



**Universidade de
Aveiro**

2020

**Catarina Rafaela Pais
Figueiredo**

**Food decarbonization: students' perceptions of meat
consumption reduction in a Portuguese University**

**Descarbonização alimentar: perceção dos estudantes
sobre o consumo de carne numa Universidade
Portuguesa**



Universidade de
Aveiro
2020

**Catarina Rafaela Pais
Figueiredo**

**Food decarbonization: students' perceptions of meat
consumption reduction in a Portuguese University**

**Descarbonização alimentar: perceção dos estudantes sobre
o consumo de carne numa Universidade Portuguesa**

Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Ecologia Aplicada, realizada sob a orientação científica do Doutor Ulisses Miranda Azeiteiro, Professor Associado com Agregação do Departamento de Biologia da Universidade de Aveiro e da Doutora Sara Costa Carvalho, bolsreira de pós-doutoramento, Departamento de Biologia & CESAM, Universidade Aveiro.

o júri

Presidente	Professora Doutora Maria Helena Abreu Silva, Professora Auxiliar, Universidade de Aveiro
Arguente	Professora Doutora Ana Luísa Ferreira Pinto de Moura Leite da Cunha, Professora Auxiliar, Universidade Aberta
Orientador	Professor Doutor Ulisses Manuel de Miranda Azeiteiro, Professor Associado c/ Agregação, Universidade de Aveiro

agradecimentos

Em primeiro lugar, gostaria de agradecer ao Professor Ulisses Azeiteiro pela possibilidade de trabalhar com o presente tema, o qual foi um desafio e me proporcionou muita satisfação, ao longo do último ano.

Por toda a disponibilidade, paciência e inestimável ajuda dada ao longo de toda a escrita da dissertação, agradeço à minha co-orientadora Sara Carvalho.

Pela ajuda imprescindível em fases do estudo nos quais o meu conhecimento era muito limitado, assim como em dicas de como tornar esta investigação mais completa, agradeço ao Antonio Garcia-Vinuesa.

Dr. William Cooke, doutorando da UA, representou um papel muito importante na fase final e não acredito que pudesse ter tido alguém que fosse tão eficiente na ajuda que me foi dada.

Por último, agradeço à minha família, a qual foi um apoio imprescindível durante todo o meu percurso académico e ainda mais neste momento.

palavras-chave

Instituições de ensino superior, educação sustentável, sistemas agroalimentares, mudanças climáticas

resumo

Esta dissertação apresenta os resultados de uma investigação sobre o consumo de carne em universidades, dirigida a alunos da Universidade de Aveiro. Este é um tópico de grande importância, abordado no contexto de alterações climáticas e sustentabilidade dos sistemas agroalimentares, assim como no papel da educação para o desenvolvimento sustentável. A motivação para este estudo é entender as perceções e atitudes dos alunos em relação ao consumo de carne. Nos últimos anos, as universidades adotaram medidas de mitigação referentes às mudanças climáticas, com temas como reciclagem, consumo de água e energia e redução das emissões de carbono relacionadas aos alimentos, eliminando carne de vaca e cabrito das ementas. Nesse contexto, é importante perceber o conhecimento dos alunos sobre os planos de ação de sustentabilidade, principalmente no nicho universitário. Os resultados mostram estudantes de doutoramento e do sexo masculino menos recetivos na redução do consumo de carne e, assim, enfatizando a importância da educação em relação às alterações climáticas, incluindo nas universidades. As estudantes geralmente são mais recetivas às mudanças na dieta, já que comer carne, por vezes, está relacionado com estereótipos masculinos. Os resultados desta dissertação irão apoiar uma discussão participativa na universidade que deve incluir *stakeholders*, alunos, docentes e não docentes para uma melhor análise do tema da descarbonização através de mudanças alimentares e redução da pegada de carbono.

keywords

Higher education institutions, sustainable education, agri-food systems, climate change

abstract

This dissertation presents the results of a research about meat consumption in universities targeting students at the University of Aveiro. This is a timely research topic addressed in a context of climate change and agri-food systems sustainability and the role of education for sustainable development. The motivation for this study is to understand the student's perceptions and attitudes about meat consumption. In the last few years universities adopted climate change mitigation measures, dealing with topics such as recycling, water and energy consumption and cutting food-related carbon emissions by removing beef and lamb from dietary offer. In this context is important to perceive the students' knowledge about sustainability action plans, mainly in the university niche. The results show PhD and male students with a low level of awareness to reduce meat consumption and thus stressing the importance of climate change education and climate literacy in Universities. Female students are usually more receptive to diet changes since eating meat is sometimes linked to male stereotypes. This dissertation results will support a participatory discussion in the university that should include stakeholders, students, teaching and non-teaching staff to better analyze the theme of decarbonization through dietary changes and reducing the carbon footprint.

Índice de Conteúdos

1- Introduction	1
2- Theoretical Basis	1
3- The University	4
4- Methodology.....	5
5- Results and Discussion	6
5.1-Descriptive Analysis	6
5.2-Contrast Analysis	13
6- Final Considerations	17
7- References	18
Supplementary Material	24

Lista de Gráficos e Tabela

Tabela 1 – Sampling details.....	6
Figura 1 – Students sex, degree and field of study	7
Figura 2 –Canteen Frequency	8
Figura 3 – Meat in the Diet	8
Figura 4 – Beef in the Diet.....	9
Figura 5 – Reasons to reduce meat consumption.....	10
Figura 6 – Contrast between canteen frequency with sex and university degree.....	13
Figura 7 – Contrast between meat frequency with sex and university degree.....	14
Figura 8 – Contrast between sex with beef presence in diet and beef frequency	14
Figura 9 – ARMC with comparison between the sex	15
Figura 10 – Contrast between sex and ARMC	16
Figura 11 - Contrast between university degree and refusal to reduce meat consumption.....	17

Siglas e Acrónimos

ARMC – Escala de Consciência na Redução do Consumo de Carne

DGS – Direção Geral de Saúde

ENEA - Estratégia Nacional de Educação Ambiental

EU – União Europeia

FAO - Organização das Nações Unidas para a Alimentação e a Agricultura

GHG – Gases Efeito Estufa

GWP – Potencial de Aquecimento Global

HEIs – Instituições de Ensino Superior

OMS – Organização Mundial de Saúde

RGPD – Regulamento Geral de Proteção de Dados

SCIRP - Serviços de Comunicação, Imagem e Relações Públicas

SDGs – Objetivos para o Desenvolvimento Sustentável

UA – Universidade de Aveiro

UNFCCC - Convenção-Quadro das Nações Unidas sobre a Mudança do Clima

1. Introduction

As the human population increases, it is necessary that its food need needs to be satisfied. In this way, the market should increase its production quickly and efficiently (Clark & Tilman, 2017). The livestock industry seems to have had a great expansion over the years but has a lack of knowledge and technology, as well as financing, to a better improvement towards sustainability (United Nations, 2015). While the production should be more efficient, the systems should also be sustainable and adapt to climate change since meat production has tripled in the last 50 years (Rijsberman, 2017; Allievi *et al.*, 2015).

The livestock industry has a significant influence in greenhouse gas (GHG) emissions and consequent climate change (Westhoek *et al.*, 2014). These events are an urgent problem that is being addressed by countries and organizations (Eggleston *et al.*, 2006). When referring to higher education institutions, this question has been the catalyzer to adopt more sustainable policies, that can differ in different universities and be applied in various sectors, including Sustainable Food Consumption (Kurz, 2018; Li *et al.*, 2015; Velazquez *et al.*, 2006).

Changing eating habits in the western diet from meat eating toward more plant-based foods is a suggested option for mitigating climate change. Despite livestock production being a very relevant component in global changes, the consumer represents a large part of the influence of food impacts in the environment, especially when we are considering the consumption of red and processed meat (Bouvard *et al.*, 2015; Afshin *et al.*, 2019). Thus, there is an increasing concern in the way human beings choose to eat.

Climate change has effects on food yields, but food production itself contributes substantially to climate change and even if there are techniques, at realistic costs that would reduce non-carbon dioxide emissions (methane and nitrous oxide) by less than 20%, it is important that consumers adapt their own practices in reducing meat consumption. It should also be taken into account that improving production efficiency, usually, comes at high costs, as more ambitious policy targets and systemic changes are needed (Gil *et al.*, 2019).

The objectives of this dissertation are to analyze different choices of university students when it comes to dietary options, especially meat, as well as to understand how changes in the menus in higher education institutions are perceived by them, and also addressing how these changes are motivated by climate mitigation.

This dissertation results will support a participative discussion about dietary choices, decarbonization through dietary changes and reducing the carbon footprint and impacts to the environment and climate change mitigation measures and practices.

2. Theoretical Basis

Climate change is in the agenda of both scientific community, news and social networks and there seems to be certain convictions among consumers for changes in their habits, as is the case in this study, in relation to excessive meat consumption (Macdiarmid *et al.*, 2016).

Studies have shown that moderating meat in the diet can generate significant changes on the planet, in terms of land use, the emission of greenhouse gases, eutrophication, acidification and even in the maintenance of fresh water availability (Poore & Nemecek, 2018).

Grains, fruit and vegetables appear to have the lower impact on the environment and meat from ruminants the highest (Willett *et al.*, 2019). When the food is evaluated in terms of global warming potential (GWP) and considering only meats which are usually present on most western diets, beef appears as the most significant, followed closely by lamb (Clune *et al.*, 2017). A vegan diet presents the lowest impact, followed by vegetarian and at last, omnivores who eat meat. This last category necessitates a larger number of resources and a higher number of disadvantages for the environment (Vries & Boer, 2010). The method of production is a factor that should also be considered, and not only the food that is consumed. Organic production shows less impact on the environment when considering a wide range of factors like climate change, acidification, land use, among others (Mcmichael *et al.*, 2007).

Turning to greenhouse gas emissions from agri-food systems they represent about a 25% of global total emissions, the contribution similar to industry and greater than power generation and transport. Considering only livestock production, this industry emits about half of all greenhouse-gas deriving from agriculture and land use (Herrero *et al.*, 2016). These values can be explained in the way that this industry involves a lot of factors like processing and transporting of grain as well as, deforestation or gases from animal manure and enteric fermentation (Smil, 2014).

Despite the population's great knowledge of carbon dioxide, gases like methane and nitrous oxide are greenhouse gases closely related to livestock industry and their concentration in the atmosphere is heavily influenced by anthropogenic activities like agriculture, including the livestock industry (Shen *et al.*, 2019). Beef is responsible for the larger portion of CO_2 emissions (14-32 kg CO_2 -e per kg product) when comparing with other meats like pork (3.9-10 kg CO_2 -e per kg product) and chicken (3.7-6.9 kg CO_2 -e per kg product) and the same happens with methane, being ruminant the most worrying, since these emissions come from manure and enteric fermentation, coming only from manure in monogastric animals (Vries & Boer, 2010).

The main reasons to adopt a more plant-based diet is in terms of health, environment, ethics and social issues (Weibel *et al.*, 2019), and as said before, climate change works on both sides: it affects food production leading to health problems, but it is also affected by it, exacerbating diverse effects on health.

According to DGS (n.d.) (Portuguese Health Ministry) meat continues to be an important food to include in the diet, since it has a high protein, vitamin, and mineral value, being rich in micronutrients such as vitamin B, iron and zinc. There is no certainty as to the consequences of the consumption of red meat (potentially carcinogenic, based on limited evidence), and thus it should be moderated, as a precaution (OMS, 2015). Processed meat causes the most concern, being considered carcinogenic to humans and should have a limited consumption (Bouvard *et al.*, 2015).

In the last few years social and ethical attitudes towards animal welfare are progressively changing as there exists a bigger concern for the way that the animals are treated (Bennett and Blaney, 2003; Cornish *et al.*, 2020). When we are talking about food labels, consumers appear to have other priorities, but if well labelled,, people prefer to buy ethically (Cornish *et al.*, 2020).

In order to address animal welfare, Portugal is governed by policies and regulations at European Union (EU) level, that, with a total of 27 member states, developed minimum standards, for not only production spaces, but also transportation and slaughter. The Amsterdam Treaty aims to bring the '5 Freedoms' to farming: freedom from hunger and thirst (1), discomfort (2), pain, injury and disease (3) and as well as freedom to express

normal behavior (4) and from fear and distress (5). At the time of the Lisbon Treaty, animals were recognized as sentient beings, this being a great development in the way that the farming animals are treated (FAO, 2009) (European Commission, 1997). Depending on the country, it is expected that the National Governments take different measures, however these treaties outline the minimum standards (European Commission, 1997).

With so many factors involved, climate change mitigation involves much uncertainty, since there are several pathways that society can follow in its development. Factors like population dynamics, market fluctuations, trade flows and varying governance levels, as well as the unpredictability of climate change itself are especially determinant in this matter (Gil *et al.*, 2019).

Public opinion regarding meat is still mostly linked to important personal, social, and cultural values, with the complete ending of meat consumption unthinkable for a large part of the population. In order to achieve healthy and sustainable diets, it is necessary to integrate these same values (Macdiarmid *et al.*, 2016). Therefore, climate education faces some challenges.

Although there is some reluctance of people to address this subject, animal sourced food leads to greenhouse gas emissions, as mentioned before. And that is one of the major problems considered when choosing the best mitigation measures by universities. Methane emissions could be mitigated by improvement in efficiency and changes in diets (enteric fermentation) as well as through improved management of manure and biogas. The mitigation of carbon dioxide emissions undertakes its sequestration by reducing and reversing deforestation arising from agricultural intensification and by restoration of organic carbon to cultivated soils and degraded pastures. Soil management decisions can be a determinant factor for greenhouse gas emissions (Galford *et al.*, 2020). Nitrous oxide emissions can be mitigated via cropping/rotational system of the legumes (Narayan and Qu, 2016), and increasing the proportion of chickens and monogastric mammals.

Mitigation should happen in all the sectors, going from the broadest, like the government to the actions of each individual.

The 2030 Agenda for Sustainable Development is a plan of action adopted by the United Nations in 2015, developing the 17 Sustainable Development Goals (SDGs). The SDGs were developed taking into account that all the progress achieved will be interconnected, since by reducing poverty, education and health will be improved, and these will be the bases for the protection of the planet, by preserving oceans and forests and trying to minimize the climate change impacts. The Goals that are most related to this study are SDG 12, that aims to achieve sustainable production and consumption and SDG 13, including initiatives of education and communication that intends to take action to mitigate climate change (United Nations, 2015).

The Paris Agreement (2016) within the United Nations Framework Convention on Climate Change (UNFCCC) aims to unite countries in an effort to combat climate change and to adapt to these changes. With the purpose of reaching global temperatures goals in the most effective way, all the countries involved should have regular reports of the progress regarding the reduction of the greenhouse gas (GHG) emissions (carbon neutrality). The Roteiro para a Neutralidade Carbónica 2050 (2019) (Guide for Carbon Neutrality 2050) established a path to achieve carbon neutrality in 2050, that goes accordingly with the Paris Agreement.

Knowing 2005 as the year of peak of gas emissions in Portugal, is necessary a reduction of GHG emissions between 85% and 90% by 2050, with measures that can come from carbon sequestration by forests and other land uses.

3. The University

The ENEA (“Estratégia Nacional de Educação Ambiental” or National Environmental Education Strategy) has an essential role in Portuguese Consumer Education for Climate Emergency. This strategy has three main goals: decarbonize society, guarantee a circular economy and recognize the value of our resources and landscape (ENEA, 2020). The three main goals are being developed with the help of the society, recognizing that each individual should be involved with the environment, especially with the local environmental measures. Society, economic agents, decision-makers and technicians from central, regional and local administration should have a significant role, with more conscientious and sustainable behaviors (ENEA, 2017).

Universities are fundamental in the development of environmentally sustainable policies, being the key to educating and graduating environmentally responsible students. Universities are increasingly aware of this role and committed to reducing carbon and other gases emissions, incorporating “green” into the curriculum, developing eco-friendly buildings (whether its energy, water or waste), and promoting green transportation.

In order to reduce the greenhouse gases emissions, the University of Cambridge has taken various measures aiming to reduce gas emissions, like reduce the use of plastics and promoting less food waste and fair trade. That way was developed the *Sustainable Food Policy* and according to studies carried out by the university itself, many advantages came from these changes. Carbon footprint has reduced by 500 tonnes of carbon dioxide per year, kg of CO_2 per kg of food purchased was also reduced by 33% between 2015 and 2018 and food waste has dropped slightly by 6% comparing 2017 to 2019 (University of Cambridge, 2018). Goldsmiths, University of London has chosen to follow the same patterns as Cambridge but there are others like Ulster, East Anglia, Oxford and Westminster that have taken reduction measures instead of complete removal of beef or lamb.

University of Coimbra was the first in Portugal to ban beef and lamb from their menus but is expected that other institutions will follow this path.

The integration of sustainability in Portuguese HEIs implies sharing information and forming networks, essential to define efficient and sustainable strategies (Aleixo *et al.*, 2018). Some universities are already included in the 200 best universities related to the integration of SGDs, like University of Coimbra, University of Aveiro, University of Minho and NOVA University of Lisbon (The World University Rankings, 2020). Results of Aleixo *et al.* (2018) show that most institutions are starting to implement some measures or policies. However, only measures related to waste separation, recycling and waste reduction plans are being implemented and these measures are well known by the students. On the contrary, in Portuguese and Spanish universities, the influence of the livestock industry in the climate change is not often perceived by the students (Almeida *et al.*, 2016) and presence of meat in university menus is a constant. Concerning common diets in countries like Portugal and Spain, the pattern is the adoption of a less healthy diet against the Mediterranean diet. Moreover, the intake of sugar, salt, processed foods, fat and meat has increased (Martinez-Lacoba *et al.*, 2020). The availability of hot dogs, hamburgers and pizza in universities snack bars are examples of the previous statement (Roy *et al.*, 2019).

University of Aveiro (UA) is a Portuguese public university with more than 12 000 students that go from undergraduate, to masters and doctoral, in areas like Science, Social Sciences, Technologies and Engineering, Arts and Humanities (University of Aveiro, 2020). Six canteens are present in UA, with different snack bars in each department for the different fields of study. Depending on the canteen or the bar we are referring to we can have various

options of meals. The main canteens “Crasto” and “Santiago” offer the most diverse meals with soup, meat or fish, diet option, salads and vegetarian, dessert, and fruit. A total of four canteens offer a meal that includes bread, soup, main course (meat, fish or vegetarian), salad, fruit/dessert and a drink with the cost of 2,65€ for the students. UA has implemented a sustainability strategy, an environmental management system, Campus + Sustentável with several goals in areas like energy, water, waste and green spaces. The university presents a great sense of responsibility towards the environment, namely in the incorporation of the SGDs. The better results happen in the Goals 6, 9, 15 and 17. The goals corresponds to avoidance in wasting water (goal 6), investments in basic infrastructures (goal 9), protection of the forests (goal 15) and partnerships to boost development (goal 17) (The World University Rankings, 2020). Although the measures are not very pronounced in food, there is concern with waste in canteens.

4. Methodology

This ecology and socio-environmental study that relates to education, particularly, environmental education, follows a quantitative approach. This approach provided research data from different topics like meat consumption or sustainability in the university context, with a single questionnaire. This large sample size (see Table 1) should be representative of the University of Aveiro students and is converted into quantitative data, with further statistical analysis. The methodology can be easily replicated in posterior studies (Babbie, 2010; Brians *et al.*, 2011).

The present study is mainly based on the analysis of the collected data from a questionnaire. The questionnaire contained 25 questions with a majority of, close-ended questions regarding meat consumption habits, students’ awareness of the recent events of removal of meat in college canteens, their opinion on this subject and how could this relate to climate change and, at last, their knowledge concerning sustainable actions related to nourishment. To the questions that would not be answered with a single option, a Likert scale was used throughout (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, and Strongly Agree).

Before being published online, the questionnaire was pretested to adjust details such as its duration, layout or content. Thus, student responses would be facilitated.

In a contrasting analysis two specific categories were evaluated: Diet habits and *Awareness of Reducing Meat Consumption* scale (ARMC). *Diet habits* has four closed-end items that explore the characteristics of the university student population regarding the inclusion of meat and beef in their diets (yes/no) and its frequencies of consumption (five options from *Rarely* to *Twice a day*). ARMC has four closed-end items are included in this scale ($\alpha = 0.725$) that offers a Cronbach's alpha reliability coefficient higher than 0.7, which is considered acceptable (Gliem *et al.*, 2003). The four items ask respondents to indicate the extent of the agreement assessing three reasons to reduce meat (Health, Environmental and Ethics) whereas the latter item indicated “not to have reasons”.

In order for the divulgation to be authorized on the university website, the questionnaire was submitted for approval from Ethics Commission and RGPD (General Regulation on Data Protection), since the study deals with subjects related to people’s convictions as well as personal data. After approval the questionnaire was released by the SCIRP (Communication, Image and Public Relations Service). Participants were informed of their rights and confidentiality, as well as the general purpose of the study.

The questionnaire was sent to all the students in the University of Aveiro and the respondents could answer the questions online. It was online for a period of 1 month (February 10th to March 17th, 2020) and a total of 1084 responded, representing about 9% of 12 584 students (2008), ranging from undergraduate degree to doctoral. Among all initiated surveys, incomplete surveys were excluded, leaving 876 surveys (Table 1). The intention of the study was to have answers of students of diverse areas, like Sciences, Humanities, Arts or Engineering.

Table 1. Sampling details

	Universe	Confidence level	n	error
Total	12.500	95%	876	3.19%

p = q = 0.05

In a first phase all the variables were counted and analyzed individually through *Microsoft Office Excel 2016*. In a second phase, with the *SPSS Statistics 26*, descriptive analyses were used to describe the study sample, and chi-square analysis and t-test ($p < 0.05$) were used to compare the independent variables: *Sex*, *Degree*, *Field Study and Canteen Routine*, that characterize the studied population. These variables were explored possible relations. Chi-square analysis is also used to compare the independent variables to *Diet Habits* and *Awareness about Reducing Meat Consumption (ARMC)* categories.

In order to properly apply chi-square analysis (avoiding cells with an expected count of less than 5) some of the options of frequency scales were reconverted:

- Once a day and Twice a day were merged into 1 or 2 times a day.
- Rarely and 2 to 3 times per month were merged into 2 to 3 times per month.

To calculate ARMC scale index we have assessed its four items from 0 to 4 according to a higher agreement to reduce meat consumption. We converted the total score into a 100 scale which indicates that the higher the index reaches the better awareness of reducing meat consumption is declared. Although the sample distribution is not normal, we selected t-test analysis following Luepsen (2018).

The results and discussion only include the figures that were used in the contrast analysis. The remaining figures are included in the supplementary material.

5. ***Results and Discussion***

5.1 **Descriptive analysis**

Figure 1 illustrates three main characteristics of the study sample: sex, degree and field of study.

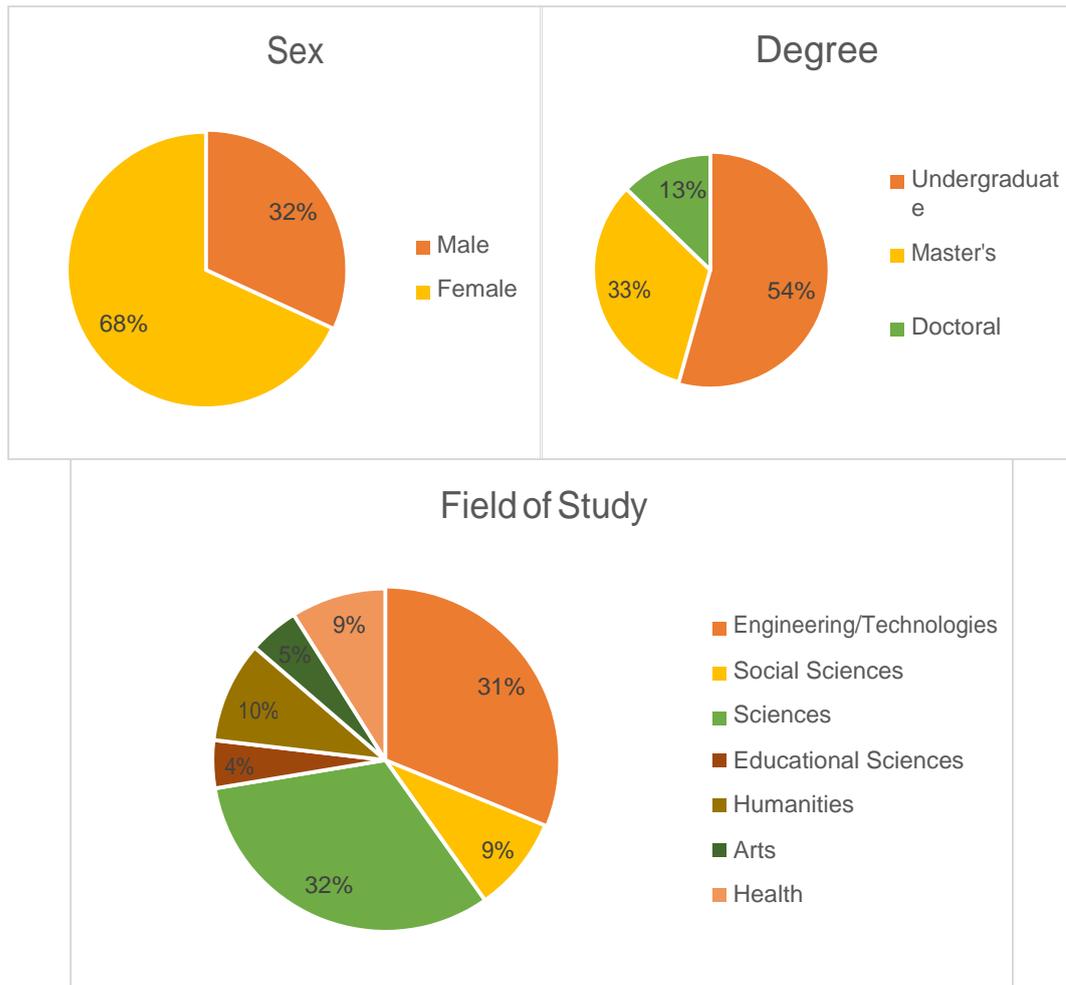


Fig.1. Students sex, degree and field of study.

Most of the students that answered the questionnaire were females (68%) and undergraduate (54%), being the smallest percentage relative to doctoral students (13%). The respondents are divided for all the fields of study presents in the university, with the majority in sciences (32%) and engineering/technologies (31%) and less in fields like arts (5%) and education (4%) (see Fig. 1).

Figure 2 illustrates the frequency of the use of the canteens from the university of Aveiro.

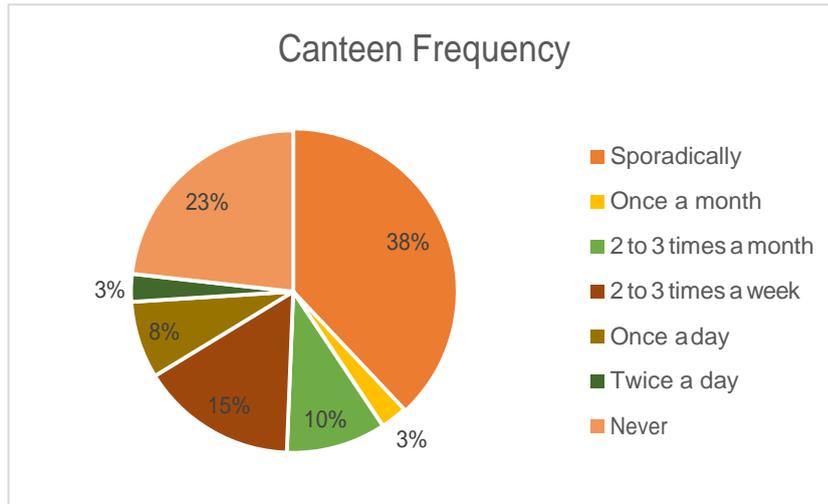


Fig.2. Student's responses regarding the frequency of the use of the canteens from the university.

The higher results are from the students that go to the canteen sporadically (38%), or even the ones that never frequent these spaces (23%). However, a quarter of the students responding (26%) go to the canteens of the university at least 2 to 3 times a week (twice a day, once a day and 2 to 3 times a week options) and a smallest percentage (11%) go at least once a day (twice a day and once a day options) (see Fig. 2). A considerable portion of nutrients comes from the canteen, so the meals offered need to be well planned.

The relation between meat consumption and health or environment is an important topic to be addressed (Boer *et al.*, 2013; Clark *et al.*, 2019) and, consequently, is important for this study to know, how big of a part this food have in students' diet (see Fig. 3).

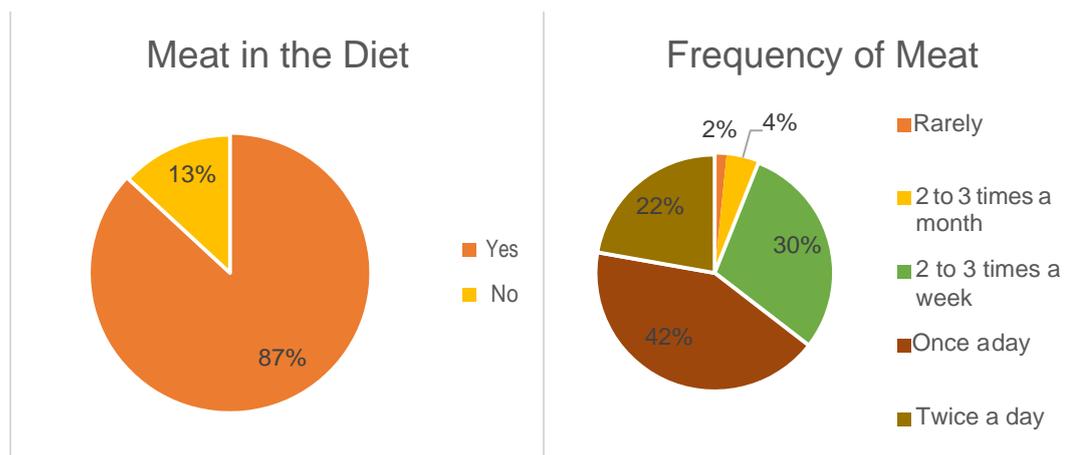


Fig.3. Student's responses regarding the presence of meat in their diet and its frequency.

The results had shown that the higher percentage of respondents (87%) have meat in their food choices, the majority (64%), once or more a day. The percentages can be even bigger if the analysis goes for the students that eat this food at least 2 to 3 times a week (94%) (see Fig. 3). Through this percentage, we can infer that meat is an important element in the university student's diet, being consequently important in canteens menus.

A study in a New Zealand university, with the aim of analyzing how healthy are students' diets shows that meat pies are present weekly, in their diets. Hot mixed dishes (with vegetables not as major components) are one of the most promoted and accessible kind of meal in this university, with hamburgers and hotdogs available and promoted more, when compared with other meals (Roy *et al.*, 2019). Students from other universities are not following the recommendations when it comes to fresh meat consumption and are trying to reduce (Ortiz-Moncada *et al.*, 2019; Kurz, 2018).

The restriction to a specific kind of meat, beef, that belongs to a group (ruminant meats) considered worse for the environment, when compared to non-ruminant meats (Clune *et al.*, 2017), was used to perceive how these or other topics can influence people's diet (see Fig. 4).

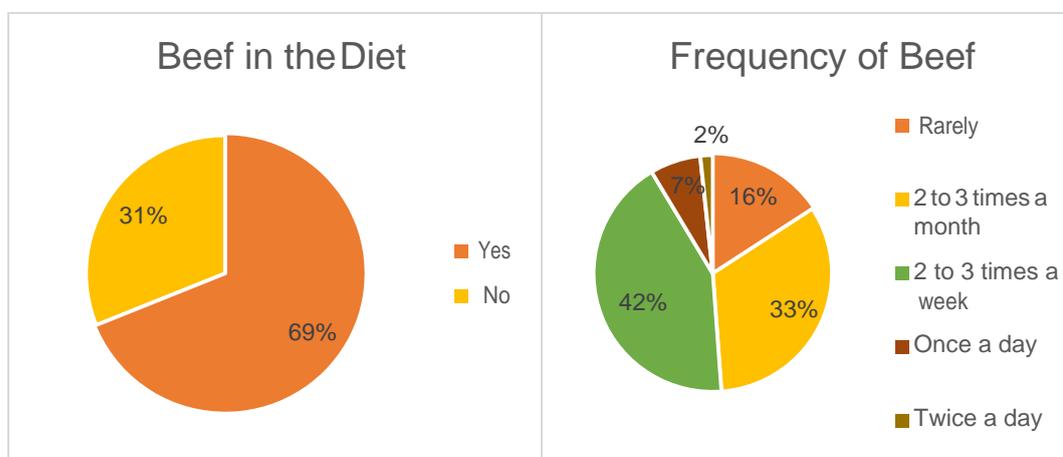


Fig.4. Student's responses regarding the presence of beef in their diet and its frequency.

When considering only beef, the results are a little different, one third (31%) of the students do not eat beef and only 9% of the questioned university students that eat this meat, appoint to eat beef once or more a day. Even if the values for beef are lower, and since we are talking about a specific kind of meat, 42% of the students have beef as a meal, 2 to 3 times a week, a significant percentage (see Fig. 4). The same pattern appears in the University of Castilla-La Mancha, Spain, where the weekly recommended consumption of red meat and processed meat is not satisfied (Martinez-Lacoba *et al.*, 2020).

Depending on the way that people choose to eat from animal sources, there are different perceptions on advantages or disadvantages to the human body, the environmental problems that surround us or even to animal wellbeing (ethics).

Knowing the habits related to the presence of meat, and particularly of beef, the reasons that could lead respondent to decrease meat consumption was also analyzed, if they have not already done so, as well as the refusal to reduce meat consumption (see Fig. 5).

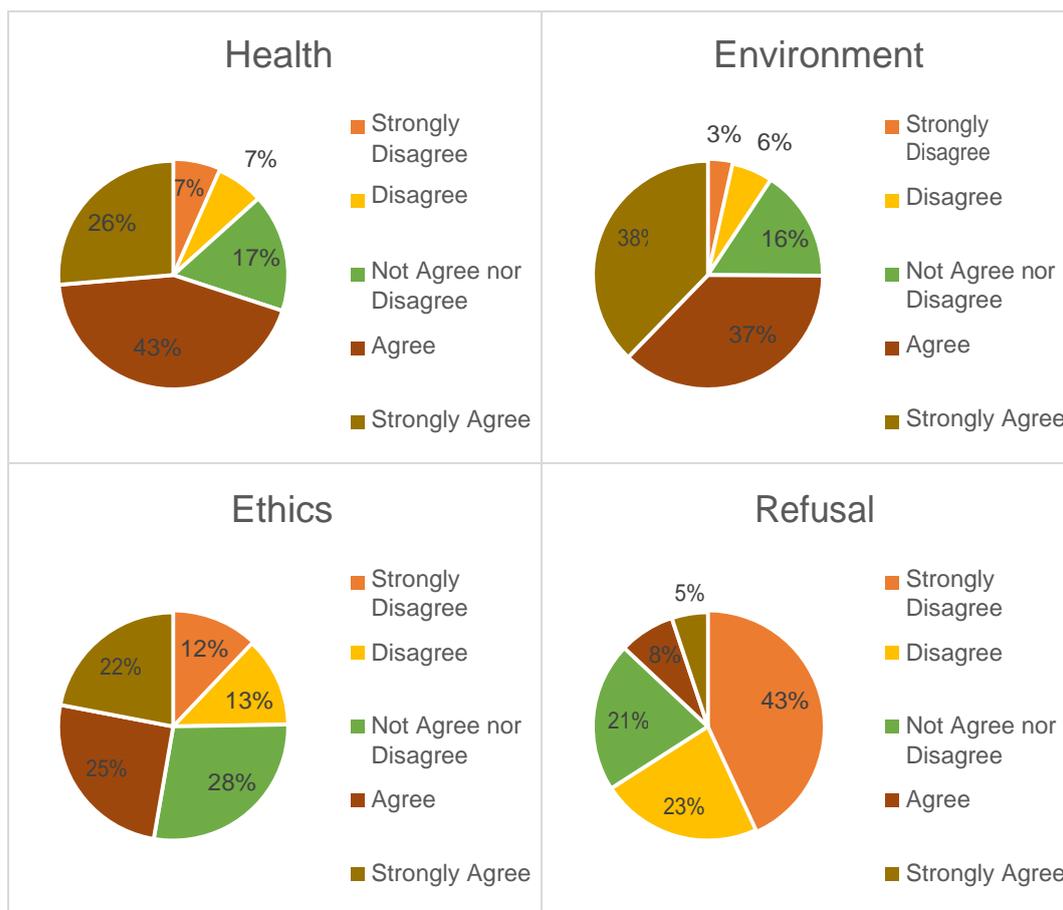


Fig.5. Students’ responses regarding the reasons that could lead them to decrease meat consumption or refuse to do so.

When questioned about the reasons that would make respondents change their meat eating habits, in order to reduce the consumption of meat, concern for the environment emerges as the most popular (based on answers of “agree” and “strongly agree”) (75%) followed by health (69%) and ethics (47%). Proportionally, ethics is the reason that students choose as less likely to make them reduce meat consumption (25%), followed by health (14%) and environment (9%) (see Fig 5). In the question that requested reasons that were not enunciated before (suggestions) that could also trigger this change, economic reasons and taste were the most prevalent. Through these results, we can see that most of the students (75% of students) are concerned with climate change. This is related to the higher level of exposure to major global environmental issues in local news and documentaries, their being the new generation increasingly aware of environmental problems (Emiru & Waktola, 2018). Surprisingly, most responses regarding the refusal of this reduction, were negative (66%), being the students, willing to try meat reduction. However, a fraction of the students (21%) is neutral on this subject and probably didn’t think about how their food choices could influence all the previous subject matters (see Fig.5). Also referred many times was animal well-being, as an alternative answer to the ones presented (environment, health and ethics), showing that when seeing the word “ethics”, university students do not correlate it with the way that the animals are treated, also apparent in 28% of students’ responses that “not agree or disagree” with “Ethics” as a reason for reduction, showing that don’t have a clear opinion on this topic.

On the date of access to the questionnaire, almost $\frac{3}{4}$ of the respondents already knew about the measures (removal of beef and lamb from canteens) that had been taken in University of Coimbra or that had already happened internationally (73%), television (74%) and social networks (65%), being the most significant (see Fig. 1; supplementary material). With these responses is possible to infer that the TV news and the internet are good communication vehicles when it comes to inform, at least, university students. Media, in this case TV news, is crucial to acknowledge and engage individuals in climate change, so this knowledge that can lead to more sustainable behaviors. However, nowadays, the media coverage, and its overall framing, are contributing to a low sense of general public awareness and responsibility in environmental subjects and thus social inaction (Areia *et al.*, 2019). The same happens with social media, which can be an increasingly efficient means to promote strategies that lead to societal changes related to the environment, especially in younger people (Simeone & Scarpato, 2020).

Based on students' answers, the removal of beef and lamb from the University of Aveiro would be a good change in canteens (64%), however with some issues that should be highly considered (see Fig. 2; supplementary material). The benefits of this measure appeared in a very positive way and the majority of the students approve some changes in canteens, taking into account advantages to environment (93%), health (78%) and ethics (65%). Advantages for the environment as a consequence of reduction of meat consumption is an aspect that is present in students' knowledge since the percentage that do not believe in this correlation (answers of "disagree" and "strongly disagree") is 2%. In the answers to this question, also mentioned are topics like the importance of this measure to a less propagation of diseases and conscientization on this matter (Fig.3; supplementary material).

Even if most of the individuals believe that this measure should be implemented, that are some concerns that come from the reformulation of canteen menus. Among the different options that were present in the questionnaire, losses for agricultural industry as well as related economic sectors (72%) and losses for the small farmers (66%), are the ones that showed more agreement, however when questioned about other disadvantages, the responses exhibit some other worries in common (see Fig. 4; supplementary material).

Some students fear that this removal could lead to a rise in menu prices, as well as to less diverse and nutritious food. One of the most frequent topics on this same question was that the removal of some types of meat is correlated to a higher consumption of other types like pork or chicken. These problems reported are very pertinent in a way that uncover the different points that should be addressed when a decision as relevant as this is taken. When a university decides to make such changes in the canteens, simple removal shouldn't be the answer. Vegetarian and vegan nutritious options should be considered, that are at the same time affordable for the students. Usually, universities, decide to incorporate measures involving recycling, less use of plastics or less food waste, all concerning the protection of the environment, and also addressed in this questionnaire (University of Cambridge, 2018). Education of the population, sustainability and local food and less food waste are highly supported by the academic community (see Fig. 5; supplementary material). Raising students' awareness and knowledge can be achieved in different ways that go from documentaries to university curricula (Emiru & Waktola, 2018). Education is the key to change behaviors and food waste is one of those behaviors. According to FAO (2017), food loss and waste constitute a major source of GHG emissions, together accounting for about 8% of global anthropogenic GHG emissions. Reducing waste, including at the consumer level, would contribute not only to meeting food security demands, but also to reducing some of the climate impacts of our food system (Reisch *et al.*, 2021).

Regarding the environment, the main point contemplated in this study, it was important to understand the influence of the meat consumption, specially from ruminant species, on the environment. Most of the respondents believe that the reduction in the consumption of meat could lead to reduction of acid rain (47%), ozone layer reduction (64%), mitigation of climate change (68%) and less contamination of the soil and water (71%) (see Fig. 6; supplementary material). The students also relate this to deforestation, loss of biodiversity and natural resources. The responses to the question related to the ozone layer reduction shows the lack of knowledge or disinterest in topics like environment and climate change. Contrary to respondents' answers, the global ozone layer has been depleted due to the anthropogenic emissions of the ozone depleting substances (ODSs), that are produced in large quantities in industries of air conditioning and plastic foam manufacturing, for example (Singh & Bhargawa, 2019). Even if the students correlate meat consumption to the previous topics (e.g., climate change), these questions appear to generate some hesitations since the answers "not agree nor disagree" represent values of 18% or 19% in the different topics, with "Reduction of Acid Rain" with the value of 35% (see fig. 6; supplementary material).

Education was one of the practices that leads to a greater agreement on a way to care for the environment; and it was interesting to evaluate if the students had access to this kind of information (sustainability) through their course. A large percentage (58%) say that this topic is never or sporadically addressed in their classes. The smallest portion (14%) answered that sustainability is widely addressed in their course (see Fig. 7; supplementary material). This percentage represents a low percentage of students, considering that sustainability is addressed more in sciences degrees and a third of the students are from these courses. However the universities should make an effort to insert these concepts in a wide range of fields and degrees (Leal Filho *et al.*, 2019; Dagiliute *et al.*, 2018).

One of the goals of this questionnaire was to understand the knowledge of the respondents about some of the most known measures taken nationally and internationally in this matter, one of them being, the SDGs (Sustainable Development Goals). Most of the answers reveal some knowledge relatively to it, but not much. A large percentage of the students (45%) appears to have heard about SDGs but were not very informed about them, not knowing what they are. A smallest percentage (32%), still nevertheless too high, have never heard of them (see Fig. 8; supplementary material).

When considering measures taken at the university level, most of the students are even less aware. "Carbon Neutral Campus", internationally, and "Campus + Sustentável", present in University of Aveiro are not known by the majority of the respondents (88% and 67%, respectively) and even the ones who know these measures, are unaware of some of the important achievements accomplished. Reduction of the use of plastics (80%) as well as topics related to recycling (86%) are some of the most popular (see Fig. 9 and Fig. 10; supplementary material). However, these topics are often heard by the students, in their daily lives and not necessarily through the university or have this kind of information through the university policies.

The integration of sustainability in the academic trajectory (namely through SDGs or national policies like ENEA) is essential for the students. Topics like climate change and sustainable cities and communities are more often addressed in the curricula of environmental sciences or education and teaching programs, limiting the spread of knowledge (Leal Filho *et al.*, 2019). These results show the urgency of involving the students in sustainability policies or measures, through HEIs.

5.2 Contrast analysis

Independent variables

Regarding sex, we found statistical differences with the other three variables: Degree, Field of Study, and Canteen Routine. Concerning the frequency in which students used the university canteens, females used to access less to this kind of services than males ($\alpha = 0.000$) (see Fig. 11; supplementary material).

Figure 6 shows the results of the crosstab to contrast Canteen Frequency with Sex and University Degree.

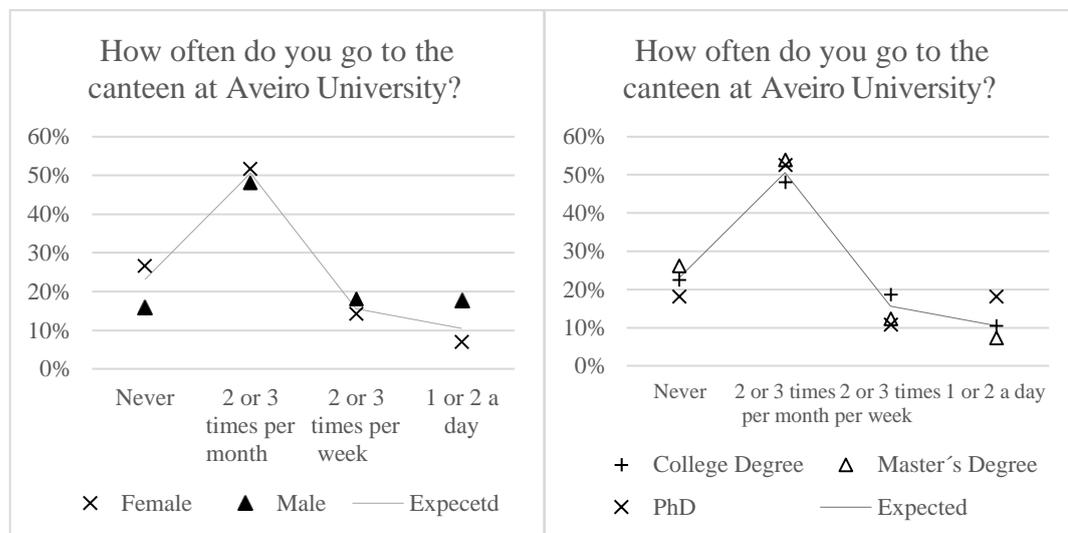


Fig. 6. Contrast analysis between the variables *Canteen Frequency* with *Sex* and *University Degree*, correspondingly.

We found just one more statistical difference comparing Canteen Routine to Degree ($\alpha = 0.004$) where PhD students use these services more often than College and Master's students. Nevertheless, this relation could be influenced by sex variable, since female students declared go to the canteen less times than male, and there are less females on PhD programs (see Fig. 6).

Diet habits

Figure 7 shows the results of the crosstab to contrast Meat Frequency with Sex and University Degree.

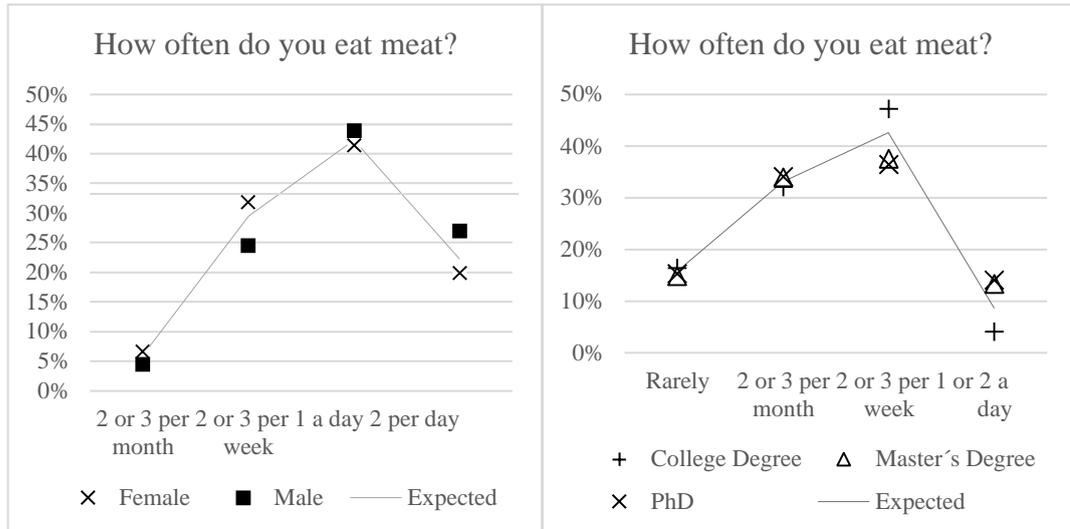


Fig. 7. Contrast analysis between the variables *Meat Frequency* (not considering only beef) with *Sex* and *University Degree*, correspondingly.

Figure 8 shows the results of the crosstab to contrast *Sex* with *Beef Presence in Diet* and *Beef Frequency*.

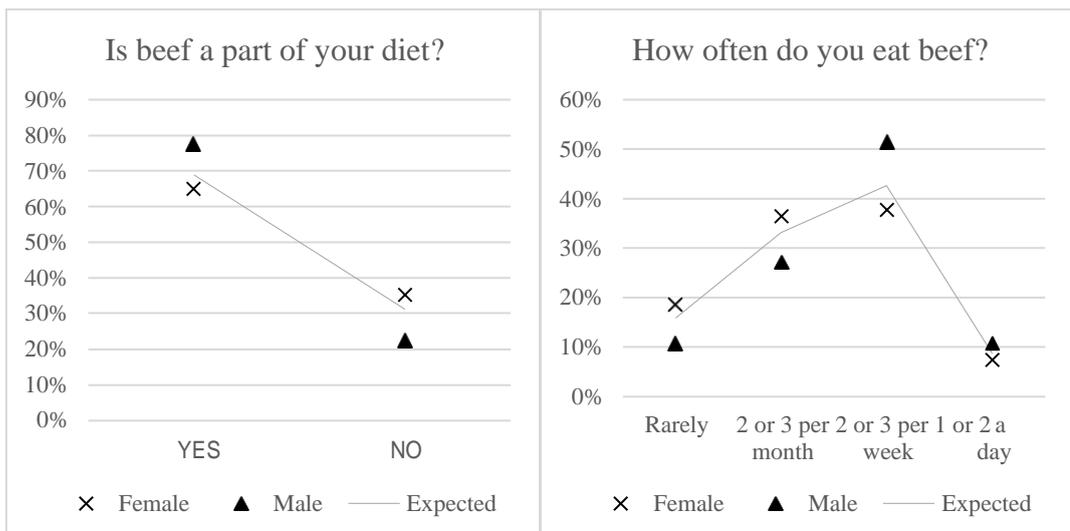


Fig. 8. Contrast analysis between the variables *Sex* with *Beef Presence in Diet* and *Beef Frequency*, correspondingly.

There are statistical differences in 3 out of 4 of the items which explore diet habits and sex. So, although there are not differences relating to the meat as a product of their diet, females declared to eat meat ($\alpha = 0.040$) and beef ($\alpha = 0.001$) less often than males and there are more females than declared not to include beef in their diets ($\alpha = 0.001$) (see Fig. 7 and Fig. 8).

We found one more statistical difference by crossing frequency of meat consumption and university degree. Masters and PhD students said they were more likely than undergraduate students to eat meat once or twice a day. To the contrary, a higher percentage of college students than Masters or PhD indicated they would do it only once or twice a week (see Fig. 7). That accords with what was shown before, where female students, a majority

on undergraduate courses, reported eating less meat or beef and a higher percentage also didn't have beef as part of their diet. These accord with Rosenfeld, (2020), which studied the eating habits of females and males and how they perceive vegetarianism. Females are more prosocially motivated and adhere more strictly to less meat consumption.

Awareness of Reducing Meat Consumption scale (ARMC)

We have conducted here two differences analyses.

- 1) ARMC scale. In relation to ARMC scale, we offer t-test results (see Fig. 9).
- 2) We also employed a chi-square analysis to get a depth explication of the results (Figure 10). For this, we created a new variable called Level of Awareness, in which there are three levels of awareness: low, medium and, high, according to its quartile distribution. T-test offer statistical differences among gender ($\alpha = 0.001$). Figure 9 shows the distribution of responses by gender.

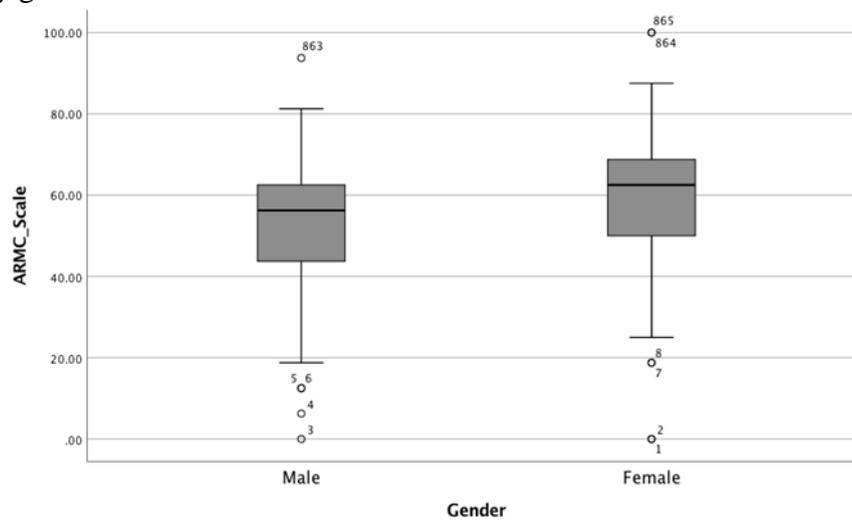


Fig. 9. Awareness of Reducing Meat Consumption scale (ARMC), with comparison between the sex.

Figure 10 shows the results of the crosstab to contrast sex and level of awareness.

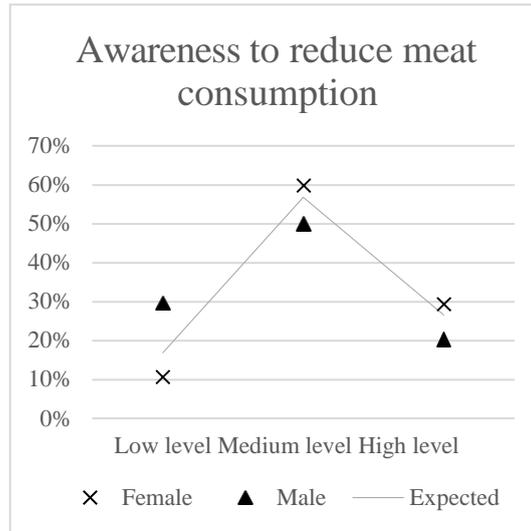


Fig. 10. Contrast analysis between the variables *Sex* and the awareness to reduce meat consumption in three different levels.

Females obtained a mean equal to 59.34 whereas males scored 53.14 out of 100. More than 60% of the females reached up of 62.50 score, getting higher maximum and minimum scores (see Fig. 10).

The previous data show a greater tendency for females, and also, inferring the undergraduate students, to the possibility of changing their eating habits when we are talking about excessive consumption of meat or beef.

Females expressed more reasons to reduce meat consumption ($\alpha_{\text{HEALTH}} = 0.000$; $\alpha_{\text{ENVIRONMENTAL}} = 0.000$; and $\alpha_{\text{ETHICS}} = 0.000$) whereas males were more unlike to have reasons to reduce ($\alpha_{\text{REFUSAL}} = 0.000$) more often. Female students declared to eat less meat and beef or not to eat beef, at all (see Fig. 9). With a higher percentage of females present in fields like science or health, we can suggest that they are more aware of the consequences that exceeding meat consumption, mainly ruminant animals, can have in the environment or health. It is important to note that these were the previous most answered options when the students were asked about reasons to reduce meat consumption. Previous studies have shown that females are more likely to reduce this consumption because of consequences to the environment and express greater support for animal rights and welfare (Mullee *et al.*, 2017). The consumption of meat is often associated with masculinity, so there is a need for social change, in which concern for the environment is not something that is exclusive to just females (García-Vinuesa, *et al.*, 2020).

Figure 11 offers the distribution by comparing the item related to refusal reasons and university degrees.

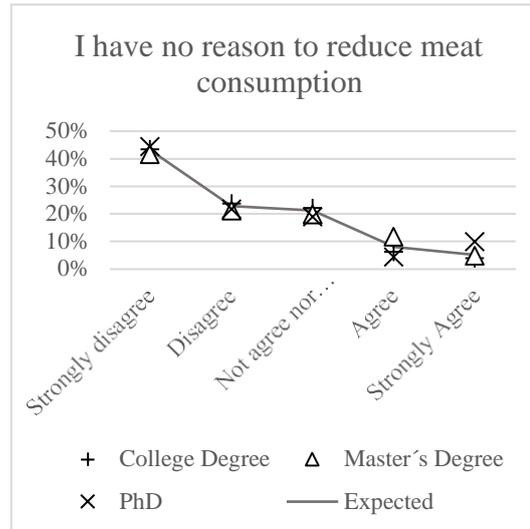


Fig. 11. Contrast analysis between the variables *University Degree* and the declared refusal to reduce meat consumption.

PhD students stated they have no reason to reduce meat in a bigger percentage than the other degree students and in higher than the expected values (strongly agree option). To the contrary, they are the ones stated, in smallest percentages, to agree to not to have reasons for this reduction (agree option), whereas Master's degree students indicated to agree to this same statement, in higher percentages (see Fig. 11). PhD students are in the majority male, this sex also being the one that frequents the canteen the most and likewise does not consider changes in their diet when it comes to meat. Well thought changes, in the canteens, as well as education, could influence some students to rethink the way they choose to eat. These results can be explained in a way that we often see the new generations (college degrees) more involved in environmental problems, through the social media. The information obtained that way can be beneficial or not, but has the power to change behaviors (Simeone & Scarpatò, 2020). However, these observations could be substantially related to the differences between sexes since, in some studies, younger people are resistant to altering lifestyles in the face of warnings on climate change. The question is have, major institutions been failing on engaging people in climate issues, and consequently in changing behaviors (Hibberd & Nguyen, 2013).

6. Final considerations

This study extended the previous literature on sustainability on the university context, with special emphasis on Sustainable Food Consumption and Sustainable Consumption and the Global Environmental and Climate Change (decarbonization). Universities have a role to play, anticipating that students would become more and more conscious about sustainability. Along these lines, the study can have a major role in decision-making processes, namely in food guidelines, if universities establish formal structures to guide the implementation of sustainable development policies and programmes (Leal Filho *et al.*, 2017).

Through this survey, we concluded that meat represents a substantial part of university students' diet, eventually more than the recommended. However, most of the students are

willing to reduce this consumption based mainly on environmental reasons. Even if there is some hesitation, changes in the canteens, like limiting the consumption of beef, are relatively well received by the students (even if some of the students feared that these changes could lead to rises in the meal prices, for example).

Education is one of the alternatives most commented through this study, and we can understand its importance. PhD and male students show a low level of awareness of the need to reduce meat consumption, thus stressing that the importance of climate change education and climate literacy in Universities is crucial achieving sustainable consumption patterns. When implementing policies based on a sustainable and healthy diet, policy makers should consider the gender differences observed in this and other studies such as the one of Martinez-Lacoba *et al.* (2020). It should be considered the higher awareness of women to adopt less-meat diets.

The results presented in this dissertation stress the growing need to include sustainability in university curricula namely in the dimensions of decarbonization through dietary changes and reducing the carbon footprint.

The University of Aveiro is an institution that already has consciousness of the importance of environmental problems, and Campus + Sustentável is a proof of that, as well as the international recognition of the integration of SDGs. Nevertheless, universities should understand the students and direct their teaching in a smart way. This study allows the HEIs to know the profile of the students they are trying to reach and continuously review their goals in education. Portugal is a country characterized by the high consumption of meat and the non-sustainable diet (Galli *et al.*, 2020). Consequently, understanding students could be decisive and the replication of this study to other universities should be considered.

Further research should be done to identify the possible relation between PhD courses (and other degrees) and climate change education and climate literacy. Since sustainability measures which include students' diet are not common, going more towards recycling and waste, more studies should be carried out, specifically for food, in Portuguese universities, for example with other products like dairy (Aleixo *et al.*, 2018).

References

- Afshin, A., Sur, P. J., Fay, K. A., Cornaby, L., Ferrara, G., Salama, J. S., ... Murray, C. J. L. (2019). Health effects of dietary risks in 195 countries , 1990 – 2017 : a systematic analysis for the Global Burden of Disease Study. *The Lancet*, 393, 1958–1972. [https://doi.org/10.1016/S0140-6736\(19\)30041-8](https://doi.org/10.1016/S0140-6736(19)30041-8)
- Agência Portuguesa do Ambiente, Fundo Ambiental, & República Portuguesa. (2019). ROTEIRO PARA A NEUTRALIDADE CARBÓNICA.
- Aleixo, A., Leal, S., & Azeiteiro, U. (2018). Conceptualization of sustainable higher education institutions , roles , barriers , and challenges for sustainability: An exploratory study in Portugal. *Journal of Cleaner Production*, 172, 1664–1673. <https://doi.org/10.1016/j.jclepro.2016.11.010>
- Aleixo, A. M., & Leal, S. (2018). The implementation of sustainability practices in Portuguese higher education institutions. *International Journal of Sustainability in Higher Education*, 19, 146–178. <https://doi.org/10.1108/IJSHE-02-2017-0016>

- Allievi, F., Vinnari, M., & Luukkanen, J. (2015). Meat consumption and production: an analysis of efficiency, sufficiency and consistency of global trends. *Journal of Cleaner Production*, *92*, 142–151. <https://doi.org/10.1016/j.jclepro.2014.12.075>
- Almeida, A., Fernández, B. G., & Emeterio, G. S. (2016). Assessment of pre-service teachers' knowledge of the impact of livestock production on global warming: a comparative study between Portugal and Spain. Assessment of pre-service teachers' knowledge of the impact of livestock production on global warming. *International Journal of Environmental Studies*. <https://doi.org/10.1080/00207233.2016.1199414>
- Areia, N. P., Intrigliolo, D., Tavares, A., Manuel, J., & Sequeira, M. D. (2019). The role of media between expert and lay knowledge: A study of Iberian media coverage on climate change. *Science of the Total Environment*, *682*, 291–300. <https://doi.org/10.1016/j.scitotenv.2019.05.191>
- Babbie, E. R. (2010). *The Practice of Social Research* (12th ed). Belmont, CA: Wadsworth Cengage.
- Bennett, R. M., & Blaney, R. J. P. (2003). Estimating the benefits of farm animal welfare legislation using the contingent valuation method. *Journal of Agricultural Economics*, *29*, 85–98.
- Boer, J. De, Schösler, H., & Boersema, J. J. (2013). Climate change and meat eating: An inconvenient couple? *Journal of Environmental Psychology*, *33*, 1–8. <https://doi.org/10.1016/j.jenvp.2012.09.001>
- Bouvard, V., Loomis, D., Guyton, K. Z., Grosse, Y., Ghissassi, F. E., Benbrahim-Tallaa, L., Guha, N., Mattock, H., Straif, K. (2015). Carcinogenicity of consumption of red and processed meat. *The Lancet Oncology*, *16*, 1599–1600. [https://doi.org/10.1016/S1470-2045\(15\)00444-1](https://doi.org/10.1016/S1470-2045(15)00444-1)
- Brians, C. L., Willnat, L., Rich, R. C., & Manheim, J. B. (2011). *Empirical Political Analysis: Quantitative and Qualitative Research Methods* (8th ed). Boston, MA: Longman.
- Clark, M., & Tilman, D. (2017). Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice. Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food. *Environmental Research Letters*, *12*.
- Clark, M. A., Springmann, M., Hill, J., & Tilman, D. (2019). Multiple health and environmental impacts of foods. *Proceedings of the National Academy of Sciences of the United States of America*, *116*(46), 23357–23362. <https://doi.org/10.1073/pnas.1906908116>
- Clune, S., Crossin, E., & Verghese, K. (2017). Systematic review of greenhouse gas emissions for different fresh food categories. *Journal of Cleaner Production*, *140*, 766–783. <https://doi.org/10.1016/j.jclepro.2016.04.082>
- Cornish, A. R., Briley, D., Jessica, B., Raubenheimer, D., Schlosberg, D., & Damien, P. (2020). The price of good welfare: Does informing consumers about what on-package labels mean for animal welfare influence their purchase intentions? *Appetite*, *148*. <https://doi.org/10.1016/j.appet.2019.104577>

- Dagiliute, R., Liobikiene, G., & Minelgaite, A. (2018). Sustainability at universities: Students' perceptions from Green and Non-Green universities. *Journal of Cleaner Production*, 181, 473–482. <https://doi.org/10.1016/j.jclepro.2018.01.213>
- DGS. (n.d.). Notas sobre alimentação e cancro. Retrieved from <https://www.dgs.pt/em-destaque/notas-sobre-alimentacao-e-cancro.aspx>
- Eggleston, H. S., Buendia, L., Miwa, K., Ngara, T., & Tanabe, K. (2006). *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.
- Emiru, T. S., & Waktola, D. K. (2018). The environmental awareness of higher education students and the implications for the Paris Climate Agreement: empirical evidences from Ethiopia and USA. *International Research in Geographical and Environmental Education*, 27(3), 216–233.
- ENE A. (2017). ENE A: Apresentação. Retrieved from <https://enea.apambiente.pt/content/apresentacao?language=pt-pt>
- ENE A. (2020). ENE A: Eixos Temáticos. Retrieved from <https://enea.apambiente.pt/?language=pt-pt>
- European Commission. (1997). Animal Welfare. Retrieved from https://ec.europa.eu/food/animals/welfare_en
- FAO. (2009). Treaty of Amsterdam. Retrieved from <http://www.fao.org/ag/againfo/themes/animal-welfare/news-detail/en/c/12981/>
- FAO. (2017). *Save food for a better climate: Converting the food loss and waste challenge into climate action*.
- Galford, G. L., Peña, O., Sullivan, A. K., Nash, J., Gurwick, N., Pirolli, G., Richards M., White J., Wollenberg, E. (2020). Agricultural development addresses food loss and waste while reducing greenhouse gas emissions. *Science of the Total Environment*, 699. <https://doi.org/10.1016/j.scitotenv.2019.134318>
- Galli, A., Pires, S. M., Iha, K., Alves, A. A., Lin, D., Mancini, M. S., & Teles, F. (2020). Sustainable food transition in Portugal: Assessing the Footprint of dietary choices and gaps in national and local food policies. *Science of the Total Environment*, 749. <https://doi.org/10.1016/j.scitotenv.2020.141307>
- García-Vinuesa, A., Iglesias da Cunha, M. L., & Pernas, R. G. (2020). Gender Differences in Adolescent's Climate Change Knowledge and Perceptions. Meta-Analysis. *Pensamiento Educativo. Revista de Investigación Educativa Latinoamericana*, 57(2), 1–21. <https://doi.org/10.7764/PEL.57.2.2020.5>
- Gil, J. D. B., Daioglou, V., Ittersum, M. Van, Reidsma, P., Doelman, J. C., Middelhaar, C. E. Van, & Vuuren, D. P. Van. (2019). Reconciling global sustainability targets and local action for food production and climate change mitigation. *Global Environmental Change*, 59. <https://doi.org/10.1016/j.gloenvcha.2019.101983>
- Gliem, J. A., & Gliem, R. R. (2003). Calculating , Interpreting , and Reporting Cronbach ' s Alpha Reliability Coefficient for Likert-Type Scales. In *Midwest Research to Practice Conference in Adult, Continuing, and Community Education* (pp. 82–88).

- Herrero, M., Conant, R., Havlík, P., Hristov, A., Smith, P., Gerber, P., Gill, M., Butterbach-Bahl, K., Henderson, B., Thornton, P. (2016). Greenhouse gas mitigation potentials in the livestock sector. *Nature Climate Change*, 6, 452–461.
- Hibberd, M., & Nguyen, A. (2013). Climate change communications & young people in the Kingdom: A reception study. *International Journal of Media and Cultural Politics*, 9(1), 27–46. <https://doi.org/10.1386/macp.9.1.27>
- Kurz, V. (2018). Nudging to reduce meat consumption: Immediate and persistent effects of an intervention at a university. *Journal of Environmental Economics and Management*, 90, 317–341. <https://doi.org/10.1016/j.jeem.2018.06.005>
- Leal Filho, W., Wu, Y. J., Brandli, L. L., Veiga, L., Azeiteiro, U. M., Caeiro, S., Rejane, L. (2017). Identifying and overcoming obstacles to the implementation of sustainable development at universities. *Journal of Integrative Environmental Sciences*, 14(1), 93–108. <https://doi.org/10.1080/1943815X.2017.1362007>
- Leal Filho, W., Shiel, C., Paço, A., Mifsud, M., Avila, L. V., Londero, L., Molthan-hill, P., Pace, P., Azeiteiro, U. M., Ruiz, V., Caeiro, S. (2019). Sustainable Development Goals and sustainability teaching at universities: Falling behind or getting ahead of the pack? *Journal of Cleaner Production*, 232, 285–294. <https://doi.org/10.1016/j.jclepro.2019.05.309>
- Li, X., Tan, H., & Rakes, A. (2015). Carbon footprint analysis of student behavior for a sustainable university campus in China. *Journal of Cleaner Production*, 106, 97–108. <https://doi.org/10.1016/j.jclepro.2014.11.084>
- Luepsen, H. (2018). Comparison of nonparametric analysis of variance methods: A vote for van der Waerden. *Communications in Statistics - Simulation and Computation*, 47(9), 2547–257. <https://doi.org/10.1080/03610918.2017.1353613>
- Macdiarmid, J. I., Douglas, F., & Campbell, J. (2016). Eating like there's no tomorrow: Public awareness of the environmental impact of food and reluctance to eat less meat as part of a sustainable diet. *Appetite*, 96, 487–493. <https://doi.org/10.1016/j.appet.2015.10.011>
- Martinez-Lacoba, R., Pardo-Garcia, I., Amo-Saus, E., & Escribano-Sotos, F. (2020). Social determinants of food group consumption based on Mediterranean diet pyramid: A cross-sectional study of university students. *PLoS ONE*, 15(1).
- Mcmichael, A. J., Powles, J. W., Butler, C. D., & Uauy, R. (2007). Food , livestock production , energy , climate change , and health. *Lancet*, 307, 1253–63. [https://doi.org/10.1016/S0140-6736\(07\)61256-2](https://doi.org/10.1016/S0140-6736(07)61256-2)
- Mullee, A., Vermeire, L., Vanaelst, B., Mullie, P., Deriemaeker, P., Leenaert, T., Henauw, S., Dunne, A., Gunter, M. J., Clarys, P., Huybrechts, I. (2017). Vegetarianism and meat consumption: A comparison of attitudes and beliefs between vegetarian , semi-vegetarian , and omnivorous subjects in Belgium. *Appetite*, 114, 299–305. <https://doi.org/10.1016/j.appet.2017.03.052>
- Narayan, T., & Qu, J. (2016). An international comparison of agricultural nitrous oxide emissions. *Journal of Cleaner Production*, 135, 1256–1266. <https://doi.org/10.1016/j.jclepro.2016.07.035>

- OMS. (2015). Cancer: Carcinogenicity of the consumption of red meat and processed meat. Retrieved from <https://www.who.int/news-room/q-a-detail/q-a-on-the-carcinogenicity-of-the-consumption-of-red-meat-and-processed-meat>
- Ortiz-Moncada, R., Morales-Suárez-Varela, M., Avecilla-Benítez, Á., Navarro, A. N., Olmeda-Requena, R., Amezcua-Prieto, C., ... Juan, L. F. V. (2019). Factors Associated with Meat Consumption in Students of Spanish Universities: UniHcos Project.
- Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, *360*, 987–992.
- Reisch, L. A., Sunstein, C. R., Andor, M. A., Doebbe, F. C., Meier, J., & Haddaway, N. R. (2021). Mitigating climate change via food consumption and food waste: A systematic map of behavioral interventions. *Journal of Cleaner Production*, *279*. <https://doi.org/10.1016/j.jclepro.2020.123717>
- Rijsberman, F. (2017). The key role of the meat industry in transformation to a low-carbon , climate resilient , sustainable economy. *Meat Science*, *132*, 2–5. <https://doi.org/10.1016/j.meatsci.2017.04.013>
- Rosenfeld, D. L. (2020). Gender differences in vegetarian identity: How men and women construe meatless dieting. *Food Quality and Preference*, *81*. <https://doi.org/10.1016/j.foodqual.2019.103859>
- Roy, R., Soo, D., Conroy, D., Wall, C. R., & Swinburn, B. (2019). Exploring University Food Environment and On-Campus Food Purchasing Behaviors , Preferences , and Opinions. *Journal of Nutrition Education and Behavior*, *51*(7), 865–875. <https://doi.org/10.1016/j.jneb.2019.03.003>
- Shen, J., Melaku, N. D., Treu, R., & Wang, J. (2019). Inventories of methane and nitrous oxide emissions from animal and crop farms of 69 municipalities in Alberta, Canada. *Journal of Cleaner Production*, *234*, 895–911. <https://doi.org/10.1016/j.jclepro.2019.06.270>
- Simeone, M., & Scarpatò, D. (2020). Sustainable consumption: How does social media affect food choices? *Journal of Cleaner Production*, *277*. <https://doi.org/10.1016/j.jclepro.2020.124036>
- Singh, A. K., & Bhargawa, A. (2019). Atmospheric burden of ozone depleting substances (ODSs) and forecasting ozone layer recovery. *Atmospheric Pollution Research*, *10*, 802–807. <https://doi.org/10.1016/j.apr.2018.12.008>
- Smil, V. (2014). Eating meat: Constants and changes. *Global Food Security*, *3*, 67–71. <https://doi.org/10.1016/j.gfs.2014.06.001>
- The World University Rankings. (2020). Impact Rankings 2020. Retrieved from https://www.timeshighereducation.com/rankings/impact/2020/overall#!/page/0/length/25/sort_by/rank/sort_order/asc/cols/undefined
- United Nations. (2015). Transforming our world: the 2030 agenda for sustainable development. Retrieved from <https://sustainabledevelopment.un.org/post2015/transformingourworld>
- United Nations Framework Convention on Climate Change. (2016). The Paris Agreement.

Retrieved from <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

University of Aveiro. (2020). Facts and figures. Retrieved from <https://www.ua.pt/en/factos-numeros>

University of Cambridge. (2018). *Our Sustainable Food Journey*.

Velazquez, L., Munguia, N., Platt, A., & Taddei, J. (2006). Sustainable university: what can be the matter? *Journal of Cleaner Production*, *14*, 810–819. <https://doi.org/10.1016/j.jclepro.2005.12.008>

Vries, M. De, & Boer, I. J. M. De. (2010). Comparing environmental impacts for livestock products: A review of life cycle assessments. *Livestock Science*, *128*, 1–11. <https://doi.org/10.1016/j.livsci.2009.11.007>

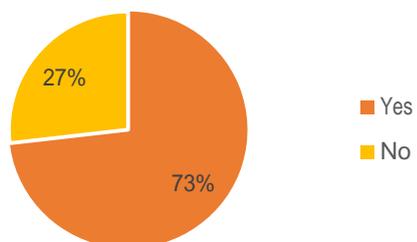
Weibel, C., Ohnmacht, T., Scha, D., & Kossmann, K. (2019). Reducing individual meat consumption: An integrated phase model approach. *Food Quality and Preference*, *73*, 8–18. <https://doi.org/10.1016/j.foodqual.2018.11.011>

Westhoek, H., Lesschen, J. P., Rood, T., Wagner, S., Marco, A. De, Murphy-Bokern, D., Leip, A., Grinsven, H. van, Sutton, M. A., Oenema, O. (2014). Food choices, health and environment: Effects of cutting Europe's meat and dairy intake. *Global Environmental Change*, *26*, 196–205. <https://doi.org/10.1016/j.gloenvcha.2014.02.004>

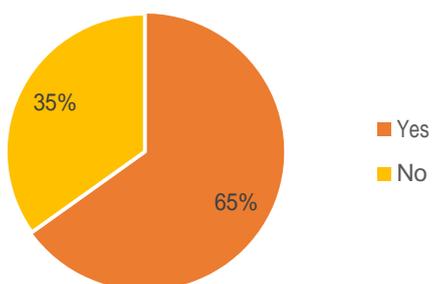
Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., Declerck, F. (2019). The Lancet Commissions Food in the Anthropocene: the EAT – Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*, 447–492. [https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/10.1016/S0140-6736(18)31788-4)

Supplementary Material I

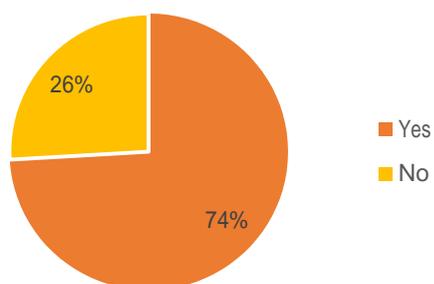
Knowledge about the removal from universities



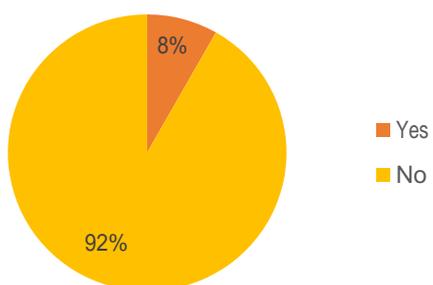
Social Media



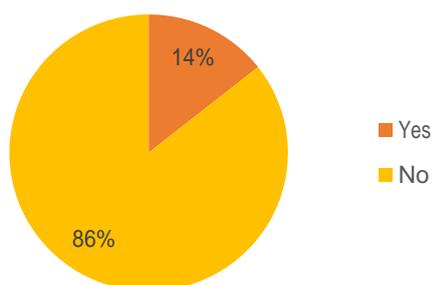
Television



Radio



Newspaper



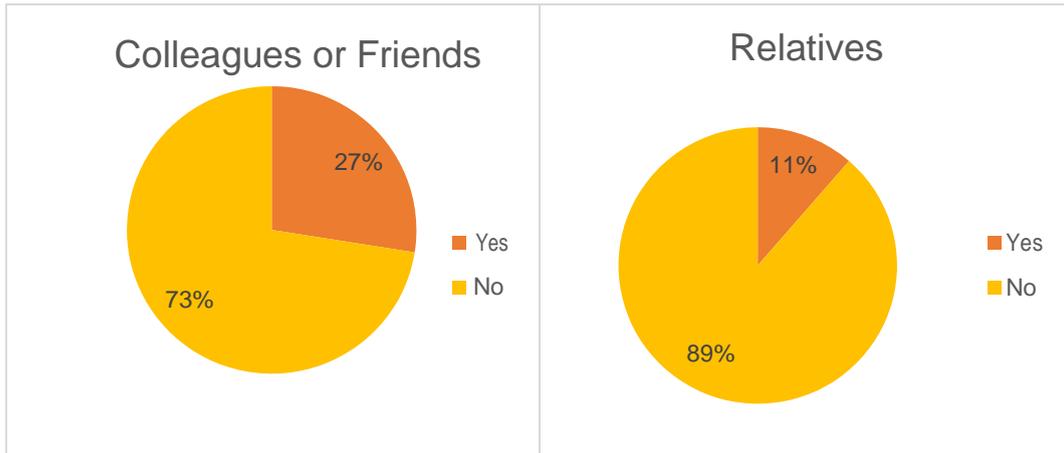


Fig.1. Student's responses regarding the knowledge about the removal of beef and other meats like lamb from universities, nationally (University of Coimbra) and internationally, as well as the way they obtained that information.

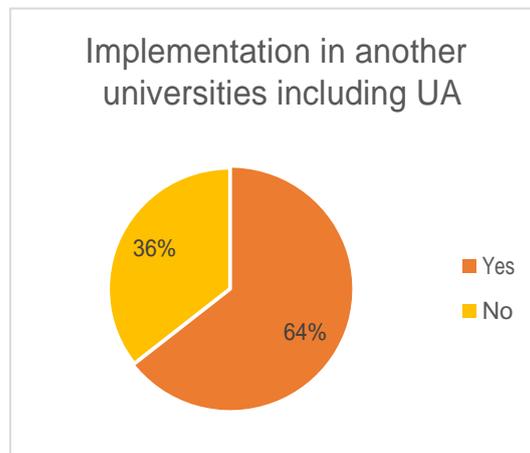
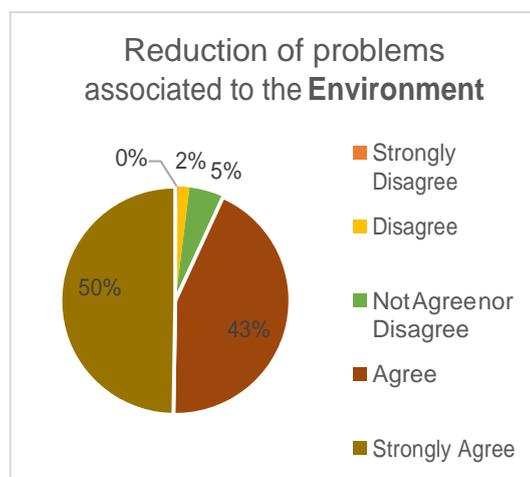


Fig.2. Student's responses regarding their approval about the implementation of the removal of some meats in other universities including the University of Aveiro.



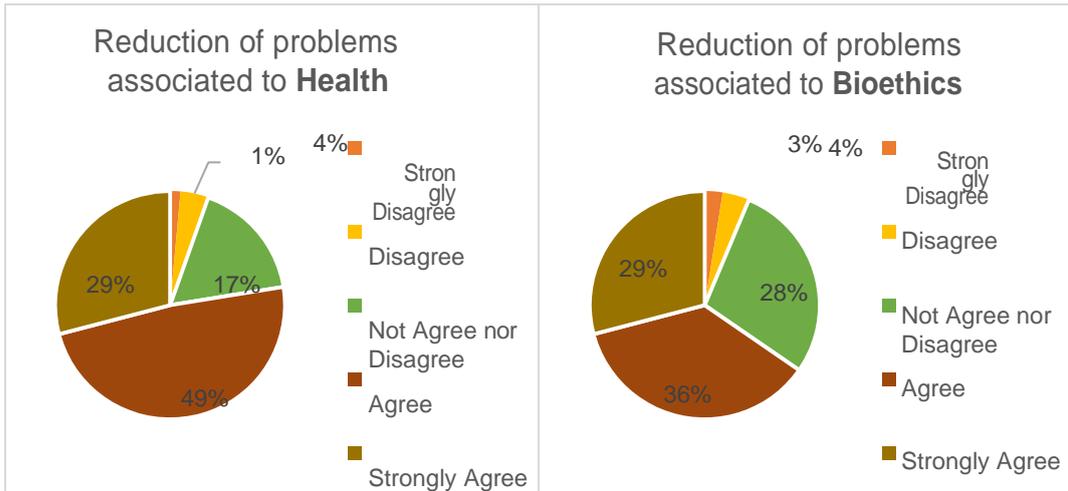
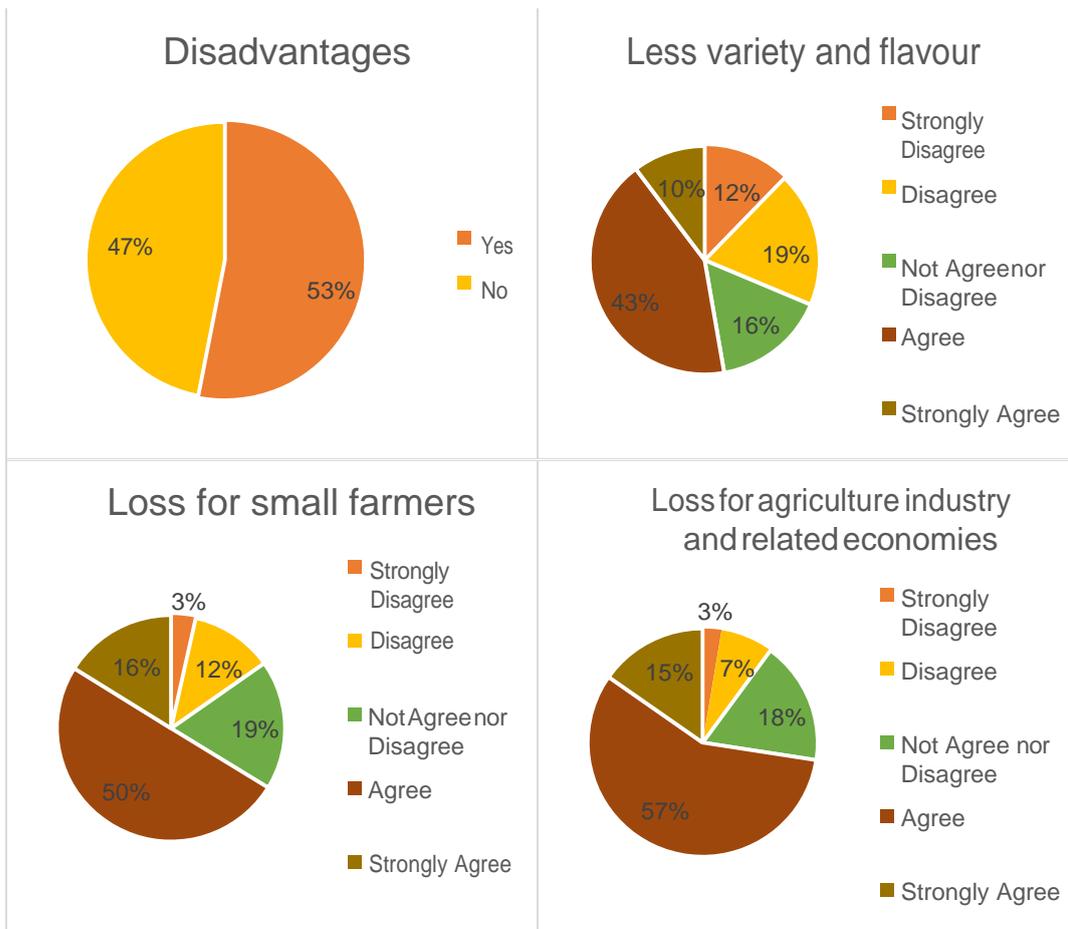


Fig.3. Student's responses regarding the advantages that this action can have for different parameters.



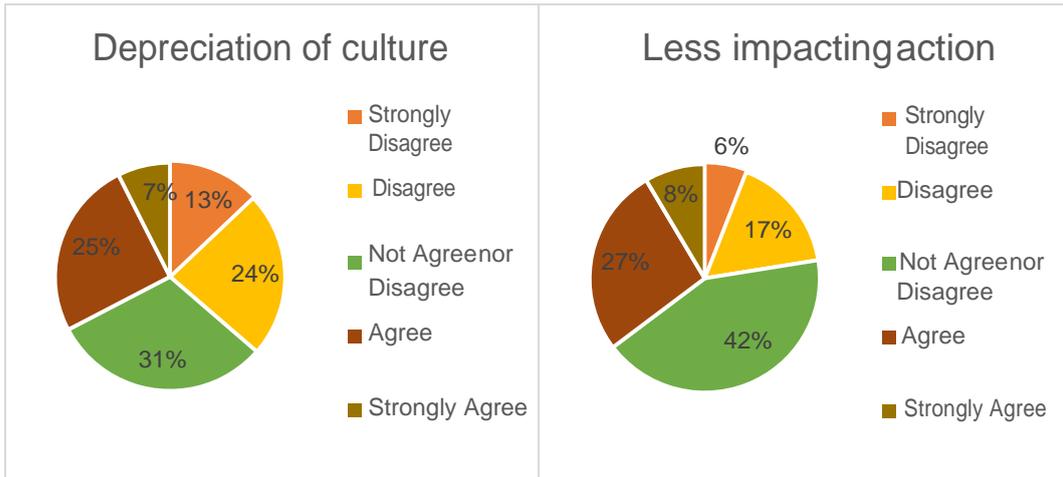


Fig.4. Student's responses regarding the existence of disadvantages that come from this action as well as what could these disadvantages be.

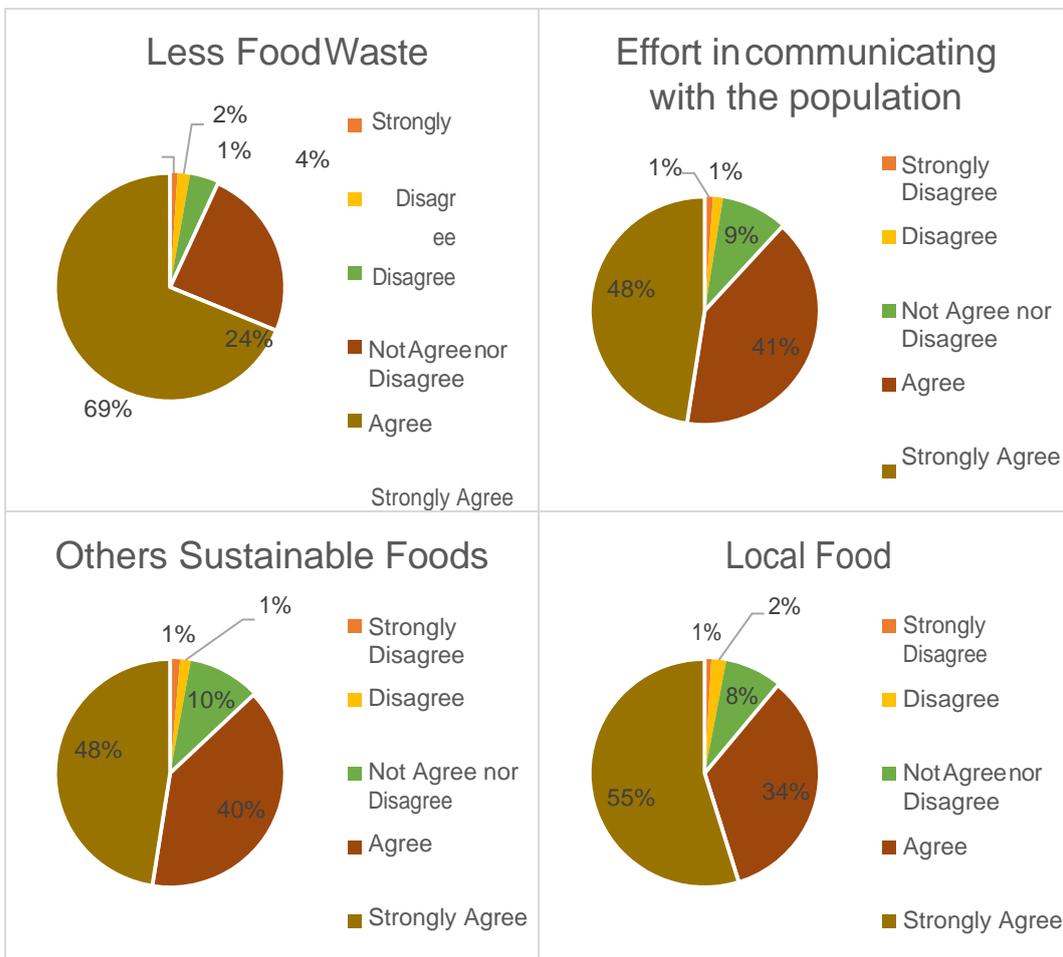


Fig.5. Student's responses regarding other measures beyond removal of some meats that should or shouldn't be considered to the universities.

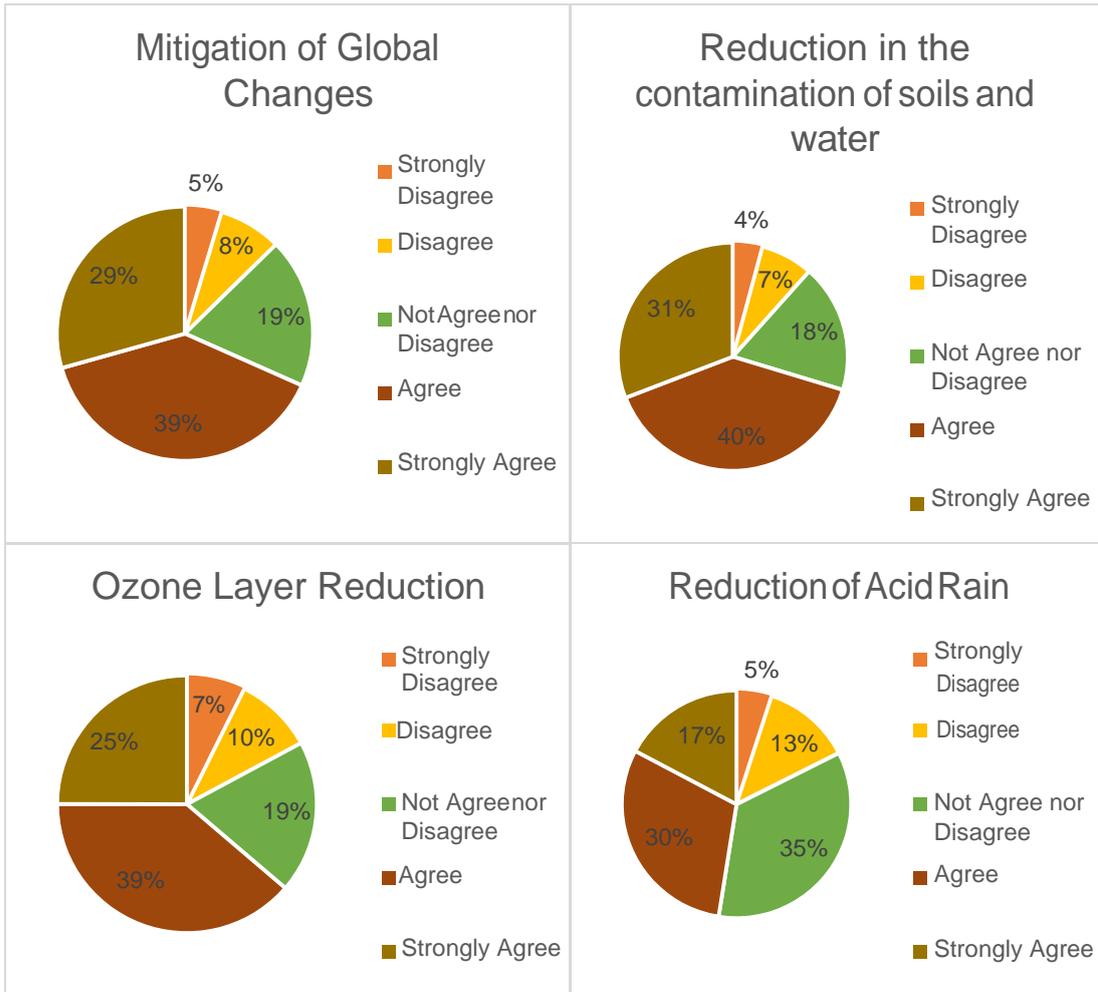


Fig.6. Student’s responses regarding the advantages that could come from the meat reduction related to the environment.

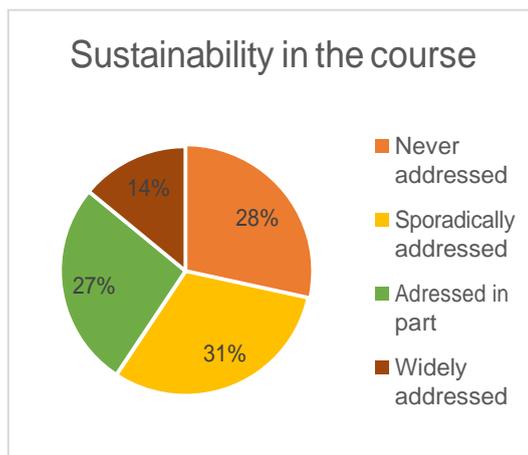


Fig.7. Student’s responses regarding how much the topic sustainability is addressed in the respective course of studies.

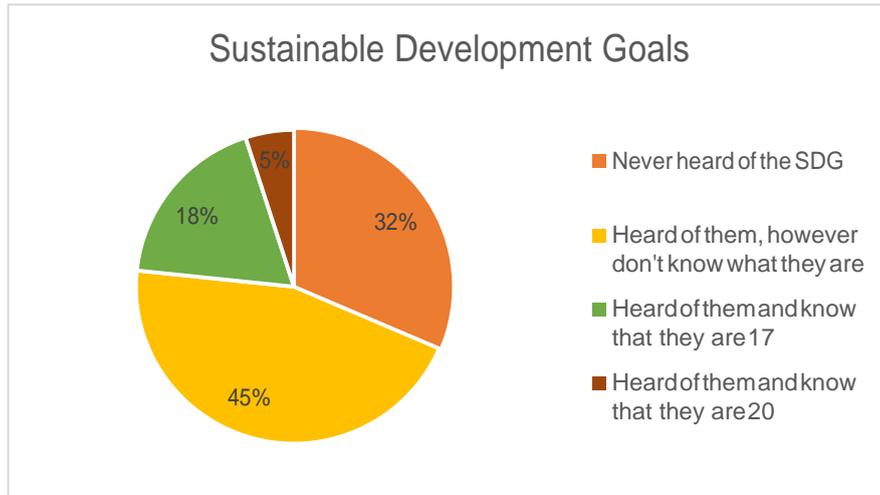
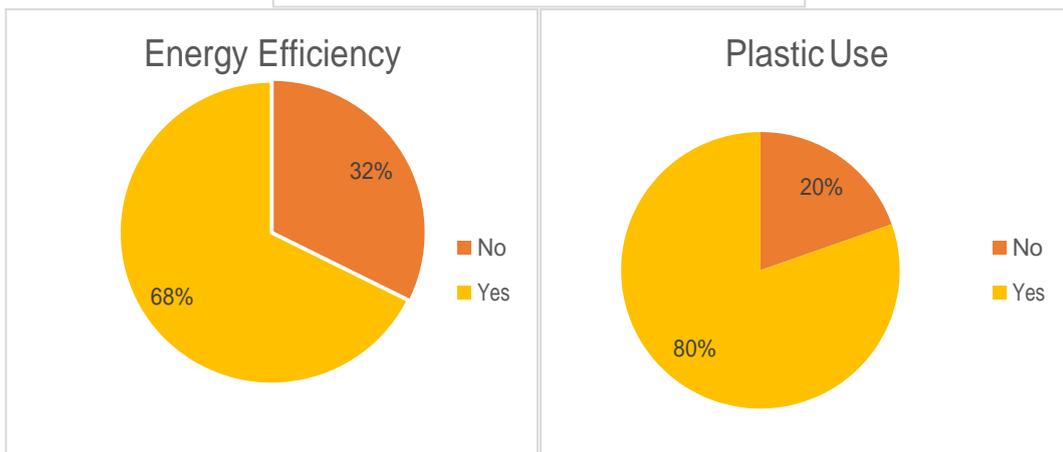
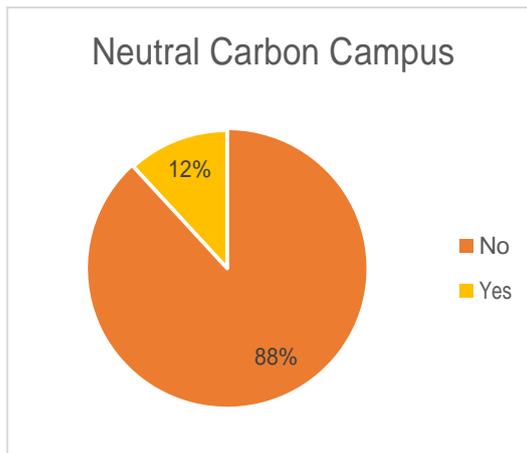


Fig.8. Student's responses regarding their knowledge about the Sustainable Development Goals



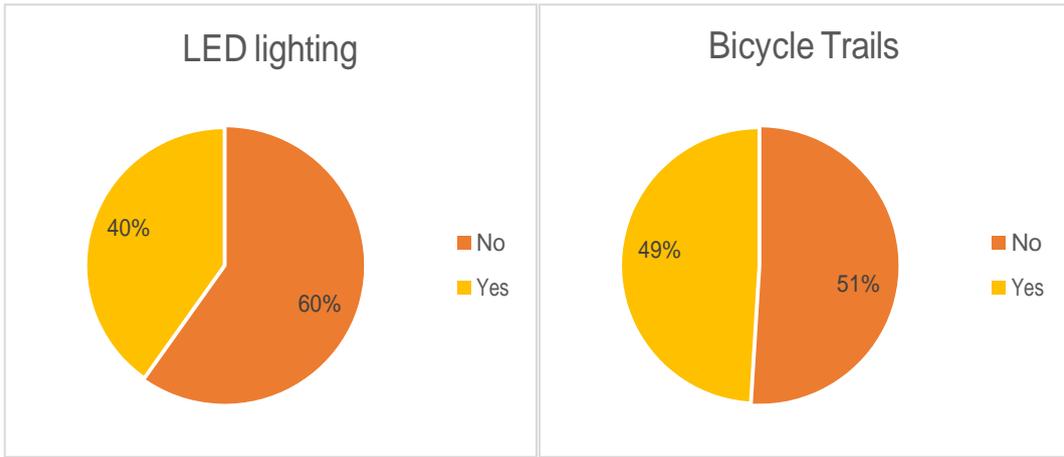
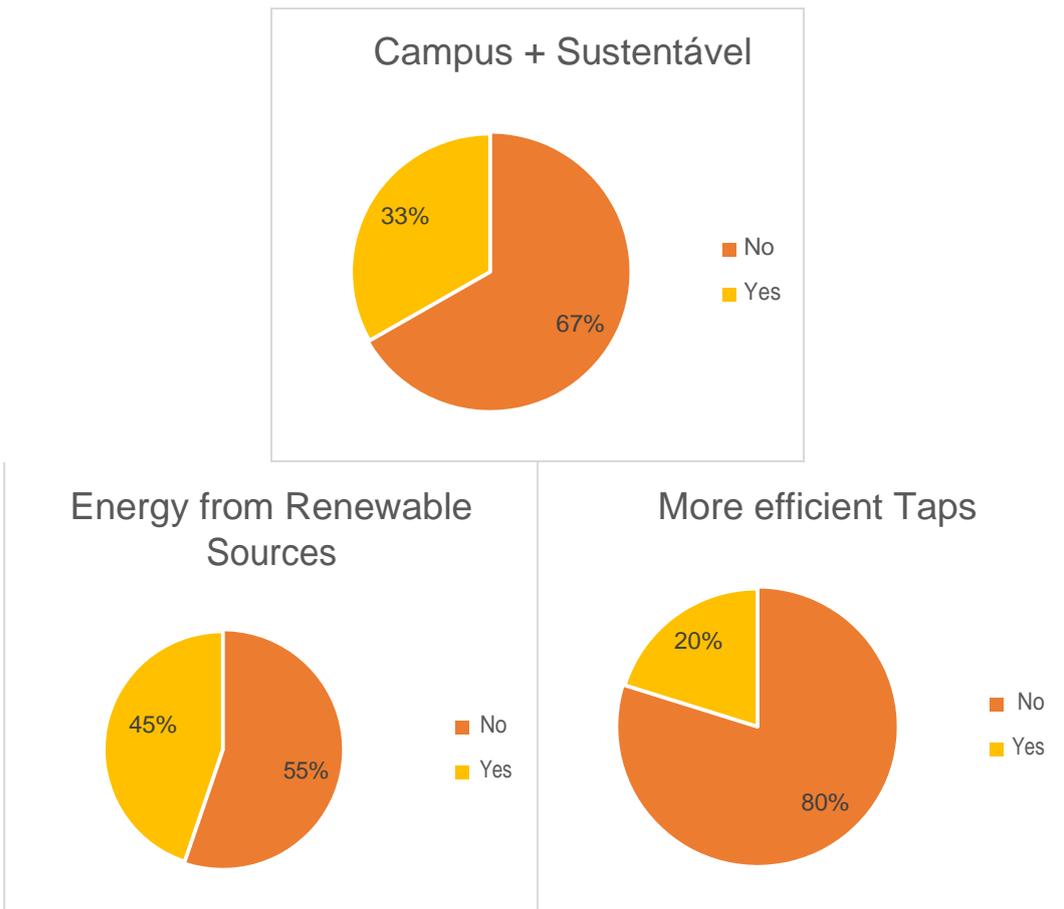


Fig.9. Student’s responses regarding their knowledge about the existence of the Carbon Neutral Campus, international action with the goal of reduce the greenhouse gases emissions that come from the universities, as well as some measures taken.



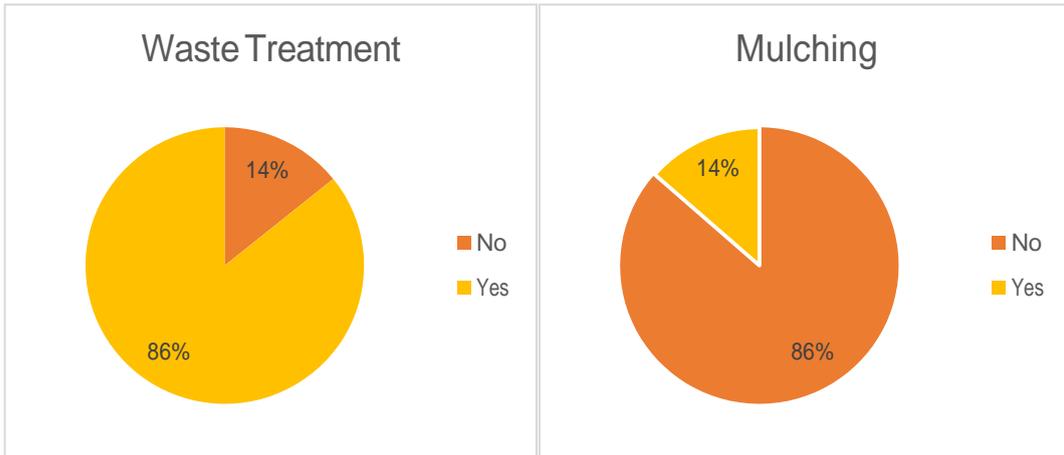


Fig.10. Student's responses regarding their knowledge about the existence of the Campus + Sustentável, sustainability strategy with the goal of helping the environment in the University of Aveiro, as well as some measures taken.

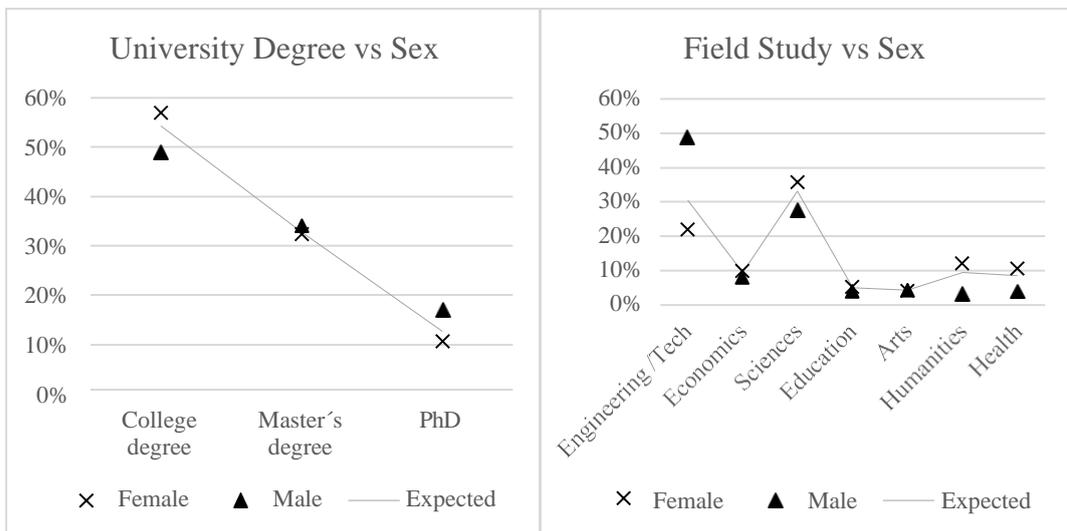


Fig. 11. Contrast analysis between the variables Sex with University Degree and Field of Study, correspondingly.

Supplementary Material II

QUESTIONÁRIO

*Obrigatório

1. Aceito participar neste estudo e permito a utilização dos dados, que de forma voluntária forneço, confiando em que apenas serão utilizados para fins científicos e publicações que dela decorram e nas garantias de confidencialidade e anonimato que me são dados pela investigadora. * Marcar apenas uma opção
 - Aceito participar
 - Não aceito participar

2. Idade _____ *

3. Sexo * Marcar apenas uma opção
 - Feminino
 - Masculino

4. Ciclo de Estudos que frequenta * Marcar apenas uma opção
 - 1º Ciclo (Licenciatura)
 - 2º Ciclo (Mestrado)
 - 3º Ciclo (Doutoramento)

5. Área de Estudos * Marcar apenas uma opção
 - Artes
 - Ciências
 - Ciências da Educação
 - Ciências Socioeconómicas
 - Engenharias/ Tecnologias
 - Humanidades
 - Saúde

6. Qual a frequência de uso das cantinas da Universidade de Aveiro? *
Marcar apenas uma opção
 - 2x por dia
 - 1x por dia
 - 2 a 3x por semana
 - 2 a 3x por mês
 - 1x por mês
 - Esporadicamente
 - Nunca

7. A carne faz parte da sua dieta? * Marcar apenas uma opção
 - Sim
 - Não

8. Em caso afirmativo, com que frequência? Marcar apenas uma opção

- 2x por dia
- 1x por dia
- 2 a 3x por semana
- 2 a 3x por mês
- Raramente
- Nunca

9. A carne de vaca faz parte da sua dieta? * Marcar apenas uma opção

- Sim
- Não

10. Em caso afirmativo, com que frequência? Marcar apenas uma opção

- 2x por dia
- 1x por dia
- 2 a 3x por semana
- 2 a 3x por mês
- Raramente
- Nunca

11. Se fosse reduzir ou ao consumo de carne, ou se já o fez, por que razão seria, ou foi? *

Marcar apenas uma opção por linha

	Discordo totalmente	Discordo	Não concordo nem discordo	Concordo	Concordo totalmente
Saúde					
Ambiente	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ética					

- Outra(s) Qual(ais): _____
- Não o faria

12. Teve conhecimento da medida implementada, de remoção de carne (vaca, cabrito) da cantina de algumas universidades, tanto nacionais, quanto internacionais? *

Marcar apenas uma opção

- Sim
- Não

13. Em caso afirmativo, através de que meio?

Pode escolher mais que uma opção, marcando tudo o que for aplicável

- Redes Sociais
- Televisão
- Rádio
- Jornal
- Colegas da Universidade ou Amigos
- Familiares
- Outro(s) Qual(ais): _____

14. Pensa que esta política poderá trazer vantagens e deveria ser implementada em outras universidades, como na Universidade de Aveiro? *

Marcar apenas uma opção

- Sim
 Não

15. Em caso afirmativo, quais seriam as vantagens?

Marcar apenas uma opção por linha

	Discordo totalmente	Discordo	Não concordo nem discordo	Concordo	Concordo totalmente
Redução de problemas associados ao ambiente	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vantagens de Saúde Bioética	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Outra(s) Qual(ais): _____

16. Em termos de vantagens para o ambiente, pensa que a redução de carne poderá ajudar no(a)...? Marcar apenas uma opção por linha

	Discordo totalmente	Discordo	Não concordo nem discordo	Concordo	Concordo totalmente
Redução da camada de ozono	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Minimização das alterações climáticas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Redução na contaminação de solos e água	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Redução das Chuvas Ácidas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Outra(s) Qual(ais): _____

17. Pensa que esta política poderá trazer desvantagens? * Marcar apenas uma opção

- Sim
 Não

18. Em caso afirmativo, quais seriam as desvantagens? Marcar apenas uma opção por linha

Discordo totalmente	Discordo	Não concordo nem discordo	Concordo	Concordo totalmente
---------------------	----------	---------------------------	----------	---------------------

Limitação na variedade de escolha dos alimentos e dietas pouco saborosas	<input type="checkbox"/>				
Prejuízo para os pequenos agricultores	<input type="checkbox"/>				
Prejuízo para Indústria Agropecuária e economias relacionadas	<input type="checkbox"/>				
Problemas de Saúde	<input type="checkbox"/>				
Desvalorização da Componente Cultural	<input type="checkbox"/>				
Ação pouco impactante comparativamente a escolha de produtos locais	<input type="checkbox"/>				

Outra(s) Qual(ais): _____

19. Para reduzir o problema das alterações climáticas, que outras medidas poderiam ser implementadas? * Marcar apenas uma opção por linha

	Discordo totalmente	Discordo	Não concordo nem discordo	Concordo	Concordo totalmente
Redução no desperdício alimentar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Esforço na comunicação com a população	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Uso de outros alimentos mais sustentáveis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Uso de alimentos locais	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Outra(s) Quais? _____

20. Considera que o tema da sustentabilidade socioambiental é abordado no seu curso? *

Marcar apenas uma opção

- Amplamente abordado
- Abordado em parte
- Esporadicamente abordado
- Nunca abordado

21. Tem conhecimento acerca dos Objetivos do Desenvolvimento Sustentável (ODS) das Nações Unidas – Agenda 2030? *

Marcar apenas uma opção

- Ouvi falar sobre os ODS, e sei que são 20
- Ouvi falar sobre os ODS e sei que são 17
- Ouvi falar sobre os ODS, no entanto não sei o que são
- Nunca ouvi falar sobre os ODS

22. Conhece o plano de ação “Campus Carbono Zero”? * Marcar apenas uma opção

- Sim
- Não

23. Caso conheça o plano de ação anterior, assinale os métodos que sabe que algumas universidades portuguesas estão a utilizar?

Pode escolher mais que uma opção, marcando tudo o que for aplicável

- Melhoria na eficiência energética
- Combate ao uso de plásticos
- Utilização de sistemas de iluminação LED
- Criação de trilhos cicláveis
- Outro(s) Qual(ais)? _____

24. Conhece a Política de Ambiente e Segurança da Universidade de Aveiro “Campus + Sustentável”? * Marcar apenas uma opção

- Sim
- Não

25. Caso conheça o plano de ação anterior, qual ou quais das iniciativas é que conhece ou já ouviu falar? Pode escolher mais que uma opção, marcando tudo o que for aplicável

- Produção de energia proveniente de fontes renováveis
- Substituição por torneiras mais eficientes (Classe A++)
- Distribuição, pelo campus, de ecopontos, pontos de eletrão, pilhões, contentores para tinteiros e tonners e contentores para RSU, resíduos perigosos e resíduos biodegradáveis
- Adoção da técnica Mulching, no tratamento e manutenção de espaços verdes
- Outra(s) Qual(ais): _____

OBRIGADA PELA PARTICIPAÇÃO!