RESEARCH ARTICLE

China and the USA, a higher perceived risk for UK consumers in a post COVID-19 food system: the impact of country of origin and ethical information on consumer perceptions of food [version 1; peer review: 1 approved, 1 approved with reservations]

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Abstract

Background: The COVID-19 pandemic has impacted global food systems and consumer eating habits. The current study explores how country of origin and ethical status information impacts attitudes toward food.
Methods: A within-subjects survey design explored how perceptions of food safety/risk, animal welfare, deliciousness, purchase intention, energy density, carbon footprint of three foods (chicken, pasta, apples) are influenced by country of origin and ethical status information (UK, EU, China, USA, Fairtrade, Organic). Data were collected from 701 UK-based participants using an online survey from the 25-30th March, following the UK lockdown (23rd March 2020).
Results: Perceptions of food safety, animal welfare, purchase intention, deliciousness and carbon footprint are influenced by origin and ethical status information. Chicken from the USA and China is perceived to be higher risk and have lower animal welfare standards. Apples from the USA and China are perceived to be higher risk. Pasta from China is perceived to be higher risk. Energy density estimations are not influenced by origin and ethical status information.
Conclusions: Consumer perceptions are influenced by country of origin and ethical information; foods from China are perceived least favourably, followed by foods from the USA; foods from the UK, EU, Organic or Fairtrade are perceived more favourably. The impact of origin and ethical information varies by food type with the perception of some foods appearing less susceptible to influence. These findings have implications for post COVID-19 (and post Brexit) food system, trade policy and public trust, and highlight the need for

Open Peer Review

Reviewer Status ✔ ?

	Invited Reviewers	
	1	**2**
version 1 04 Jun 2020	✔ report	? report

1. **Annabelle M. Wilson**, Flinders University, Adelaide, Australia

2. **Vilma Xhakollari**, University of Bologna, Bologna, Italy

Any reports and responses or comments on the article can be found at the end of the article.

communication of food safety.

Keywords
UK, COVID-19, food safety, food risk, food system, consumer perceptions, carbon footprint, energy density

This article is included in the Sustainable Food Systems gateway.

This article is included in the Coronavirus (COVID-19) collection.

Corresponding author: Beth Armstrong (m.armstrong@sheffield.ac.uk)

Author roles: Armstrong B: Conceptualization, Formal Analysis, Investigation, Methodology, Project Administration, Visualization, Writing – Original Draft Preparation; **Reynolds C**: Conceptualization, Funding Acquisition, Methodology, Project Administration, Supervision, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

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Introduction

The COVID-19 pandemic and lockdown has resulted in changes to global food systems and consumer eating habits, both what is being eaten and where meals are being eaten (Hubbub, 2020; Wall, 2020) Since lockdown, purchases of food and beverages have increased by 19%. More purchases are being made at convenience stores and local outlets such as independent butchers, alongside an increase in online shopping (AHDB, 2020; McKevitt, 2020). As the food system shifts towards a 'new normal' policy makers will need to understand the changes in consumer perceptions, preferences and trust of foods.

Following the COVID-19 outbreak, the World Health Organisation (WHO) has produced guidelines to minimise food risk and prevent contamination. The WHO states that it is very unlikely that COVID-19 can be contracted through food or food packaging. The report highlights the importance of maintaining consumer confidence in the availability and safety of food (Department of Communications, 2020). Trust in media communications increases during times of food scares, potentially causing a greater negative impact on food safety perceptions and purchase intention (Lobb *et al.*, 2007). In addition, consumers associate factors such as production methods, origin and quality marks with food safety (Röhr *et al.*, 2005). Consequently, several factors beyond WHO advice, may impact on consumer perceptions of how safe different foods are to eat. As food safety perceptions are linked to food choices and consumer demand (Grunert, 2005) it is key to how consumers perceive food safety in light of the COVID-19 pandemic.

The context for this research was the potential acceptance of chlorinated chicken as part of the UK-US trade deal was widely discussed in the UK media prior to COVID-19. The process of washing chicken carcasses in a chlorinated solution is intended to remove high levels of harmful bacteria, but the need for this process has been criticised as a substitute for higher welfare and food hygiene standards required in the EU. Consequently, the media coverage may have an additional impact on both safety and welfare perception of products from the USA (Soil Association, 2020; Strong & Wells, 2020).

In the current research we explore how consumer perceptions of food safety, animal welfare, deliciousness, purchase intention, energy density, carbon footprint of three foods (chicken, pasta, apples) are influenced by information about the country of origin and ethical status (UK, EU, China, USA, Fairtrade, Organic). Data were collected (n=698, UK) using an online survey from the 25th to 30th March, following the UK lockdown (23/03/2020).

Methods

Participants

In total, 701 UK based participants were recruited using Prolific, an online recruitment tool. Registered Prolific panel members were recruited via an advert on Prolific, this linked to the online survey which was hosted on Qualtrics. All participants were paid for taking part in the study. Data collection ran from 25–30th March 2020. Participants were required to be based in the UK, over 18 years and registered Prolific users to take part in the survey. Participation in the study took approximately 20 minutes.

Survey

A within-subjects design was used, with participants rating all conditions (see *Extended data*). Variables included food type (chicken, pasta, apple) and country of origin flag or ethical status (UK, EU, USA, China, Fairtrade, Organic, control/no information). Each food type was combined with each information type (displayed as a flag or logo) to create 21 food-information images. Each image was rated on a series of attributes; energy density (scale: 0 -1000 Kcal), carbon footprint (scale: 0-8180 g Co2), purchase intention (5-point Likert scale), deliciousness (5-point Likert scale), (chicken only) animal welfare (scale: Low welfare-high welfare) and food safety (scale: Low risk-high risk) using a slider input tool.

When rating the safety of a food, consumers were asked to consider various aspects of safety, including how likely it was that eating the food would damage their health due to risks of contamination, food poisoning, improper handling, food fraud and mislabelling. When rating animal welfare, consumers were asked to consider how well animals are treated, the quality in which they are kept in, and how humanely they are slaughtered.

Presentation order of the images was randomised. Presentation order of the attributes was consistent. Participants then completed a series of demographic, dietary preference, BMI, and motivation for reducing meat consumption questions.

A copy of the survey can be found in *Extended data* (Armstrong & Reynolds, 2020).

Data collection and analysis

The data of three participants were removed as incomplete surveys were submitted, leaving a total of 698 UK based participants (M=34.68, SD=12.64, female=63%) to be used in the analyses. Participant estimations of carbon footprint and energy density were classified (below, in range, above) a -/+10% range of validated values. The validated values for carbon footprint were based on Audsley *et al.* (2010), Clune *et al.* (2017), and Poore & Nemecek (2018). The validated values for energy density were taken from energy content data (Kcal/100g product) were taken from the National Diet and Nutrition Survey databank (Public Health England, 2018) and NHS (2019).

Data failed to meet the assumptions required for regression analysis, therefore Kruskal-Wallis and Chi-square analysis were used. SPSS version 26 was used to conduct the analyses.

Ethical considerations

This study was conducted according to the guidelines laid down in the Declaration of Helsinki. All procedures involving research study participants were approved by the Geography Department, University of Sheffield ethics panel (reference, Piloting Zooniverse to help us understand citizen food perceptions - 3rd phase no. 033181). Each participant was presented with an

information sheet prior to the survey, with information about how the data would be used in research, and a statement which specified that proceeding with the study would be taken as informed consent.

Results

The data indicate that consumer perceptions of all variables (food safety: H(6)=747.76 p<.001, animal welfare: H(6)=770.86, p<.001, purchase intention: (H(6)=1288.23, p<.001, deliciousness: H(6)=3784.03, p<.001, carbon footprint: H(6)=1140.23, p<.001), except energy density (H(6)=9.37, p=.15), are influenced by origin and ethical status information.

We observe that safety perceptions differ by food type (H(2)=3252.46, p<.001) with chicken being considered higher risk than apples and pasta. Pasta and apples do not differ in perceptions of food safety (H(2)=2.15, p=.10). When considering the impact of origin and ethical information, the data indicate that consumers consider foods produced in China to be the highest risk, followed by those produced in the USA (Table 1). Products from the UK and EU, or those with an ethical l abel (Organic, Fairtrade) were considered to be safer than a standard (unlabelled control) product. This pattern is replicated when we consider safety perceptions of chicken and apples (except EU apples which do not differ from a standard apple: H(1)=203.20, p=.10). Fewer differences are observed for pasta, with pasta produced in the USA (H(1)=2.14, p=.68), EU (H(1)=2.30, p=.45), Organic (H(1)=2.09, p=.76) being similar to perceptions of a standard (control) product. Pasta from the UK (H(1)=408.14, p<.001) is considered to be lower risk than the control; however, pasta from China (H(1)=566.01, p<.001) is perceived to be higher risk.

Consumers perceive that chicken from China (H(1)=646.49, p<.001) and the USA (H(1)=265.01, p=.01) will have lower welfare standards. Chicken certified as Organic (H(1)=955.98, p<.001), Fairtrade (H(1)=881.01, p<.001), from the UK (H(1)=571.65, p<.001) or EU (H(1)=466.66, p<.001) is expected to have higher welfare standards.

When comparing the accuracy of calorie estimations against validated values (see Table 2), we observe that participants are more likely to overestimate the energy density of apples ($\chi^2(2)$ =3063.51, p <.001) and chicken ($\chi^2(2)$ =1066.69, p <.001). Conversely, the energy density of pasta is typically underestimated ($\chi^2(2)$ =3063.51, p <.001) (see Table 3). Country of origin and ethical status information does not impact the accuracy of energy density estimates ($\chi^2(12)$ =11.88, p=.46).

When comparing the accuracy of carbon estimations against validated values, we observe that participants overestimate the carbon footprint of apples ($\chi^2(2)$ =8833.93, p <.001), chicken ($\chi^2(2)$ =7140.80, p <.001) and pasta ($\chi^2(2)$ =9658.34, p <.001) (see Table 3). As the majority of estimations were above the tolerated range, a subsequent analysis of the carbon footprint estimates of the three foods from which we observe that order of carbon footprint estimates are correct (mean rank apple = 5729.36, pasta = 760028, chicken= 8658.85, H(2)=1200.89, p<.001). Country of origin and ethical status information does not impact the accuracy of energy density estimates ($\chi^2(12)$ =9.08, p=.63).

Pairwise comparisons demonstrate that the estimated carbon footprint values of foods from China (H(1)=2249.35 p<.001), the USA (H(1)=1986.85 p<.001) and EU (H(1)=405.13, p=.04) are estimated to be higher than the control. Carbon footprint estimations of Fairtrade (H(1)=112.61, p=1.00) and Organic (H(1)=152.35, p=1.00) products do not differ from the control. Carbon footprint estimations of UK (H(1)=1412.69, p<.001) products are lower than the control.

Consumers expect foods from China (H(1)=1642.81, p<.001) and the USA (H(1)=925.55, p<.001) to be less delicious. Organic (H(1)=612.08, p<.001) and Fairtrade (H(1)=922.62, p<.001) products, those from the UK (H(1)=1250.30, p<.001) and EU (H(1)=460.44, p=.01) are expected to be more delicious compared to the control products.

Pairwise comparisons demonstrate that the purchase intention of foods from China (H(1)=2467.19, p<.001) and the USA

Table 1. Impact of origin and ethical information on consumer perceptions.

		Attribute (mean rank)					
		Food risk	**Animal welfare**	**Purchase intention**	**Deliciousness**	**Carbon footprint**	**Energy density**
Country of origin and ethical information	Control	7571.50	2162.96	7576.32	7232.77	6873.94	7299.66
	UK	6316.59**	2734.60**	9027.29**	8483.08**	5461.25**	7291.54
	EU	6923.23**	2629.62**	7875.98	7693.21*	7279.07*	7303.49
	China	9108.08**	1516.46**	5109.13**	5589.97**	9123.30**	7376.56
	USA	8156.81**	1897.95*	5999.61**	6307.23**	8860.79**	7565.89
	Organic	6670.12**	3118.94**	7629.40	7844.85**	6721.60	7211.76
	Fairtrade	6559.97**	3043.96**	8088.76*	8155.39**	6986.55	7257.60

*p<.05, **p<.001 (2-tailed) vs. control (unlabelled).

Table 2. Carbon footprint and energy content values.

		Carbon footprint (gCO2e)	Energy content (Kcal)
Food	Pasta	257-314	309-377
	Apples	45-55	52-63
	Chicken	415-507	177-216

Table 3. Accuracy of carbon footprint and energy content estimates.

		Carbon footprint (%)			Energy content (%)		
		Below	In range	Above	Below	In range	Above
Food	Apple	138 (3)	23 (1)	4725 (97)	853 (18)	587 (12)	3446 (71)
	Chicken	370 (8)	107 (2)	4409 (90)	1427 (29)	814 (17)	2645 (54)
	Pasta	11 (.2)	8 (.2)	4867 (100)	2495 (51)	746 (15)	7736 (34)
	Total	519 (4)	138 (1)	1401 (96)	4775 (33)	2147 (15)	7736 (53)

(H(1)=1576.71, p<.001) is lower than the control. The purchase intention of Organic (H(1)=53.01, p=1.00) or EU (H(1)=299.66, p=.41) products does not differ from the control. Consumers have a greater purchase intention for Fairtrade products (H(1)=512.43, p=.001) and those from the UK (H(1)=1450.97, p<.001).

We observed gender differences across the majority of attributes with females estimating higher carbon footprint values (H(2)= 124.42, p<.001), greater taste expectations (H(2)=41.89, p<.001), and lower food safety perceptions (H(2)=38.96, p<.001) compared to males. However, no differences in energy density (H(2)=2.36, p=.31), purchase intention (H(2)=2.72, p=.26) or animal welfare perceptions (H(2)=1.23, p=.54) were observed.

A range of correlations are observed between the attribute variables (see Table 4). Higher levels of foods safety were (moderately) associated with greater purchase intention (r(14657)=.37, p<.001), taste better (r(14657)=.35, p<.001), a lower carbon footprint (r(14657)=.37, p<.001) and better animal welfare standards (r(4884)=.29, p<.001).

Table 4. Pearson correlation of food perception attributes.

		1	2	3	4	5	6
1	Energy density						
2	Carbon footprint	.30**					
3	Deliciousness	-.06**	-.22**				
4	Purchase intention	-.04**	-.30**	0.78**			
5	Food safety	0.10**	0.33**	0.35**	-.37**		
6	Animal welfare	-.02	-.22**	.43**	.43**	-.29**	

*P<.05, **p<.001 (2-tailed), n=698.

Discussion

This research demonstrates that UK consumer perceptions of food are impacted by information about the country of origin and ethical status. Though perceptions of food safety, animal welfare, purchase intention and taste were influenced, energy density was not, indicating that some attributes may be less susceptible to informational influence. Foods produced in China and the USA were typically rated less favourable with Organic, Fairtrade, EU and UK foods being rated more positively.

Foods produced in China are considered least safe, followed by those produced in the USA. Conversely, foods produced in the UK, EU, and those with ethical labels (Fairtrade, Organic) are typically considered as safer. However, as safety perceptions of pasta appear to be less susceptible to influence than perceptions of chicken and apple, we suggest that the extent to which perceptions are influenced may vary by food type. As perceptions of food risk influence consumer purchase decisions (Grunert, 2005), and subsequent consumption, it is key to understand whether food risk perceptions of specific foods or food groups are more susceptible to influence. Should specific food groups be more susceptible this (e.g. fruit and vegetables vs. high fat salt and sugar) could have a negative impact on the uptake and consumption of sustainable, healthy diets within the UK population.

The majority of consumers overestimated the carbon footprint of food. However, estimates for apple, pasta and chicken were in the correct order suggesting that consumers hold some "folk knowledge" of the relative carbon footprint of foods, however lack numerical knowledge.

We observe conflation across attributes explored, indicating that consumers may struggle to rate affective, cognitive and sensory attributes independently. This may be due to a halo effect which can have a positive, or negative impact on consumer perceptions across a variety of seemingly unrelated attributes (Sörqvist *et al.*, 2015).

Based on the current findings we recommend that the Government and food industry should communicate to the public that the risk of contracting COVID-19 through food or food packaging is very low. We propose that further research should explore how consumer perceptions change over development of the COVID-19 pandemic, to confirm when the negative perceptions of foods from the USA and China is due to the COVID-19 pandemic or other influences. In addition, further research should investigate whether country of origin information impacts other food categories, and explore whether the impact of origin and ethical information on perceptions translates to in-store purchase decisions.

The findings of the current study have implications for public trust, post lockdown and post Brexit trade policy. Effective public facing communication of food safety, animal welfare and supply must be coordinated, transparent and wide reaching in order to successfully rebuild the post COVID-19 food system.

Data availability

Underlying data

Open Science Framework: How does country of origin and ethical information impact consumer perception and purchase intention of different foods? https://doi.org/10.17605/OSF.IO/MB72G (Armstrong & Reynolds, 2020).

Extended data

Open Science Framework: How does country of origin and ethical information impact consumer perception and purchase intention of different foods? https://doi.org/10.17605/OSF.IO/MB72G (Armstrong & Reynolds, 2020).

This project contains the following extended data:

- Survey: Food origins and certification.docx (Version 1).

Acknowledgements

Thanks to Dr Emma Foster and the Intake 24 team (Newcastle) for the use of their portion images.

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Reference Source

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Reference Source

Open Peer Review

Current Peer Review Status: ✔ ?

Version 1

Reviewer Report 01 April 2021

https://doi.org/10.21956/emeraldopenres.14786.r27402

?

Vilma Xhakollari
Department of Agricultural and Food Sciences, University of Bologna, Bologna, Italy

Check the sample size in the abstract and methods where it has been written 701 and the introduction 698.

Survey - The extended data is very difficult to be found in the very long material of 645 pages of the project. Please add it as an appendix. Otherwise explain all the questions in this section. It is a bit difficult to understand results without knowing the survey you used. Did you think about conducting a choice experiment? Why not?

Results - It is very difficult for me to understand the results since the explanation of the survey is not very clear.

Discussion - I would highly suggest you to consider some more literature for this part. I understand that the topic is quite new but still you can compare it to other studies with food scandals for example.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
No

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Are all the source data underlying the results available to ensure full reproducibility?

Partly

Are the conclusions drawn adequately supported by the results?
Yes

Is the argument information presented in such a way that it can be understood by a non-academic audience?
Yes

Does the piece present solutions to actual real world challenges?
Yes

Is real-world evidence provided to support any conclusions made?
Yes

Could any solutions being offered be effectively implemented in practice?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Consumer behaviour

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 15 July 2020

https://doi.org/10.21956/emeraldopenres.14786.r26896

Annabelle M. Wilson
College of Medicine and Public Health, Flinders University, Adelaide, SA, Australia

The authors write about an important topic. Food risk perception is especially relevant in the COVID-19 era. Some questions to the authors to consider are as follows:

1. Could you provide some more information about the items you chose to measure food safety/risk, animal welfare, deliciousness, purchase intention, energy density, carbon footprint of three foods? Additionally, what was the reason for choosing these items to measure?

2. Do you have any data to compare these data to pre-COVID-19?

3. In the Introduction, and in the last paragraph of the discussion, you refer to implications of the work. It would be good to expand on these and describe what the implications are from your perspective, based on this research.

4. Can you justify the choice of the three foods: chicken, apples and pasta?

5. It would be good to provide a more explicit link between your study and COVID-19. For example, the second to last paragraph of the discussion came as a bit of a surprise to me as it was not mentioned earlier that the paper was investigating participants' perceptions of contracting COVID-19 from food.

6. Page 5, Discussion Line 7 - this is currently written as 'favourable' whereas it should say 'favourably'

7. The paper could also benefit from some additional references around trust/ food/media/country of origin/COVID-19 .

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Partly

Is the argument information presented in such a way that it can be understood by a non-academic audience?
Partly

Does the piece present solutions to actual real world challenges?
Partly

Is real-world evidence provided to support any conclusions made?
Partly

Could any solutions being offered be effectively implemented in practice?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Food systems research, trust in the food system, Aboriginal and Torres Strait Islander health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.