OUR DAILY BREAD AND CLIMATE CHANGE – STUDENTS' AWARENESS OF THE CLIMATE CHANGE AND THEIR CONTRIBUTION TO MITIGATION THROUGH DIETARY HABITS PILOT STUDY

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Abstract:

Climate change is one of the critical issues of today's society, and one of the most significant contributors to climate change is agriculture. Even though policy changes and producers' practices are crucial, altering food consumption patterns can also significantly mitigate climate change since previous research showed that animal-based products and ultra-processed foods are linked to the highest GHG emissions. In contrast, plant-based foods have lower GHG intensity. This research analyzed Croatian students' awareness of climate change and their potential contribution through changed consumption habits. A questionnaire involving 20 students assessed their attitudes toward climate change and their knowledge of sustainable food practices. While students recognized the importance of climate change, they needed to understand how food production, storage, transport, preparation, and consumption affect it. The study highlighted the need for further education on the environmental impact of food choices.

Keywords: *climate change, mitigation, awareness, food system*

1. INTRODUCTION

Climate change, a grave peril confronting our society, has been identified by the European Commission and European Parliament (2008), as the second most pressing global issue. Agriculture, a significant contributor, is responsible for approximately 30% of anthropogenic greenhouse gas (GHG) emissions (Smith and Gregory, 2012). The entire food system, from preproduction activities like fertilizing to postproduction processes such as processing, packaging, and waste disposal, significantly impacts GHG emissions (Vermeulen, et al., 2012), underscoring its substantial role in climate change.

While there are various strategies to mitigate agricultural GHG emissions, such as improved cropland and grazing land management, restoration of degraded lands, cultivate organic soils, water management, land use change and agroforestry, livestock management and substitution of fossil fuels for energy production by agricultural feedstocks (Smith, et al., 2007), the most impactful change can come from all of us through altering our food consumption patterns. Previous research has consistently shown that animal-based products – meat and dairy, as well as ultra-processed food, are associated with the highest GHG emissions (Lochman, 2023, da Cruz, et al., 2024), while plant-based food has lower GHG intensity (Poore and Nemecek, 2018).

It is heartening to note that awareness about the impact of our eating habits on climate change and our potential to contribute to its mitigation is growing. Research by the European Commission and European Parliament revealed that in 2008, only one-third of Europeans recognized climate change as a serious problem, a figure that has now risen to 93% in 2021 (European Commission and European Parliament, 2008).

Also, over the last decade, climate change concerns in the European Union have increased. The results of the research conducted by Baiardi and Morana (2021) showed that the climate change awareness rises together with the level of income, social trust, education, physical distress, share of young people in the total population, media coverage and economic losses caused by extreme weather conditions.

The importance of effect of food consumption was recognized by Jürkenbeck, et al. (2021), who analyzed the awareness of climate change of young population in Germany and showed that half of the young generation is highly aware of climate change, while minority think that climate change does not exist. The results of the research also showed that young people aware of the climate change choose more climate sustainable nutrition.

Similar results have been obtained by Lee, et al. (2015), who analyzed climate change awareness in 119 countries and showed that it depends on socio-demographic characteristics, geography, and perceived well-being. They concluded that educational attainment is the strongest predictor of climate change awareness and that there is a need to improve basic education, climate literacy, and public understanding of climate change.

Finally, research conducted in Pakistan showed that agricultural producers who are aware of the threat of climate change are able to adapt, while those who are not aware of climate change face climate change adaptation issues (Ahmed Khan and Nawaz, 2020). Therefore, it is important to educate people on climate change and raise their awareness in order to ensure climate change adaptation.

The main goal of this research was to analyze the awareness of students in Croatia on the importance of climate change and awareness of their possibility to contribute to climate change mitigation through a change in their consumption habits. The conducted research aimed at showing that students are aware that there are more climate-friendly food they can choose to affect the climate change mitigation.

2. METHODS

The research was conducted in two phases to analyze the students' awareness of the importance of climate change: desk research and a survey. The desk research included an in-depth review of the relevant scientific literature (books, articles), which was the basis for the development of the questionnaire.

The survey was conducted in March and April 2023. It was divided into three parts. The first part of the questionnaire analyzed personal attitudes towards climate change. In the second and third parts, students were asked to choose the most climate—and environmentally sustainable foods and practices. One of the choices was also the answer "I do not know" to exclude the possibility of guessing the correct answer. A total of 20 students participated in the research—15 females and 5 males.

3. RESULTS

The first part of the questionnaire was related to personal attitudes towards climate change, with the first question being how important they consider climate change on a scale of 1 to 10, and the average rating was 8.1, indicating that students are aware of the importance of climate change and consider it a serious issue.

In the second question, students had to express their agreement with certain statements related to climate change. For the statement that individuals addressing climate change are making a big deal out of nothing, the most significant number of students (45%) stated that they do not know and are unsure whether they agree or disagree with that statement. In comparison, 25% agree, 20% disagree, and 10% strongly disagree. Regarding the statement that climate change does not affect us in Croatia, 35% of students strongly disagree, 25% disagree, and the same percentage is unsure. Only 10% of students in Croatia agree that climate change does not affect us, and only one student completely agrees. For the statement that European countries are not responsible for causing global climate change, the most significant number of students (35%) disagree, and the same number is unsure whether they agree. In comparison, 20% of students strongly disagree, and 5% agree or completely agree.

Most students, 45%, still determine whether they agree or disagree with the statement that Croatia is too small a country for us to do anything about climate change. In comparison, 25% strongly disagree with that statement, 20% agree, and 10% disagree. A significant 45% of students agree that countries in the region should work together to address climate change, while 30% of students completely agree. On the other hand, 15% of students are unsure, while 5% disagree or strongly disagree that countries in the region should work together to address climate change. The majority of students, 55%, agree that people need more information about climate change, 20% are unsure, and 15% completely agree, while 5% disagree or strongly disagree with the statement.

Regarding the statement that children should be taught about climate change in school, 35% of students agree, while 30% are unsure. 20% of students completely agree with the statement, 10% disagree, and 5% strongly disagree. Finally, most students, a whopping 65%, stated that they are still determining whether they agree or disagree with the statement that it is difficult to know how their lifestyle affects climate change. In comparison, 20% agree with that statement, 10% disagree, and 5% strongly disagree. The students' attitudes towards climate change are presented in Figure 1.

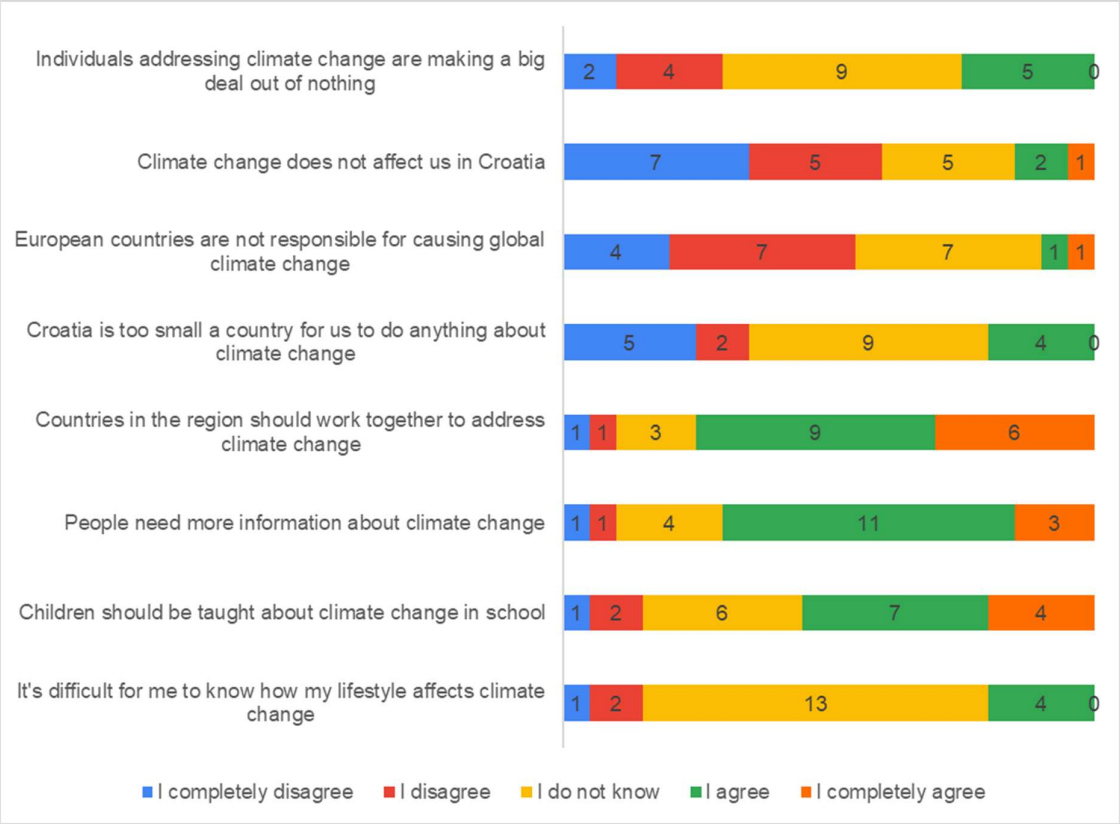

Figure 1 The students' attitudes towards climate change

Source: Authors

Also, the students have been asked to indicate their familiarity with certain aspects of the connection between school education and gastronomy with climate change.

Concerning the concept of the circular economy and its implications on gastronomy, 40% of students are partially familiar with it, while 35% stated that they are not familiar with it at all, and 25% are familiar with this concept. Furthermore, 45% of students are partially familiar with ways to reduce food waste in gastronomy through the circular economy approach. In comparison, 40% are familiar with this aspect, 10% are fully familiar with it, and 5% are not familiar with it.

Most students, 50%, are familiar with how reducing food waste in the gastronomic sector affects the environment. In comparison, 35% are partially familiar, 10% are fully familiar, and 5% are not familiar with it. Similarly, 55% of students are familiar with using sustainable ingredients in meal preparation to reduce environmental impact, while 30% are partially familiar, 10% are not familiar, and only 5% are fully familiar.

45% of students are familiar with the types of optimization of food transportation and distribution to reduce environmental impact, while 30% are partially familiar, 15% are not familiar, and 10% are fully familiar.

A majority of students, 40%, are partially familiar with the significance of reducing carbon footprint during food preparation and how it can be achieved. While 35% are familiar, 15% are not familiar with this aspect of gastronomy's impact on climate change, and 10% are fully familiar with it.

Furthermore, 40% of students are partially familiar with how the consumption of meat and dairy products in gastronomy affects the environment, 35% are familiar, 20% are not familiar, and only 5% are fully familiar.
Finally, 40% of students are partially familiar with how gastronomy can measure and reduce carbon footprint during food preparation, 30% are familiar, 25% are not familiar, and only 5% are fully familiar.
Figure 2 presents the students' familiarity with certain aspects of the connection between school education, gastronomy, and climate change.

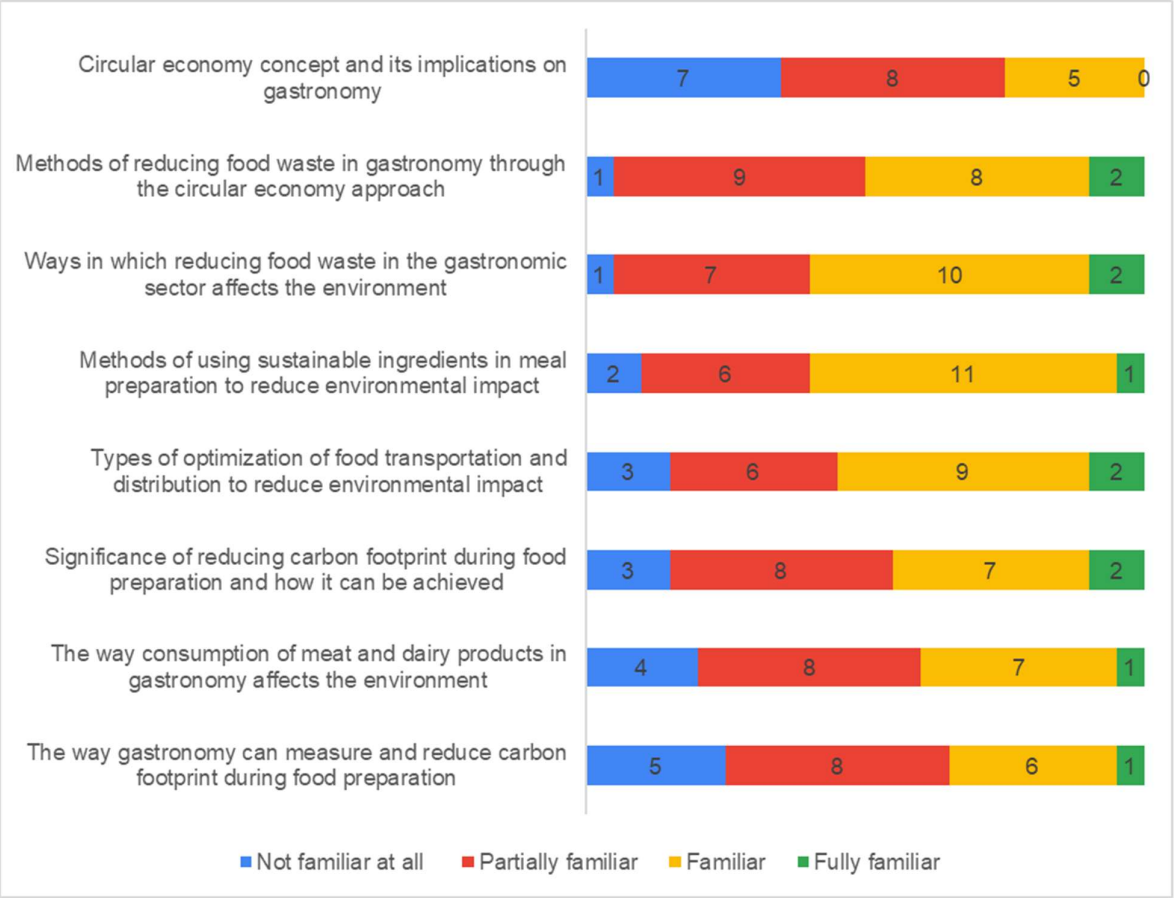

Figure 2 Students' familiarity with certain aspects of the connection between school education and gastronomy with climate change

Source: Authors

The second part of the questionnaire concerns food sustainability and climate change and consists of 4 questions. In the first question, students had to indicate the most sustainable practice. The options were transporting food by plane over long distances, locally produced organic meat, vegetables for deep freezing, and growing vegetables in greenhouses heated with fossil fuels. The correct answer is locally produced organic meat because the other options include the use of fossil fuels and other non-renewable energy sources, and 45% of students answered correctly.

In the second question, students had to choose which of the following options they consider the most sustainable: growing food locally, growing food with fewer fossil fuels, food containing genetically modified organisms, or food grown without harmful environmental impact. The correct answer is food grown without harmful environmental impact because even though all three options are more environmentally friendly than transporting food over long distance or using fossil fuels in production, other options are more harmful than food grown without environmental impact. 50% of students answered correctly.

Furthermore, students were asked which of the following foods—grains, beef, melons, and leafy vegetables such as lettuce or spinach—requires the most water for growth for one typical serving. The correct answer is beef because meat production requires more water than fruits, vegetables or grains, and only 25% of students answered correctly, while 50% answered that it is leafy vegetables such as lettuce or spinach.

Finally, the last question in the second part was about what characteristics food should have to increase the benefits of a vegetarian diet, which is more environmentally sustainable. The options provided were regional/locally produced, consumed seasonally, organically grown, or all of the above. The correct answer is all the above because all these options use least non-renewable energy sources for its production and distribution; only 40% of students answered correctly. The students' awareness of food sustainability and climate change is presented in Figure 3.

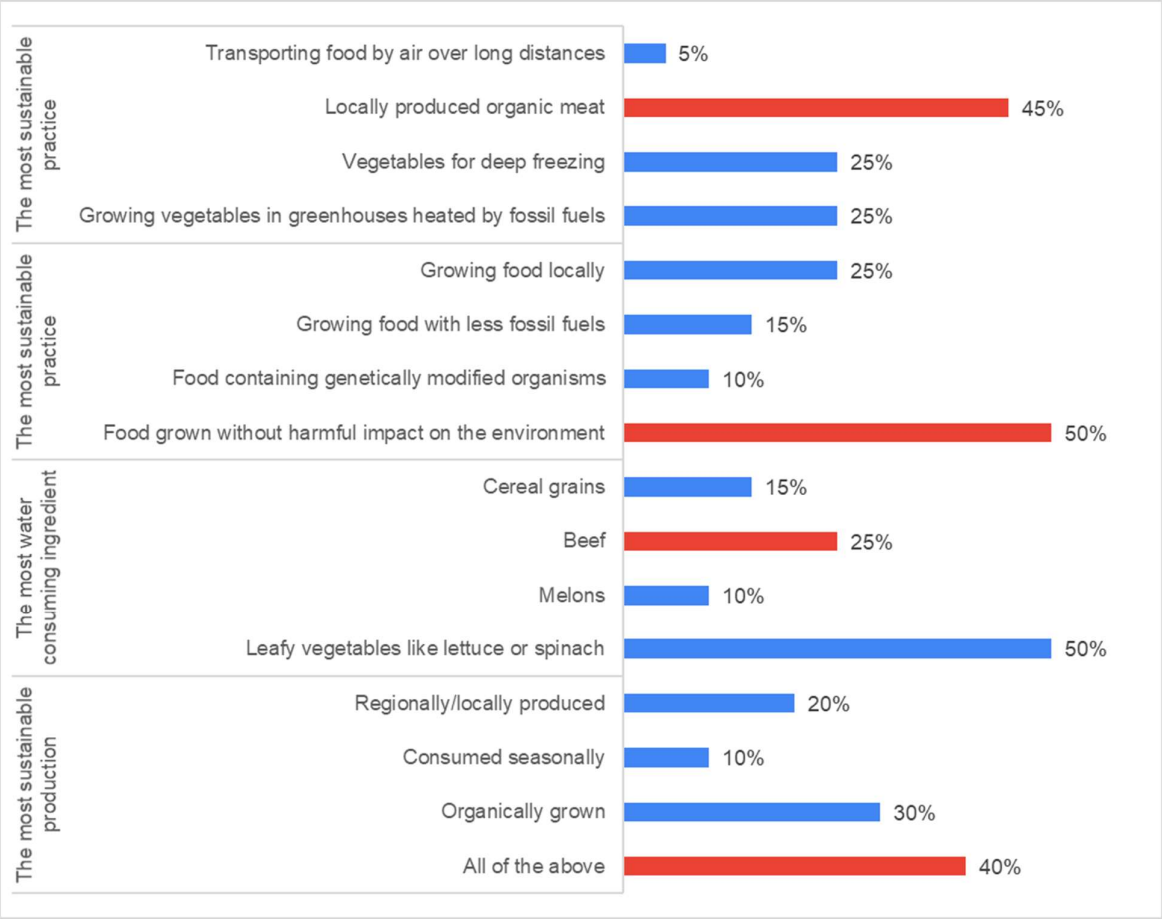

Figure 3 Students' awareness of food sustainability and climate change

Source: Authors

Note: Red labels present the correct answer

The third part of the questionnaire consists of 15 questions related to the impact of food on the environment. In the first question, students had to answer which aspect of the food industry has the most significant impact on the environment and climate change. The options provided were production, storage, packaging, transportation, and I do not know. The correct answer to this question is production because chemical fertilizers, pesticides, antibiotics and plastic materials used in agriculture, livestock production, fishing and aquaculture are major drivers of water and soil pollution and affect climate change more than other parts of food system. 40% of students answered it correctly.

Additionally, students had to answer whether it is true that the production of meat and dairy products causes higher CO2 emissions per kilogram than the production of vegetables. As shown in the introduction, the correct answer to this question is true according to Lochman, 2023, da Cruz, et al., 2024, and Poore and Nemecek, 2018, and 30% of students answered it correctly.

Furthermore, students had to respond to whether it is true that the production of 1 kg of beef generates more greenhouse gases than the production of 1 kg of wheat. The correct answer to

this question is true, which has also been shown by Lochman, 2023, da Cruz, et al., 2024, and Poore and Nemecek, 2018, and only 20% of students answered it correctly.
The next question asked students whether they consider it true that the adverse effects of food production and consumption on climate change and the environment can be reduced by transitioning to a vegetarian diet (without meat consumption). As already explained in the introduction, according to Poore and Nemecek, 2018, the correct answer to this question is true, and only 15% of students answered it correctly. Students' awareness of the food industry's effect on climate change is presented in Figure 4.

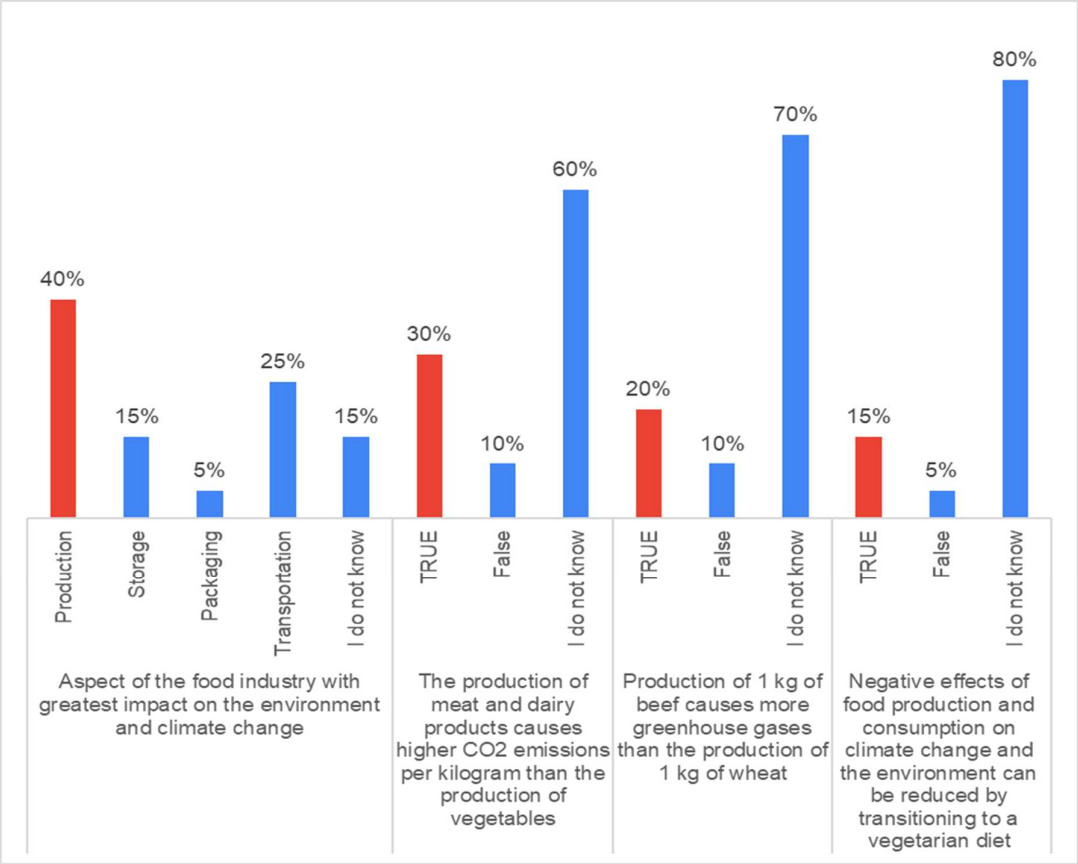

Figure 4 Students' awareness of the food industry's effect on climate change
Source: Authors
Note: Red labels present the correct answer

In the following questions, students were presented with several ingredients. They had to choose which type of food is associated with the least impact on climate change and the environment (per 100 kg). Between potato chips, pastries, and salami sticks, the correct answer is pastries. Compared to salami sticks, pastries are more environmentally friendly because they are non-meat product, while compared with potato chips, pastries are more environmentally friendly because potato chips production uses fossil fuel powered machinery to plant and dig the potatoes. 25% of students answered it correctly.

Among milk, white, and dark chocolate, the chocolate with the least impact on climate change and the environment is dark chocolate because it contains the least share of dairy products, and 35% of students answered it correctly.

Also, students were given a choice between 100g of imported asparagus (transported by plane), 100g of domestic chicken, 100g of domestic beef, 100g of imported tofu (transported by boat), and 100g of domestic pork. The most climate- and environmentally friendly option among these products is 100g of imported tofu (transported by boat) because it is a non-dairy food and the boat transport has a lower environmental fingerprint than airplane transport, and only 10% of students answered it correctly.

In the following question, students had to choose which main ingredient they wanted to prepare a dinner that was as climate—and environmentally friendly as possible. The options were tofu from overseas and meatloaf from local meat, and the correct answer was tofu from overseas, as explained above. Only 10% of students answered this question correctly, while 35% chose meatloaf from local meat.

Apart from the main ingredient, students had to choose a side dish for a climate- and environmentally-friendly dinner. The options were asparagus imported by plane and beans imported by boat. The correct answer to this question is beans imported by boat, because, as explained above, boat transport has a lower environmental fingerprint than airplane transport and only 15% of students answered it correctly. Students' awareness of climate- and environmentally-friendly ingredients is presented in Figure 5.

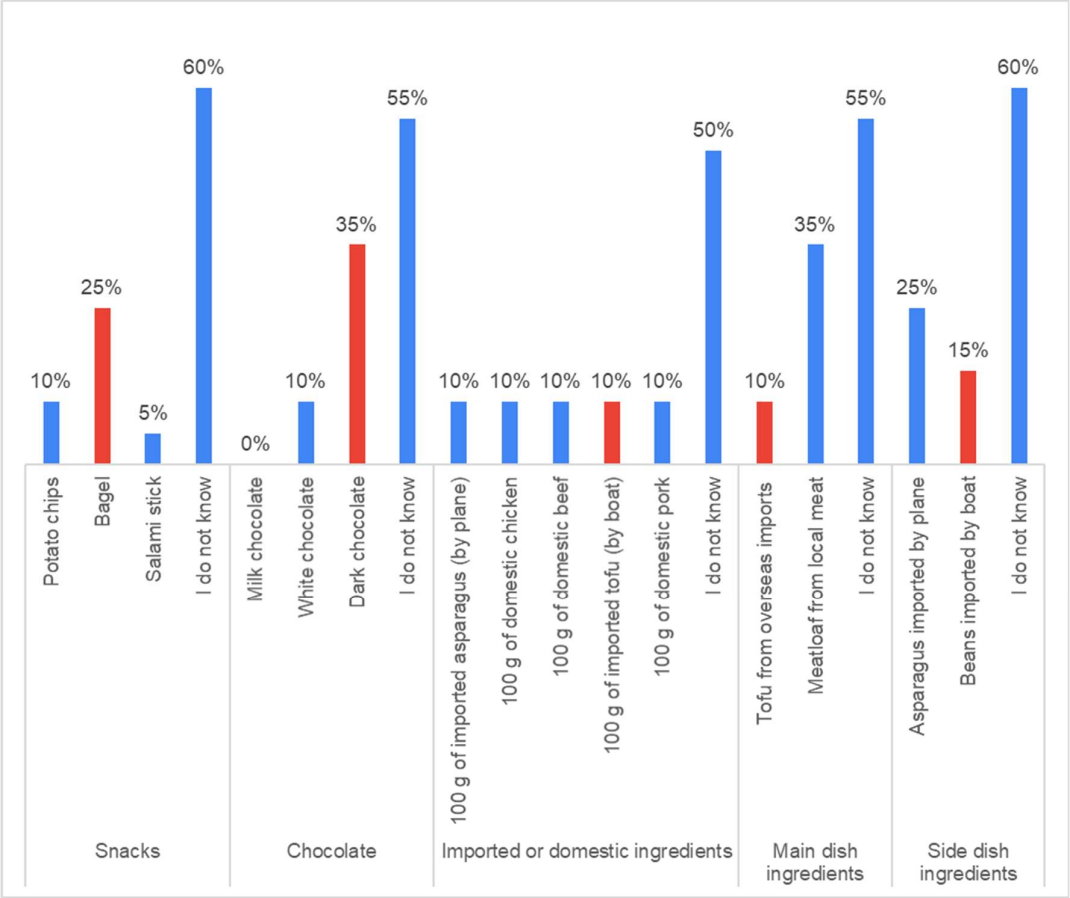

Figure 5 Students' awareness of climate- and environmentally-friendly ingredients

Source: Authors

Note: Red labels present the correct answer

In the next set of questions, students were presented with several dishes and had to choose the most climate- and environmentally-friendly. Among pasta with beef Bolognese sauce and pasta with vegetables and tomato sauce, the most environmentally friendly dish is pasta with vegetables and tomato sauce because it is a non-meat dish, and 50% of students answered it correctly.

Between organic beef burger, organic salmon burger, and quinoa burger, the most climate and environmentally friendly dish is quinoa burger, also because it is a non-meat dish, and only 20% of students answered it correctly.

In the choice between meat kebab and falafel kebab, the most climate and environmentally friendly dish is falafel kebab, as a non-meat version of kebab, and 20% of students answered it correctly.

In the following question, students had to choose between beef ragout, mashed potatoes and beans, chicken ragout, mashed potatoes and beans, and mushroom ragout, mashed potatoes, and beans. The most climate—and environmentally-friendly dish was non-meat option – mushroom ragout, mashed potatoes, and beans, and 40% of students answered it correctly. Figure 6 presents the students' awareness of climate—and environmentally-friendly dishes.

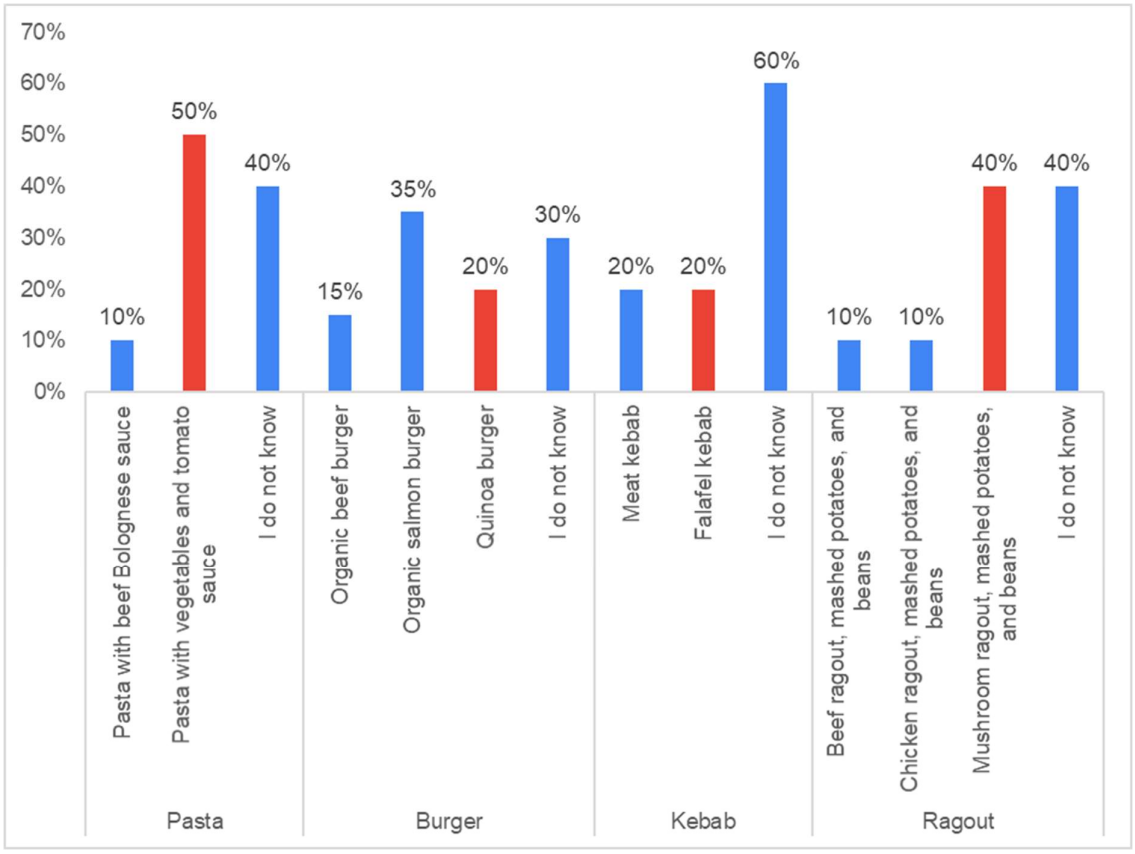

Figure 6 Students' awareness of climate—and environmentally-friendly dishes

Source: Authors

Note: Red labels present the correct answer

The last two questions related to climate and environmentally friendly beverages. In the first question, students had to choose between coffee and black tea. The correct answer was black tea because on a per-liter basis, the carbon emissions of instant coffee are 2.5 times more than for tea ready to drink (Bawa and Liu, 2023). 50% of students answered this question correctly. In the last question, students had to choose mineral and tap water as the more environmentally and climate-friendly drink. The correct answer to this question is tap water because it has no production, packaging and transport effects on the environment, and 50% of students answered it correctly. The students' awareness of climate- and environmentally-friendly beverages is presented in Figure 7.

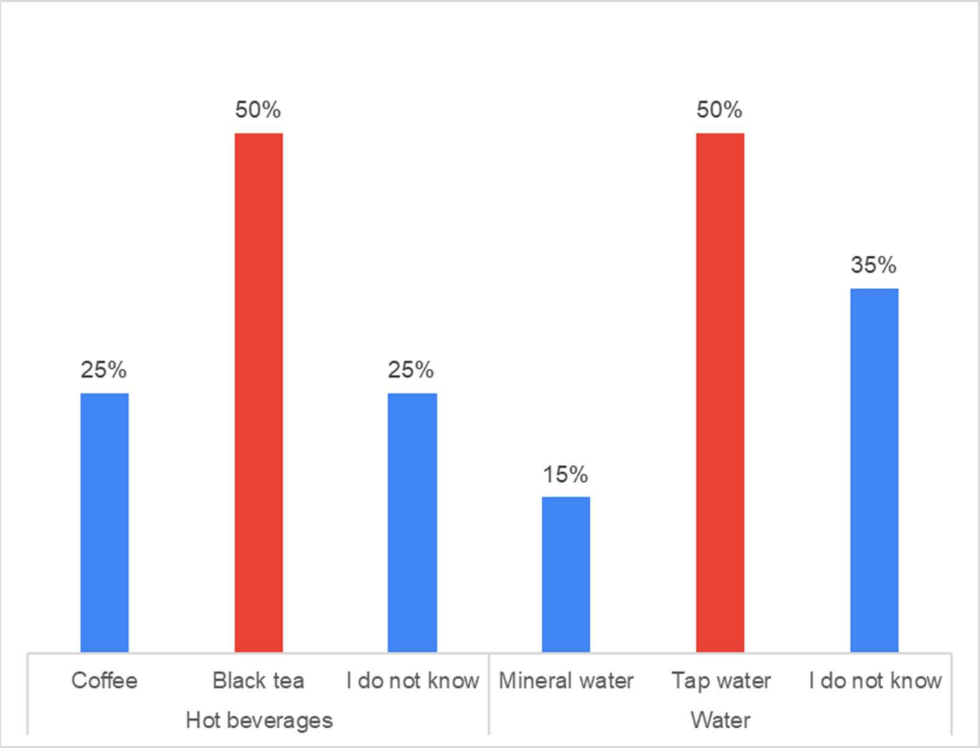

Figure 7 Students' awareness of climate- and environmentally-friendly beverages
Source: Authors
Note: Red labels present the correct answer

4. CONCLUSION

In the past several years, one of the most critical issues in the world has been climate change. One of the most significant contributors to climate change is agriculture and the food system as a whole, including fertilization, processing, packaging, refrigeration, transport, retail, catering, food management and waste disposal. However, due to the implementation of policies related to climate change mitigation, awareness of climate change has increased around the world. People are becoming aware that individuals can also contribute to climate change mitigation. One of the easiest way individuals can contribute to climate change mitigation is the change of food consumption – from animal-based foods to plant-based foods that are associated with lower GHG emissions.

The research on students' awareness of climate change and its relationship with food consumption, conducted in the Republic of Croatia, yielded significant findings. The study revealed that students are cognizant of the importance of climate change, a result that aligns with the research conducted by the European Commission and European Parliament (2008) and Baiardi and Morana (2021). Moreover, the research underscored students' belief that more information about climate change should be integrated into the education system, a sentiment echoed in the studies by Baiardi and Morana (2021) and Lee et al. (2015).

On the other hand, students stated that they are unsure if it is difficult to know how their lifestyle affects climate change. That was confirmed in the second and third parts of the questionnaire when they were asked to recognize the most sustainable practices and the most

climate and environment-friendly ingredients, meals and drinks. Students provided only 29% correct responses, unlike young people in Germany who are aware of the food system's impact on climate change and act accordingly (Jürkenbeck, et al., 2021).

The research findings highlight a crucial gap in students' understanding-while they are aware of the climate change issue, they are not cognizant of their potential role in climate change mitigation through their food consumption patterns. This underscores the urgent need for more effective communication and awareness-raising strategies. It is imperative to disseminate this information more effectively, leveraging platforms such as workshops, the education system, national policies, and national TV programmes, to raise awareness and promote changes in food consumption patterns that can mitigate climate change.

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