now.

The gap between supply and demand in the Egyptian food market, generally in terms of many products and specifically in terms of wheat, makes GM drought-tolerant wheat very important for increasing cultivation in areas where sub-optimal conditions, such as water deficit, salinity or high temperature, prevail (Ahmed Bahieldin, a plant geneticist who worked on a variety, 2019)²⁰.

Many of the Egyptian respondents lack knowledge about GMOs, but they know that foods in the market are either produced locally or imported, and this could help a lot of farmers plant GMOs and sell them at a price of normal foods, and therefore help them make higher profits.

In 2019, a team of researchers from Benha University and the Agricultural Genetic Engineering Research Institute detected existence of genetically modified foods in the Egyptian food market. Their samples included three groups: italic fresh samples, cereals and seed samples, and food products²¹.

This refers to the hard situation Egypt is in by having GMOs without any control on their cultivation or commercialization to ensure at least their safety and suitability for human consumption.

Egypt should have laws to regulate GMOs, to control this industry, and to form committees to ensure these products' safety as either locally produced or imported.

Conclusion

In this research, we showed the impact of the Russia-Ukraine war on global food security and global oil prices, which both affected all economies negatively: first the US and EU economies which are facing a sharper economic decline and an inflation rate increasing every month, and then consequently the other economies significantly. This may lead the world economies to a global recession.

We also made a comparison between Russia and Egypt about how their economies are affected by the war, particularly in terms of food prices (wheat and corn) and inflation.

Moreover, we have conducted a survey among Russians and Egyptians to get a picture of their knowledge about GMO foods and of what they will choose in different cases: GMO foods or regular foods.

It became clear that Russians had more knowledge about GMO foods than Egyptians, and that a lot more of them saw GMOs as safe compared to Egyptians.

In the survey, the greater part of the Russians was ready to have GMO foods if they were cheaper or sustainable, whereas most of the Egyptians preferred regular foods in all cases and ignored GMOs. However, a high percentage of the foods in the Egyptian markets is already genetically modified. We assume this is due to a lack of knowledge or misknowledge about GMOs in Egyptians.

We suggested that the Russian administration should remove some barriers for imported GMO products and open part of the Russian market for them, since this is better for the economy than banning imports and prohibiting the cultivation of GMO crops. On the other hand, the Egyptian administration should draft and adopt laws to regulate the cultivation and commercialization of GMO products in order to ensure their safety, to keep the Egyptian people's health safe, and to raise awareness about the available GMO and non-GMO foods on the market, so that consumers can take informed decisions.

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¹⁹ Ibid.

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²¹ **Elzahraa, F., et al.** Detection of Genetically Modified Foods Existence in Egypt Markets. *Annals of Agricultural Science, Moshtohor*, 57(3), 2019, pp. 725–738.

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