

# *Investigating students' food packaging-related challenges and preferences in Europe and Asia*

Article

Published Version

Creative Commons: Attribution 4.0 (CC-BY)

Open Access

Norton, V., Oloyede, O. O. ORCID: <https://orcid.org/0000-0001-6392-0937>, Alexi, N., Menil, A., Ren, G., Jadhav, N. and Lignou, S. ORCID: <https://orcid.org/0000-0001-6971-2258> (2024) Investigating students' food packaging-related challenges and preferences in Europe and Asia. *Sustainability*, 16 (12). 5185. ISSN 2071-1050 doi: <https://doi.org/10.3390/su16125185> Available at <https://centaur.reading.ac.uk/116852/>

It is advisable to refer to the publisher's version if you intend to cite from the work. See [Guidance on citing](#).

To link to this article DOI: <http://dx.doi.org/10.3390/su16125185>

Publisher: MPDI

All outputs in CentAUR are protected by Intellectual Property Rights law, including copyright law. Copyright and IPR is retained by the creators or other copyright holders. Terms and conditions for use of this material are defined in the [End User Agreement](#).

[www.reading.ac.uk/centaur](http://www.reading.ac.uk/centaur)

**CentAUR**

Central Archive at the University of Reading

Reading's research outputs online

## Article

# Investigating Students' Food Packaging-Related Challenges and Preferences in Europe and Asia

Victoria Norton <sup>1</sup>, Omobolanle O. Oloyede <sup>2</sup>, Niki Alexi <sup>3</sup>, Audrey Menil <sup>1</sup>, Guangling Ren <sup>1</sup>, Nirmal Jadhav <sup>1</sup> and Stella Lignou <sup>1,\*</sup>

<sup>1</sup> Sensory Science Centre, Department of Food and Nutritional Sciences, Harry Nursten Building, University of Reading, Whiteknights, Reading RG6 6DZ, UK; nirmaljadhav99@gmail.com (N.J.)

<sup>2</sup> Department of Nutrition, Food and Exercise Sciences, Dorothy Hodgkin Building, University of Surrey, Stag Hill, Guilford GU2 7XH, UK

<sup>3</sup> Food Quality Perception and Society Science Team, iSense Lab, Department of Food Science, Faculty of Technical Sciences, Aarhus University, Agro Food Park 48, 8200 Aarhus N, Denmark

\* Correspondence: s.lignou@reading.ac.uk

**Abstract:** There is increasing pressure for everyone to adopt sustainable behaviours and typically this starts at-home via appropriate food-based disposal practices; however, this is associated with various barriers impacting compliance. Targeted education in college and/or the university environment could provide a viable approach to overcome such difficulties; yet, limited readily available resources exist to bring this forth. This paper explores students' food packaging expectations and attitudes as well as information preferences in four countries (UK, France, India, and China). Students (n = 533) completed an online survey capturing food packaging purchase-based decisions, disposal-related challenges, and communication preferences. Students noted that food packaging had a dominant role in product choice. Fresh produce was considered an area for improvement, especially in the UK, India, and France, whereas snacks/baked goods were a priority in China. Disposal-related challenges were mostly associated with mixed materials. Students cited no clear information, limited choices, excessive packaging, and no nearby bins as common food packaging issues. This suggests that improving infrastructure (more bins, clearer signing) could be fundamental to encourage students to implement more sustainable food packaging behaviour. Furthermore, colleges and/or universities should consider students' preferred information formats (infographics, videos) and develop targeted education (recyclability) which can be easily disseminated to promote engagement and sustainable food packaging knowledge and awareness.

**Keywords:** food packaging; sustainability; cross-country; barriers; behaviour; education

**Citation:** Norton, V.; Oloyede, O.O.; Alexi, N.; Menil, A.; Ren, G.; Jadhav, N.; Lignou, S. Investigating Students' Food Packaging-Related Challenges and Preferences in Europe and Asia. *Sustainability* **2024**, *16*, 5185. <https://doi.org/10.3390/su16125185>

Academic Editor: Giovanni De Feo

Received: 7 May 2024

Revised: 14 June 2024

Accepted: 17 June 2024

Published: 18 June 2024



**Copyright:** © 2024 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

Sustainability incorporates various key pillars (e.g., environmental, social, and economic) with the overall aim of creating a more sustainable future for all [1,2]. Accordingly, there is increasing pressure for consumers to adopt sustainable behaviour and typically this starts at-home via recycling products, food waste reduction, and limiting single-use plastic [3]. However, there are several barriers (e.g., affordability, lack of knowledge, insufficient time, limited information, task difficulty, etc.) to overcome which can impact compliance [3,4]. Moreover, it is likely that key drivers such as environmental concern, perceived recyclability, task-specific benefits, and convenience may help to engage consumers [4,5]. More specifically, food packaging provides numerous functional roles and incorporates different materials (such as plastic, glass, metal, paper/cardboard), subsequently contributing to notable disposal-related challenges [1,6–8]. In addition, ensuring that food packaging utilises sustainable materials and encourages appropriate end-user

behaviour is fundamental; accordingly, this represents key global challenges for both companies and consumers alike [1,9–11].

There is widespread uncertainty, inconsistency, and infrastructure differences relating to food packaging, all contributing to consumer confusion; hence, there is a need for additional research so that consumer-centric messaging can be developed and/or inform relevant future policies [11–14]. Additionally, consumers' expectations relating to sustainable food packaging are modulating; for example, behaviour that supports spending less are on the rise (e.g., repairing items, second-hand items, and longer-lasting products) as well as an emphasis on convenience aspects such as shelf-life, resealable, re-closable, and easy to open [3,5]. It should also be noted that, alongside the previous actions, collecting more packaging waste is fundamental to closing the circular economy loop [10]. However, there is widespread variation (within country and cross-country) suggesting improved collection systems and/or waste management, which can have a notable impact as well as addressing differences in consumer preferences and values [10,12–17]. Thus, cross-country research enables key factors to be tested in different countries and highlights relevant cultural aspects that need to be considered for future targeted approaches [18]. This is also relevant for global food brands as they are responsible for driving food packaging-related innovation and this subsequently needs to match consumers' expectations in a number of different countries which often have differing recycling infrastructures [9].

Targeted education is deemed a viable and cost-effective approach to increasing sustainable food packaging-related knowledge and awareness; however, in order to maximise the effectiveness, content needs to be tailored to the specific population and disseminated in their preferred information formats [11,12,19]. Hence, students were selected as the ideal target population to investigate as they are likely to be at a cross-roads per se, and in most cases, will need to adapt to new surroundings and subsequent sorting procedures. For example, students (aged 18 years and over) often experience new independence in terms of food choice decisions (e.g., living away from home for first time) and are considered to undergo a transitional period; therefore, they are more likely to be modulating eating habits and/or lifestyle behaviours compared with other age groups [20,21]. In addition, colleges and/or universities provide the ideal opportunity to promote sustainable food packaging practices as well as being considered knowledge-generating centres; yet, limited resources are readily available within this remit [22,23]. Thus, to overcome such a research gap, it is important to understand students' preferences and challenges in different countries so that a more targeted approach can be developed in the future. Accordingly, two countries from both Europe and Asia were selected based on differing waste management infrastructure as follows: (i) the UK and France, representing similar populations in Northern and Western Europe, respectively, and (ii) India (South Asia) and China (East Asia) as two of the largest countries globally. Hence, this paper aims to investigate students' food packaging needs, awareness, expectations, and attitudes as well as information preferences in four countries (UK, France, India, and China).

## 2. Methods

### 2.1. Study Outline

Five hundred and thirty-three students (aged 18–30 years) from four countries (UK:  $23.9 \pm 3.0$  years; France:  $21.0 \pm 1.8$  years; India:  $21.8 \pm 2.2$  years; and China:  $24.4 \pm 1.7$  years) completed an online survey between May and July 2023. Students were defined as individuals enrolled at further (e.g., higher national certificates/diplomas, apprenticeships or vocational/technical training) or higher (e.g., registered on foundation, undergraduate, master's or doctorate-related programmes at universities) education. It was evident that at least 100 students within each country would be an adequate number based on the Yamane's formula  $n = \frac{N}{1+Ne^2}$  ( $n$  = sample size;  $N$  = population and  $e$  = precision) [24]. Students were recruited via universities' departmental circulation email lists, posters on campuses, and social media. The project received a favourable ethical opinion for conduct

from the University of Reading School of Chemistry, Food and Pharmacy Research Ethics Committee (study number: 31/2022). In addition, students were informed of the anonymised nature and that they were free to withdraw at any time as well as provided consent prior to partaking in the survey.

## 2.2. Survey Design

The survey was deployed via the Compusense platform (Version 24.0.27813, Compusense Cloud Software, Guelph, Canada) in various languages (e.g., English, French, and Chinese) to aid compliance and understanding. All translation utilised the double-back approach to enable consistency between the English and French/Chinese versions. It should be noted that the Indian survey was conducted in English as it is an official language in the country. In addition, country-specific responses were included for relevant questions such as shopping examples and region location. The survey was adapted from our previous work [11] to ensure relevance for the student population and consisted of four sections using the following question types: (i) single selection; (ii) check-all-that-apply (CATA); (iii) ranking; and (iv) open-ended question.

The survey started with definitions of the relevant terminology (e.g., sustainable behaviour and food packaging—packed vs. unpacked, material, amount and disposal). The first section focused on purchase-based decisions: (1) impact of food packaging type; (2) role of different food categories (fresh meat/fish, fresh fruit/vegetables, drinks, dairy, long-shelf products, baked goods and snacks); (3) common shopping locations (supermarkets, mini markets, convenience stores, specialised foods shops, farmers markets, and online services—examples within each category varied by country); and (4) food packaging issues (limited sustainable options, excessive packaging, no clear information, preferred option unavailable, too many options, no time, unable to bring own container, no trust, expensive, and no issues).

The second section determined the extent of food packaging material challenges: (1) location-based (at-home vs. on-the-go); (2) food packaging types (paper/cardboard, glass, mixed materials, aluminium, soft/hard plastic, and bio-based plastic); (3) at-home issues (collection system, no trust, no incentive/motivation, too confusing, and no clear labelling); (4) on-the-go issues (no nearby recycling bin, no clear information, unable to clean/separate materials, no motivation, bins are full, and no issues); and (5) common sustainable options (paper, reusable nettings, tupperware, buy unpack, bags for life, reusable bottles, and bio-based packaging).

The third section explored communication preferences: (1) information formats (video, infographics, written articles (short and long), audio, interactive chat, and quizzes); (2) frequency of information searching (daily to never); (3) topics of interest (environmental impact, recyclability, reusability, packaging importance, disposal icons, material types, and reducing food packaging); (4) trustworthy sources (research centres, organisations (public, government, evidence and independent), journalists, social media, family/friends, and food companies); (5) location of sources (popular articles, search engine, scientific studies, documentaries, news, podcasts, government, social media, labels on pack, conversation, and mobile apps); (6) willing to partake in sustainable food packaging (not willing to willing); (7) strategies to increase motivation (incentives, fines, fits into routine, environmental consciousness, social responsibility, legislation and accessibility) and (8) open-ended question on sustainable food packaging.

The final section identified basic demographic information: (1) region location (e.g., Berkshire—examples varied by country); (2) age; (3) gender; (4) involvement in food shopping decisions (never to yes always); (5) diet style (omnivore, pescatarian, vegetarian, vegan, flexitarian, and religious); (6) food choice factors (price, shelf-life, quality, brand, sustainability, nutritional content, company values, processed, convenient, origin, and taste); and (7) educational status (doctorate, masters, undergraduate, foundation, higher national certificates, and diplomas, apprenticeships, and vocational/technical training).

### 2.3. Statistical Analysis

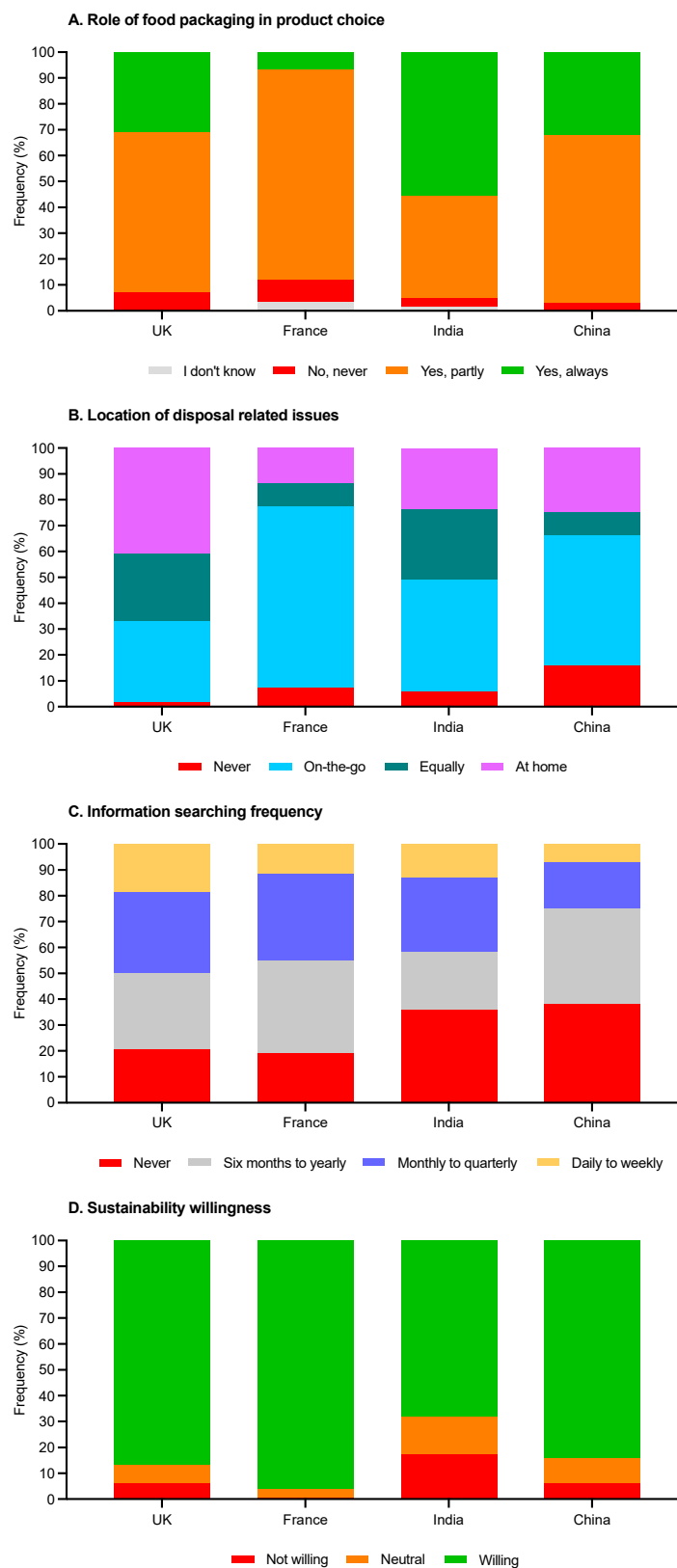
All analyses were conducted in XLSTAT (version 2022.3.2.1348, New York, NY, USA) using the following approaches: (1) analysis of variance (ANOVA) was utilised to determine the country-related differences for CATA and single selection-based questions; and (2) Friedman's test using ranked data (within each individual country) with the Nemenyi's approach for multiple comparisons. The significance value was  $p < 0.05$  for all analyses. In addition, data from five-point category scales were categorised as follows: (i) at-home to on-the-go: at-home (only at home + more at-home, but also on-the-go), equally (at-home and on-the-go) and on-the-go (only on-the-go and more on-the-go, but also at-home); and (ii) willingness: not willing (not willing + somewhat not willing), neutral (undecided), and willing (somewhat willing + willing), in a percentages format.

### 3. Results

Students were predominantly in higher education, responsible for food shopping, and adhering to an omnivore-based diet (Table 1). Students' key drivers in food choice were modulated by country; for example, price was dominant in the UK, France, and China, whereas quality/safety was a priority in India (Figure S1). It was evident that the supermarket was the main shopping location regardless of country (Figure S1). Food packaging played a role in students' product choice independently of the country examined; however, the extent varied significantly, with cross-country effects indicating a more important role in India compared to France ( $p < 0.0001$ ; Figure 1).

**Table 1.** Students' (n = 533) demographic overview by country.

Demographics	UK (n = 130)		France (n = 181)		India (n = 122)		China (n = 100)	
	n	%	n	%	n	%	n	%
<b>Gender</b>								
Male	39	30.0	32	17.7	58	47.5	25	25.0
Female	90	69.2	145	80.1	62	50.8	74	74.0
Other	1	0.8	4	2.2	2	1.6	1	1.0
<b>Education</b>								
Doctorate degree	30	23.1	2	1.1	4	3.3	6	6.0
Graduate degree	65	50.0	14	7.7	51	41.8	58	58.0
Undergraduate degree	30	23.1	5	2.8	47	38.5	35	35.0
Foundation degree	0	0.0	59	32.6	8	6.6	0	0.0
Higher national certificates/diplomas	2	1.5	101	55.8	5	4.1	0	0.0
Apprenticeships/vocational/technical training	3	2.3	0	0	5	4.1	0	0.0
Other	0	0	0	0	2	1.6	1	1.0
<b>Food Shopping</b>								
Disagree	7	5.4	21	11.6	12	9.8	2	2.0
Neutral	10	7.7	11	6.1	19	15.6	15	15.0
Agree	113	86.9	149	82.3	91	74.6	83	83.0
<b>Diet Style</b>								
Omnivore	91	70.0	113	62.4	63	51.6	94	94.0
Pescatarian	9	6.9	6	3.3	8	6.6	1	1.0
Vegetarian	10	7.7	16	8.8	24	19.7	3	3.0
Vegan	3	2.3	0	0.0	5	4.1	0	0.0
Flexitarian	16	12.3	44	24.3	17	13.9	1	1.0
Religious related diet	1	0.8	2	1.1	5	4.1	0	0.0
Other	0	0.0	0.0	0.0	0	0.0	1	1.0



**Figure 1.** Summary of students' (n = 533) (A) role of food packaging in product choice; (B) location of disposal related issues (at-home: only at-home/more at-home, but also on-the-go; equally: at-home and on-the-go; and on-the-go: only on-the-go/more on-the-go, but also at-home); (C) frequency of searching for sustainable food packaging behaviour, by country (UK: n = 130; France: n = 181; India: n = 122; and China: n = 100). Data expressed as percentages.

Product categories considered influential from a packaging perspective varied by country with fresh produce (meat, fish, fruit and vegetables) and dairy in the UK, India, and France, in contrast to snacks, baked goods, and dairy in China (Table 2). In addition, students cited mixed materials as the most challenging food packaging material type at-home in terms of disposal, especially in the UK, France, and India (Table 2).

**Table 2.** Students' (n = 533) influential product categories and food packaging material types (at-home disposal) by country.

	UK (n = 133)		France (n = 181)		India (n = 122)		China (n = 100)	
	Mean ranks	Ranking	Mean ranks	Ranking	Mean ranks	Ranking	Mean ranks	Ranking
<b>Product categories</b>								
Meat and fish	2.88a	1	3.78bc	3	3.17a	2	4.61cd	5
Fruit and vegetables	2.92a	2	2.51a	1	3.54ab	3	4.76cd	6
Dairy	3.81b	3	3.68b	2	3.07a	1	3.57ab	3
Baked goods	4.32bc	4	3.88bc	4	4.26bc	4	3.19ab	2
Long-shelf	4.45bc	5	4.44cd	5	4.59c	6	5.10d	7
Drinks	4.73c	6	5.09d	7	4.89c	7	3.86bc	4
Snacks	4.89c	7	4.62d	6	4.48c	5	2.91a	1
<b>Material types</b>								
Mixed materials	2.95a	1	2.51a	1	3.39a	1	3.97ab	3
Soft plastic	3.38ab	2	2.68a	2	3.56a	2	4.16ab	5
Glass	3.42ab	3	5.67d	6	3.61a	3	3.08a	1
Aluminium/metals	3.88bc	4	4.19c	5	3.61a	4	3.08a	2
Hard plastic	4.03bc	5	3.65bc	4	3.63a	5	4.02ab	4
Bio-based plastic	4.46c	6	3.14ab	3	4.9b	6	4.57b	6
Paper/cardboard	5.87d	7	6.15d	7	5.3b	7	5.11b	7

Data expressed as mean ranks (where lower values denote more commonly selected) and differing letters (within each individual country) reflect significance from multiple comparisons.

Overall, students cited dominant food packaging-related issues as limited options, excessive packaging, no clear information/expensive; however, the extent of such effects varied by country in most cases (Table 3). Students reported the collection system, too confusing and no clear instructions as common at-home disposal issues (Table 3). In addition, students in all countries noted no nearby bin, no clear information, and no cleaning as noteworthy on-the-go issues (Table 3). There were also significant differences ( $p < 0.0001$ ) in terms of the location of disposal-related issues where the UK had more challenges at-home, whereas in China/France, they struggled more on-the-go (Figure 1).

**Table 3.** Students' (n = 533) food packaging issues overall, at-home, and on-the-go by country.

	UK (n = 133)	France (n = 181)	India (n = 122)	China (n = 100)
<b>Overall</b>				
Limited options	0.58 a	0.64 a	0.45 b	0.35 b
Excessive packaging	0.45 b	0.86 a	0.31 c	0.46 b
No clear information	0.38 b	0.20 c	0.36 b	0.64 a
Preferred option unavailable	0.16 a	0.08 b	0.11 ab	0.15 ab
Too many options	0.19 b	0.12 b	0.19 b	0.34 a
No time	0.12 b	0.13 b	0.20 ab	0.23 a
Unable to use own containers	0.18 ab	0.23 a	0.12 b	0.10 b
No trust	0.11 b	0.03 c	0.20 a	0.13 ab
Expensive	0.34 a	0.38 a	0.21 b	0.20 b
No issues	0.04	0.03	0.08	0.02
<b>At-home</b>				

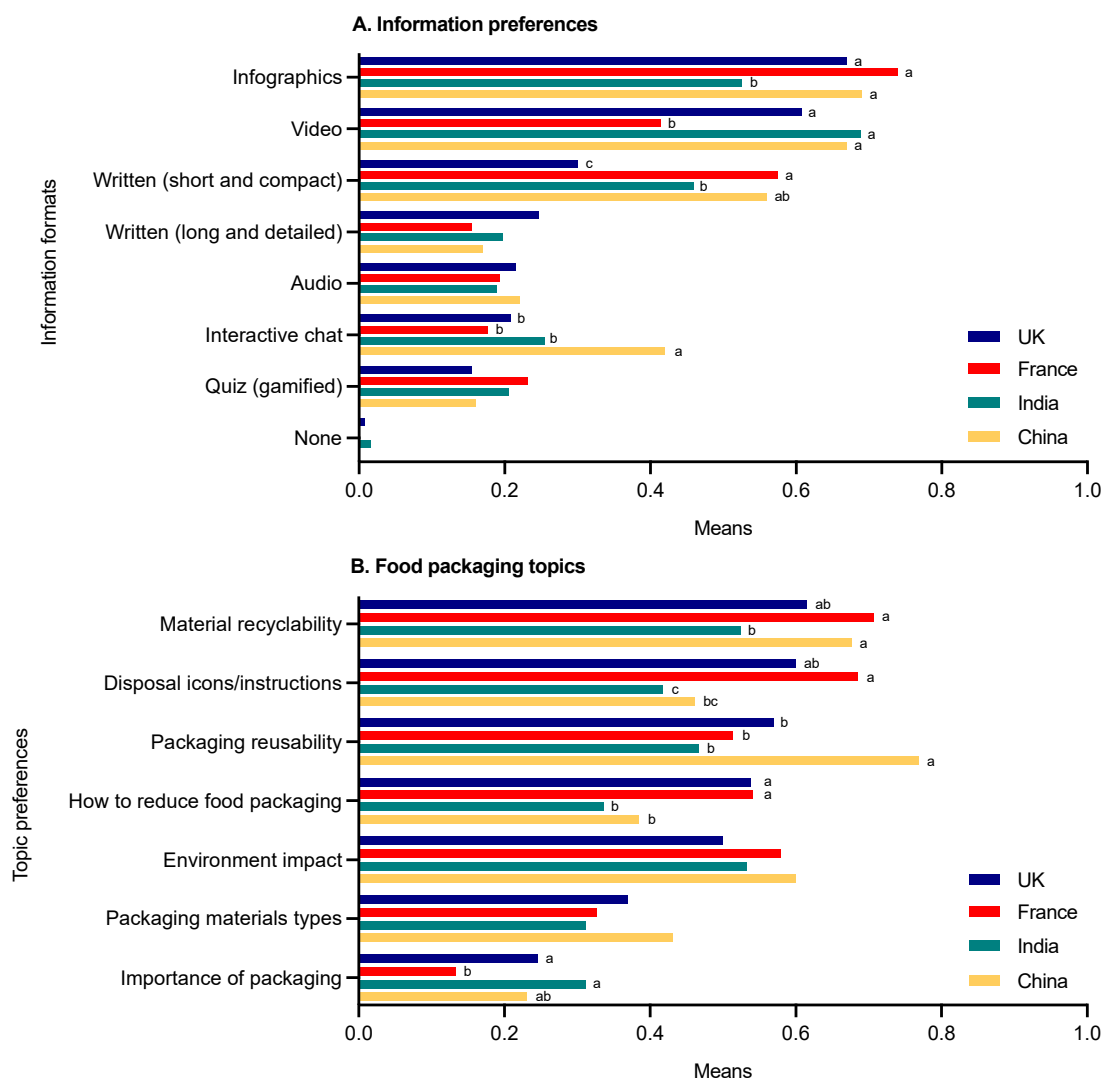


Collection system	0.35 b	0.34 b	0.34 b	0.66 a
No trust	0.22	0.16	0.27	0.25
No incentive	0.21 b	0.04 c	0.20 b	0.46 a
Too confusing	0.43 b	0.12 d	0.30 c	0.74 a
No clear instructions	0.59 ab	0.64 a	0.48 b	0.54 ab
<b>On-the-go</b>				
No nearby bin	0.74 bc	0.89 a	0.65 c	0.81 ab
No clear information	0.38 b	0.31 b	0.34 b	0.55 a
No cleaning	0.58 a	0.45 b	0.31 c	0.65 a
No motivation	0.11 b	0.07 b	0.13 b	0.47 a
Bins are full	0.31 b	0.44 a	0.25 b	0.12 c
No issues	0.05 b	0.03 b	0.11 a	0.01 b

Data expressed as means and differing letters reflect country significance from multiple comparisons.

Students' sustainable packaging types were modulated by country; for example, bags for life were commonly utilised in the UK, China, and France, whereas paper was more dominant in India; in addition, tupperware was prevalent in the UK and France (Figure S1). Infographics, videos, and short/compact written articles were perceived as students' preferred information formats and recyclability was identified as a key topic of interest regardless of country (Figure 2). There was also no clear consensus on the searching frequency of sustainable food packaging information in all countries; however, students in China were looking for information less often compared with the UK (Figure 1).

Students noted that scientists or research centres and evidence-based organisations were considered trustworthy sources and information was typically located via search engines in all countries (Table 4). Overall, students were relatively willing to adopt more sustainable food packaging behaviour; however, students in India were marginally less willing compared with other countries ( $p < 0.0001$ ; Figure 1). Students cited easiness into daily routine as a key motivator to increase sustainable behaviour, regardless of country, as well as environmental consciousness, especially in the UK and China (Table 4). Key themes emerged from open-ended questions such as plastic, recycling process, trust, disposal advice, and material types (Figure 3).



**Figure 2.** Students' (n = 533) food packaging preferences relating to (A) information formats and (B) topics of interest, by country (UK: n = 130; France: n = 181; India: n = 122; and China: n = 100). Data expressed as means and differing letters reflect country significance from multiple comparisons.

**Table 4.** Students' (n = 533) trustworthy sources, information searching locations, and motivators to improve sustainability by country.

	UK (n = 133)	France (n = 181)	India (n = 122)	China (n = 100)
<b>Trustworthy sources</b>				
Scientists or research centres	0.69 <sup>c</sup>	0.93 <sup>a</sup>	0.54 <sup>d</sup>	0.80 <sup>b</sup>
Public and governmental organisations	0.45	0.43	0.43	0.45
Evidence-based organisations	0.80 <sup>a</sup>	0.52 <sup>b</sup>	0.60 <sup>b</sup>	0.75 <sup>a</sup>
Independent consumer organisations	0.19 <sup>ab</sup>	0.25 <sup>a</sup>	0.15 <sup>b</sup>	0.10 <sup>b</sup>
Journalists and/or TV personas	0.09 <sup>a</sup>	0.03 <sup>b</sup>	0.12 <sup>a</sup>	0.08 <sup>ab</sup>
Social media influencers	0.08 <sup>b</sup>	0.01 <sup>c</sup>	0.15 <sup>a</sup>	0.06 <sup>bc</sup>
Friends and family	0.11	0.20	0.16	0.15
Food companies	0.25 <sup>a</sup>	0.09 <sup>b</sup>	0.14 <sup>b</sup>	0.11 <sup>b</sup>
None	0.00 <sup>b</sup>	0.02 <sup>ab</sup>	0.04 <sup>a</sup>	0.00 <sup>b</sup>
<b>Information searching locations</b>				
Popular articles	0.32 <sup>b</sup>	0.13 <sup>c</sup>	0.30 <sup>b</sup>	0.47 <sup>a</sup>
Search engine	0.60	0.61	0.58	0.62
Scientific studies	0.40	0.48	0.39	0.43

Documentaries	0.22	0.28	0.22	0.29
News programmes	0.10 c	0.05 c	0.20 b	0.38 a
Podcasts	0.05	0.07	0.08	0.09
Government guidelines	0.32	0.24	0.24	0.29
Social media	0.18	0.16	0.18	0.24
Labels on pack information	0.55 a	0.43 b	0.22 c	0.41 b
Conversation	0.08 b	0.32 a	0.09 b	0.11 b
Mobile apps	0.05 ab	0.03 b	0.11 a	0.11 a
None	0.02	0.06	0.03	0.06
<b>Motivators to improve sustainability</b>				
Incentives	0.42 b	0.29 c	0.23 c	0.59 a
Levy/fines for unsustainable practices	0.28 ab	0.19 b	0.25 b	0.37 a
How easily it fits into daily routine	0.57 b	0.71 a	0.60 ab	0.60 b
Environmentally conscious	0.60 b	0.55 bc	0.47 c	0.74 a
Social responsibility	0.41	0.41	0.48	0.50
Government legislation	0.28	0.24	0.24	0.29
Accessible sustainable solutions	0.50 b	0.70 a	0.30 c	0.39 bc
Nothing	0.01 b	0.01 b	0.05 a	0.01 b

Data expressed as means and differing letters reflect country significance from multiple comparisons.



Figure 3. Overview of key themes from the open-ended questions by country (UK, France, India, and China).

#### 4. Discussion

Overall, there were cross-country differences in food choice factors; for example, price was a key driver in the UK, France, and China, whereas quality/safety was considered dominant in India (as well as China). This supports previous research identifying cross-country similarities and differences in food choice factors [25]. Moreover, food is perceived as a vital component of Indian culture and traditions which could be a contributory factor to such findings in India [26]. Additionally, it is evident that food safety concerns are more apparent in Asia compared with Europe, subsequently impacting food choice-related factors [27] as noted in our paper. In addition, the supermarket was the most popular food shopping location regardless of country. Hence, highlighting its global dominance in the food market as well as the potential role of supermarkets in modulating sustainable food packaging behaviour (e.g., educating households via information-based campaigns) and food-based decisions.

Food packaging had a noteworthy role in product choice; however, the importance varied by country where French students tended to be marginally less interested in food packaging compared with the other countries. This could relate to sustainability-related knowledge, individual values, and/or infrastructure differences driving such findings [16,17]. In addition, it is beneficial to understand the impact of common product categories in identifying key areas for focus. For example, students' key product categories from a packaging perspective varied by country: (1) fresh produce (meat, fish, fruit, and vegetables) were influential in the UK, India, and France; (2) baked goods and snacks were significant in China; and (3) dairy products were also cited as problematic in all countries. Such findings may relate to the increasing negative connotation associated with plastic in terms of its environmental impact at a global level [28,29]. More specifically, fresh fruit and vegetables are often sold in plastic packaging (depending on the specific country or store); yet, providing an unpack option could reduce its environmental impact and is unlikely to adversely impact purchase intention [30]. In contrast, developing sustainable packaging options for fresh meat and fish are considered more challenging (e.g., due to concerns over contamination and moisture absorption) [31,32]. In addition, there are logistical complications associated with purchasing fresh meat/fish unpacked in order to ensure consumers have an appropriate container. Recently, France has implemented new legislation (anti-waste and circular economy) to prohibit the sale of fresh fruit and vegetable in plastic packaging (it should be noted that various fruits and vegetables are exempted) [33]. However, it appears it will take time for the French students' knowledge of the changes to develop in terms of modulating their perceptions. Moreover, in China, it is likely that the long-standing tradition of snack consumption (e.g., guests or family meet ups) which is associated with plastic-based packaging coupled with convenient aspects could result in more issues related to this product category [34–36]. In addition, mixed materials (e.g., paper and cardboard/paper) were considered a challenging food packaging material type for at-home disposal in all countries. Such findings are supported in the literature where this area has been cited as potentially benefiting from additional education and clarification [37,38]. In addition, glass was also a noteworthy challenge in China and this may relate to China's relatively low recycling rates of glass waste (approximately 8–20% in Hong Kong and Shanghai) [39]. Accordingly, this suggests that all countries would benefit from a more streamlined infrastructure enabling consumers to adhere more easily to appropriate disposal practices.

Understanding students' food packaging disposal-related issues is key so that appropriate guidance can be provided; all students noted that limited options, excessive packaging and no clear information/expensive were common barriers. In addition, it is important to understand the location of such barriers (e.g., at-home vs. on-the-go) and the extent of cross-country differences which were considered polarising. For example, UK students cited more issues at-home and this finding may relate to the lack of clear instructions, confusion, and/or collection system challenges. In contrast, Chinese and French students noted greater challenges on-the-go most likely due to no nearby bin and/or no cleaning. This suggests that, regardless of location (e.g., at-home or on-the-go), all countries have infrastructure-based challenges subsequently impacting students. Moreover, most countries have now adopted initiatives to reduce single-use plastic [40,41]. This has led to a rise in sustainable alternatives where students were commonly using bags for life (UK, China, and France), tupperware (UK and France), and paper (India). This latter finding may relate to the prevalence in India of using paper to wrap, pack, and serve food [42,43]. Overall, this suggests that promoting students to make a change (including cost implications) has resulted in a positive surge in everyday sustainable approaches.

It is imperative to capture students' preferences and initial issues relating to food packaging so that targeted educational materials can be subsequently developed in areas of interest. Positively, most students (at least 68%) were willing to adopt more sustainable food packaging behaviour regardless of country; therefore, there is an appetite for change within this population. It should be noted that the frequency of information searching was

cited as an area for improvement; therefore, future research should aim to understand the causes of infrequent searching/reading and strategies to encourage engagement. This suggests incorporating students' preferences in terms of information formats is key; infographics, videos, and written articles (short and compact) were the most preferred in all countries. More specifically, recyclability coupled with reusability and environmental impact were food packaging topics of interest; accordingly, any developed materials should incorporate such topics to maximise impact for this population. Recently, three campaigns (packaging symbols, cleaning food packaging prior to recycling, and fresh fruit/vegetable packaging) were developed based on British and Greek consumers' (aged 18–45 years) insights, with subsequent measurements indicating a positive impact on intended behaviour (e.g., adoption of at least one sustainable food packaging choice/ disposal practice post-campaign engagement) [11,19]. It is also fundamental that all developed educational materials are readily available and disseminated appropriately; however, it is vital that the information comes from trusted sources. Students cited scientists or research centres and evidence-based organisations as dominant trustworthy sources; hence, information coming from such sources could be key. Moreover, this population can be described as the digital generation; hence, readily available resources (e.g., via a mobile app) could help encourage everyday sustainable behaviour. This also suggests that colleges and/or universities could be key disseminators of tailored information for students and subsequently improve their knowledge and awareness. In addition, utilising such an approach could overcome any regional and cross-country differences typically associated with food packaging disposal infrastructure [11–13,15–17]. Students also mentioned easiness into daily routine as a dominant driver of modulating sustainable behaviour. This finding supports previous research which highlighted that individuals are more likely to engage in educational messaging if there are clear benefits, it is easy to implement, and resonates [44]. Thus, our paper provides key design pointers for students; accordingly, next steps should involve implementing such cues as well as investigating the impact of educational materials on students' behaviour over both the short and long term in ecologically valid settings (e.g., household and/or on-the-go). Moreover, future research would benefit from a larger student cohort, with more balanced quotas, as well as being expanded to a greater number of countries so that the findings can be considered globally representative. In addition, capturing extra demographic information (such as knowledge levels, current recycling compliance, household type) could help to assist further in understanding individual drivers (e.g., warriors, strugglers, and slackers [45]) in sustainable food packaging behaviour.

## 5. Conclusions

This paper explored students' current food packaging-related challenges, to assist in designing more tailored support (e.g., targeted education) that can promote sustainable practices for this segment in the future. Food packaging had a noteworthy role in product choice; therefore, more emphasis on improving sustainability-related knowledge to help overcome any cited disposal barriers is key. For example, fresh produce (e.g., meat, fish, fruit, and vegetables) (UK, India and France) and snacks/baked goods (China) were considered key opportunities for change. Disposal challenges were associated with mixed materials, especially in the UK, France, and India, as well as glass in China. Students' food packaging issues (e.g., no clear information, limited options, excessive packaging, no nearby bin, etc.) related to the need for improved infrastructure via clear signing and more bins (at-home and on-the-go) so that it is easier for students to adopt everyday sustainable food packaging behaviour regardless of product category or packaging type. Students were searching relatively infrequently for food packaging information; thus, utilising preferences (such as disseminating information in short digestible ways via infographics or videos on topics of interest namely recyclability) could help to increase engagement. Overall, this suggests that colleges and/or universities may provide a feasible solution to disseminating targeted information to students and subsequently improve knowledge

and awareness. The implications could be widespread as preventing inappropriate disposal practices at an individual level can have notable societal impact in terms of the collective effective to reduce climate change.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su16125185/s1>, Figure S1. Students' (n = 533) (A) food choice-related factors; (B) food shopping locations; and (C) sustainable food packaging types, by country (UK: n = 130; France: n = 181; India: n = 122; and China: n = 100).

**Author Contributions:** Conceptualisation, V.N., O.O.O., N.A. and S.L.; methodology, V.N., O.O.O., N.A. and S.L.; software, V.N. and S.L.; validation, V.N. and S.L.; formal analysis, V.N. and S.L.; investigation, V.N., A.M., G.R., N.J. and S.L.; resources, V.N. and S.L.; data curation, V.N. and S.L.; writing—original draft preparation, V.N.; writing—review and editing, V.N., O.O.O., N.A., A.M., G.R., N.J. and S.L.; visualisation, V.N., O.O.O. and S.L.; supervision, V.N., O.O.O., N.A. and S.L.; project administration, V.N. and S.L. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** The study was conducted in accordance with the Declaration of Helsinki, and approved by the University of Reading School of Chemistry Food and Pharmacy Research Ethics Committee (study number: 31/2022 and approval date: 6 July 2022).

**Informed Consent Statement:** Informed consent was obtained from all students involved in the study.

**Data Availability Statement:** The data presented in this paper are available upon request from the corresponding author.

**Conflicts of Interest:** The authors declare no conflicts of interest.

## References

- Otto, S.; Strenger, M.; Maier-Noth, A.; Schmid, M. Food packaging and sustainability-consumer perception vs correlated scientific facts: A review. *J. Clean. Prod.* **2021**, *298*, 126733.
- United Nations. *Take action for the Sustainable Development Goals*. Available online: <https://www.un.org/sustainabledevelopment/sustainable-development-goals/> (accessed on 5 January 2024).
- Deloitte. *The Sustainable Consumer 2023*. Available online: <https://www.deloitte.com/uk/en/Industries/consumer/research/sustainable-consumer.html> (accessed on 21 December 2023).
- Fogt Jacobsen, L.; Pedersen, S.; Thogersen, J. Drivers of and barriers to consumers' plastic packaging waste avoidance and recycling—A systematic literature review. *Waste Manag.* **2022**, *141*, 63–78.
- Goode, A. UK Attitudes towards Food Packaging Market Report 2023. Available online: <https://store.mintel.com/report/uk-attitudes-towards-food-packaging-market-report> (accessed on 19 January 2024).
- Marsh, K.; Bugusu, B. Food packaging—Roles, materials, and environmental issues. *J. Food Sci.* **2007**, *72*, 39–55.
- Norton, V.; Waters, C.; Oloyede, O.O.; Lignou, S. Exploring consumers' understanding and perception of sustainable food packaging in the UK. *Foods* **2022**, *11*, 3424.
- Dornyei, K.R.; Uysal-Unalan, I.; Krauter, V.; Weinrich, R.; Incarnato, L.; Karlovits, I.; Colelli, G.; Chrysochou, P.; Fenech, M.C.; Pettersen, M.K.; et al. Sustainable food packaging: An updated definition following a holistic approach. *Front. Sustain. Food Syst.* **2023**, *7*, 1119052.
- Klaiman, K.; Ortega, D.L.; Garnache, C. Perceived barriers to food packaging recycling: Evidence from a choice experiment of US consumers. *Food Control* **2017**, *73*, 291–299.
- Tallentire, C.W.; Steubing, B. The environmental benefits of improving packaging waste collection in Europe. *Waste Manag.* **2020**, *103*, 426–436.
- Norton, V.; Oloyede, O.O.; Lignou, S.; Wang, Q.J.; Vásquez, G.; Alexi, N. Understanding consumers' sustainability knowledge and behaviour towards food packaging behaviour to develop tailored consumer-centric engagement campaigns: A Greece and the United Kingdom perspective. *J. Clean. Prod.* **2023**, *408*, 137169.
- Trubetskaya, A.; Scholten, P.B.V.; Corredig, M. Changes towards more sustainable food packaging legislation and practices. A survey of policy makers and stakeholders in Europe. *Food Packag. Shelf. Life* **2022**, *32*, 100856. <https://doi.org/10.1016/j.fpsl.2022.100856>.
- Holmes, H.; Shaver, M.; Holmes, T.; Kortsen, K. Tackling Household Plastic Waste: Best Practices for a Circular Plastics Economy. Available online: [https://www.sustainablefutures.manchester.ac.uk/research/case-studies/one\\_bin\\_to\\_rule\\_them\\_all/](https://www.sustainablefutures.manchester.ac.uk/research/case-studies/one_bin_to_rule_them_all/) (accessed on 4 November 2023).

14. Mielinger, E.; Weinrich, R. A review on consumer sorting behaviour: Spotlight on food and fast moving consumer goods plastic packaging. *Environ. Dev.* **2023**, *47*, 100890.
15. Prakash, G.; Pathak, P. Intention to buy eco-friendly packaged products among young consumers of India: A study on developing nation. *J. Clean. Prod.* **2017**, *141*, 385–393.
16. Herbes, C.; Beuthner, C.; Ramme, I. Consumer attitudes towards biobased packaging—A cross-cultural comparative study. *J. Clean. Prod.* **2018**, *194*, 203–218.
17. Herbes, C.; Beuthner, C.; Ramme, I. How green is your packaging—A comparative international study of cues consumers use to recognise environmentally friendly packaging. *Int. J. Consum. Stud.* **2020**, *44*, 258–271.
18. Randall, T.; Cousins, A.L.; Neilson, L.; Price, M.; Hardman, C.A.; Wilkinson, L.L. Sustainable food consumption across Western and Non-Western cultures: A scoping review considering the theory of planned behaviour. *Food Qual. Prefer.* **2024**, *114*, 105086.
19. Vásquez, G.; Wang, Q.J.; Lignou, S.; Oloyede, O.O.; Norton, V.; Alexi, N. Impact of co-created digital information campaigns on GenZ and Millennials’ intention to adopt more sustainable packaging behaviours: A Greece and United Kingdom perspective. Working Paper..
20. Sobal, J.; Bisogni, C.A.; Devine, C.M.; Jastran, M. A conceptual model of the food choice process over the life course. In *The Psychology of Food Choice*; Shepherd, R., Raats, M., Eds.; CABI: Oxford, UK, 2006; pp. 1–18.
21. Hafiz, A.A.; Gallagher, A.M.; Devine, L.; Hill, A.J. University student practices and perception on eating behaviours whilst living away from home. *Int. J. Educ. Res.* **2023**, *117*, 102133.
22. Izagirre-Olaizola, J.; Fernandez-Sainz, A.; Vicente-Molina, M.A. Internal determinants of recycling behaviour by university students: A cross-country comparative analysis. *Int. J. Consum. Stud.* **2015**, *39*, 25–34.
23. Bennett, E.M.; Alexandridis, P. Informing the public and educating students on plastic recycling. *Recycling* **2021**, *6*, 69.
24. Yamane, T. *Statistics: An Introductory Analysis*; John Weather Hill Inc.: London, UK, 1973.
25. Prescott, J.; Young, O.; O’Neill, L.; Yau, N.J.N.; Stevens, R. Motives for food choice: A comparison of consumers from Japan, Taiwan, Malaysia and New Zealand. *Food Qual. Prefer.* **2002**, *13*, 489–495.
26. Samaddar, A.; Cuevas, R.P.; Custodio, M.C.; Ynion, J.; Ray, A.; Mohanty, S.K.; Demont, M. Capturing diversity and cultural drivers of food choice in eastern India. *Int. J. Gastron. Food Sci.* **2020**, *22*, 100249.
27. Tomasevic, I.; Hambarzumyan, G.; Marmaryan, G.; Nikolic, A.; Mujcinovic, A.; Sun, W.; Liu, X.C.; Kovacevic, D.B.; Markovinić, A.B.; Terjung, N.; et al. Eurasian consumers’ food safety beliefs and trust issues in the age of COVID-19: Evidence from an online survey in 15 countries. *J. Sci. Food Agric.* **2023**, *103*, 7362–7373.
28. Dilkes-Hoffman, L.S.; Pratt, S.; Laycock, B.; Ashworth, P.; Lant, P.A. Public attitudes towards plastics. *Resour. Conserv. Recycl.* **2019**, *147*, 227–235.
29. White, A.; Lockyer, S. Removing plastic packaging from fresh produce—what’s the impact? *Nutr. Bull.* **2020**, *45*, 35–50.
30. van Herpen, E.; Immink, V.; van der Puttelaar, J. Organics unpacked: The influence of packaging on the choice for organic fruits and vegetables. *Food Qual. Prefer.* **2016**, *53*, 90–96.
31. Oloyede, O.O.; Lignou, S. Sustainable paper-based packaging: A consumer’s perspective. *Foods* **2021**, *10*, 1035.
32. Lignou, S.; Oloyede, O.O. Consumer acceptability and sensory profile of sustainable paper-based packaging. *Foods* **2021**, *10*, 990.
33. SGS. France: the ban on plastic packaging for fruits and vegetables is back in force. Available online: <https://www.sgs.com/en-gb/news/2023/06/safeguards-7823-france-the-ban-on-plastic-packaging-for-fruits-and-vegetables-is-back-in-force> (accessed on 24 January 2024).
34. Zhou, Y.; Shan, Y.; Guan, D.; Liang, X.; Cai, Y.; Xue, J.; Ma, Z.; Yang, Z. Sharing tableware reduces waste generation, emissions and water consumption in China’s takeaway packaging waste dilemma. *Nat. Food* **2020**, *1*, 552–561.
35. Li, Z.; Zhou, Y.; Zhang, H.; Cai, Y.; Yang, Z. Driving factors and their interactions of takeaway packaging waste generation in China. *Resour. Conserv. Recycl.* **2022**, *185*, 106467.
36. Ma, Y. Snack foods in China – statistics & facts. Available online: <https://www.statista.com/topics/10257/snack-foods-in-china/#topicOverview> (accessed on 22 January 2024).
37. Norton, V.; Alexi, N.; Contente, A.; Lignou, S. The 3Is: Let’s INVOLVE, INFORM and INSPIRE the next generation on disposing food packaging sustainably. *J. Clean. Prod.* **2023**, *424*, 138807.
38. Norton, V.; Alexi, N.; Lignou, S. Using workshops to engage key stage three children in disposing food packaging sustainably. *Foods* **2023**, *12*, 3542.
39. Kua, H.W.; Teoh, W.S.; Xiaozhen, X.; Huang, B.; Geng, Y. A review of glass recycling policies in Stockholm, Hong Kong SAR and Shanghai from a circular economy perspective. *J. Clean. Prod.* **2024**, *434*, 140068.
40. Two Sides. Packaging Preferences. 2020. Available online: <https://www.twosides.info/packaging2020/> (accessed on 4 June 2022).
41. Wang, B.; Li, Y. Consumers’ Intention to Bring a Reusable Bag for Shopping in China: Extending the Theory of Planned Behavior. *Int. J. Environ. Res. Public Health* **2022**, *19*, 3638.
42. Deshwal, G.K.; Panjagari, N.R.; Alam, T. An overview of paper and paper based food packaging materials: Health safety and environmental concerns. *J. Food Sci. Technol.* **2019**, *56*, 4391–4403.
43. Verma, M.K.; Shakya, S.; Kumar, P.; Madhavi, J.; Murugaiyan, J.; Rao, M.V.R. Trends in packaging material for food products: Historical background, current scenario and future prospects. *J. Food Sci. Technol.* **2021**, *58*, 4069–4082.

44. Ruxton, C.H.S.; Ruani, M.A.; Evans, C.E.L. Promoting and disseminating consistent and effective nutrition messages: Challenges and opportunities. *Proc. Nutr. Soc.* **2023**, *82*, 394–405.
45. Ngugen, T.T.T.; Malek, L.; Umberger, W.J.; O'Connor, P.J. Food waste 'Warriors', 'Strugglers' and 'Slackers': Segmenting households based on food waste generation and sorting behaviours. *Food Qual. Prefer.* **2023**, *112*, 10500.

**Disclaimer/Publisher's Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.