ENOUGH

EUROPEAN FOOD CHAIN SUPPLY
TO REDUCE GHG EMISSIONS BY 2050

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EXECUTIVE SUMMARY

Delivery 3.2 (D3.2) is the delivery from Work Package 3 (WP3) Task 3.2 "Public perception issues, social and behavioural barriers", which aims to identify barriers for reducing energy and carbon emissions of the food chain from behaviour and public perception perspectives.

A broad literature review was conducted including both theoretical and practical work in this area. The theories related to attitudes, behaviour and choice, and the identified main behavioural drivers affecting the food supply chain emissions were used to form the questionnaire design to collect key information, in order to form future scenarios for predicting the energy consumption and GHG emissions of the food supply chain in 2030 and 2050.

Four different WP3 partner countries participated in the survey data collection, with an additional sample country added, Slovenia, who had a group of visiting students at WP3 partner Università Politecnica delle Marche (UNIVPM) and completed the questionnaires during their visit. The Slovenia data are included in the analysis along with the four partner countries to compare if any similarities and differences exist across countries in terms of the main behavioural drivers of future energy consumption and GHG emissions of the food supply chain.

Based on the literature review of WP3 and horizon scanning from WP1, the questionnaire covered the important areas of public perception and behaviours related to alternative protein, food waste reduction, frozen food, online platform, and food packaging. Similarities and differences have been identified across the countries, which are detailed in this report.

The report will be used to feed into the development and refinement of future scenarios of Task 1.4 "2030 and 2050 projected emissions" and Task 3.3 "generation of energy road map" with different pathways for 2030 and 2050, providing the essential information of behavioural issues and challenges for reducing GHG emissions of the food supply chain in Europe.

1 INTRODUCTION

The agri-food is one of the largest sectors in the European Union (EU) and United Kingdom (UK). It contributed about £116.2bn and EUR 173.3 billion to the national Gross Value Added of UK and EU in 2020 respectively (Department, for Environment, and Food & Rural Affairs, 2024). There are over 4.1 million jobs in the sector in UK and over 29 million workers that produce, process, distribute, prepare, and sell food and beverages in the EU involving about 13 million enterprises (Rachele, 2020). Apart from being a tradeable good necessary for human survival, food has deep-rooted historical, cultural, and social importance. This is specifically apparent in the global prominence of some EU foodstuffs and protected designations, and in the promotion of culinary tourism in many areas of Europe. Therefore, the EU food system supports consumers' choices and attitudes towards food consumption and diets. In this sense, all citizens are major stakeholders in the EU food system.

However, the food sector is accountable for 75% of global freshwater consumption. The global food value chain generates 690 Mt CO_2eq each year (Turner *et al.*, 2021) while food system related GHG emissions accounts for 9.2% of total EU GHG emissions (Lombardi, Berni and Rocchi, 2017). Specifically, emissions associated with food and drink manufacturing in the EU is about 94 Mt CO_2eq/year which is mainly associated with energy usage within the food chain. The world population is projected at 10 billion by 2050 with corresponding increase in food demand by 35% to 56% compared to 2010 (van Dijk *et al.*, 2021). Climate change and finitude of natural resources pose great challenge to food security. Although, the EU population only increases by 1.25% between 2010 to 2020 however, the globalisation of food system and geographical localisation of some foods makes EU food system vulnerable to global challenges.

The EU is targeting 55% emission reduction by 2030 including greening the agricultural sector while maintaining food security (Directorate-General for Environment, 2024). A study has indicated reduction in the GHG emissions from the food production systems of the EU-28 countries from an average of 788 Mt CO_2-eq in 2010–2013 to 770 Mt CO_2-eq in 2014–2017. However, the average share of the food production system in overall GHG emissions has increased from 20.3% in 2010–2013 to 21.7% in 2014–2017 (Smith *et al.*, 2014). One of the options at achieving the twin targets of sustainable food system and food security within EU is from the consumption perspective. For example, by looking at the efficiency gains from changing diets. In terms of protein output, crop production is more than 6 times more efficient than animal production. Besides, about 25% of food purchase by the UK households ends up as waste and efficient saves from these practices can help towards achieving emissions free food system.

Therefore, this piece of work is looking into the consumers perceptions, social and behavioural issues that can impede the EU's target of zero emission food system by 2050. Our previous works from Work Package 1 indicated the following (Table 1) social and behavioural sub-drivers have medium to high impacts on achievement of sustainable food system.

Table 1: Social and Behavioural issues pertinent to food chain

Issues	Sub-Drivers
Social issues	Population Growth
	Urbanisation- increase in urban population
	Reduction in food loss- post harvest loss
	Impact of climate change and food choice
	Skills and Capacity (for the efficient running of the cold chain operations, and transition to low GWP refrigerants)
Behavioural Issues	Dietary change
	Change in food shopping habits – on-demand delivery/ transfer to more home cooking/ or ordering food (increase in online shopping)
	Shopping for more frozen food and less fresh food
	Reduction in food waste at consumer end
	Education children from a young age about "farm to fork"
	Knowledge exchange initiatives (e.g. "best before" versus "use by" date)
	Social media campaigns and raising awareness - food choices and food storage habits
	Shop and eat directly from local - From farmers to consumers

Consequently, the above sub-drivers are then summarized into six categories:

- ✓ Change in Dietary
- ✓ Food waste reduction
- ✓ Knowledge and education
- ✓ Online food shopping
- ✓ Purchase of locally produced foods
- ✓ Preference for frozen foods.

The above is further categorised into the following research questions.

1) What are the perceptions, social and behavioural challenges towards adoption of alternative protein (AP)[1] in EU?
    a) What is the acceptance level of AP across EU countries?
    b) Is there any socio, cultural or behavioural barriers to acceptance of AP within EU?
    c) Older UK's consumers are more motivated to adopt AP due to environmental concerns while young adults are motivated by animal welfarism. Is this same in other EU countries?
    d) Cultured meat and insects have great prospects but have low acceptability among EU consumers. Are there creative ways to do the push? What are consumers expectations about these 2 AP?
    e) What are the acceptability rates of other APs?
2) What are the perceptions, social and behavioural challenges towards reduction of households' food waste across EU?
    a) Are there social or behavioural barriers to food waste reductions in EU?
    b) What do EU citizens think of food waste?
    c) Social pressure, especially from family, is preventing people from receiving food from food banks, as this is seen as food of poor. Which demography of EU is facing this and in what percentage?
    d) What proportion of EU households have detail understanding of correct storage of food?
3) What are the perceptions, social and behavioural challenges towards adoption of pro-environmental behavioural knowledge within EU?
    a) Is there any impediment to the adoption of new technology/skills within EU?
    b) What do we think of media campaigns within EU and what percentage of EU consumers make food choices decisions based on social media?
    c) What skills are required for consumers to avoid food waste?
    d) What is the frozen food storage awareness level across EU?
4) What are the perceptions, social and behavioural challenges towards adoption of frozen foods (FF) in EU?
    a) What is the citizens acceptability of frozen foods across EU?
    b) There is recent surge in acceptability of frozen food. Is this accidental due to rising cost of living? Would the trend continue if economy stabilise?
    c) What's the trend in FFs acceptability along demographic strata of EU and UK?

[1] Alternative proteins include for example, proteins that are plant-based, insect-based, algae-based, or microbial fermentation, or cell cultivated/cultured meat (from stem-cell).

d) EU is increasingly becoming culturally diversified with some culturally attached to fresh food. What proportion of the EU consumers are not likely to adopt FFs?

5) What are the perceptions, social and behavioural challenges towards adoption of online food shopping across EU?
   a) What are the perceptions of EU citizens towards online food shopping?
   b) Are there any social or behavioural barriers to online food shopping within EU?
   c) How does the future food shopping look like within EU?

6) What are the perceptions, social and behavioural challenges towards purchase of locally produced foods in EU?

2 LITERATURE REVIEW

Given the above research questions, we adopt a systematic review method to identify gaps in the related literature, media and knowledge associated to the sub-drivers in Table 1. This type of approach allows us to identify, evaluate, and produce contributions pertinent to the subject and address question(s), with least possible bias and error (Nguyen *et al.*, 2022). The review is framework-based in organizing the barriers to and drivers of the consumers perceptions on social and behavioural issues pertinent to zero emissions food chain. Specifically, the preferred reporting items for systematic reviews and meta- analyses (PRISMA) protocol (Moher *et al.*, 2015) was adopted using literature search approach in Figure 1 with the inclusion and exclusion criteria itemised on Table 3.

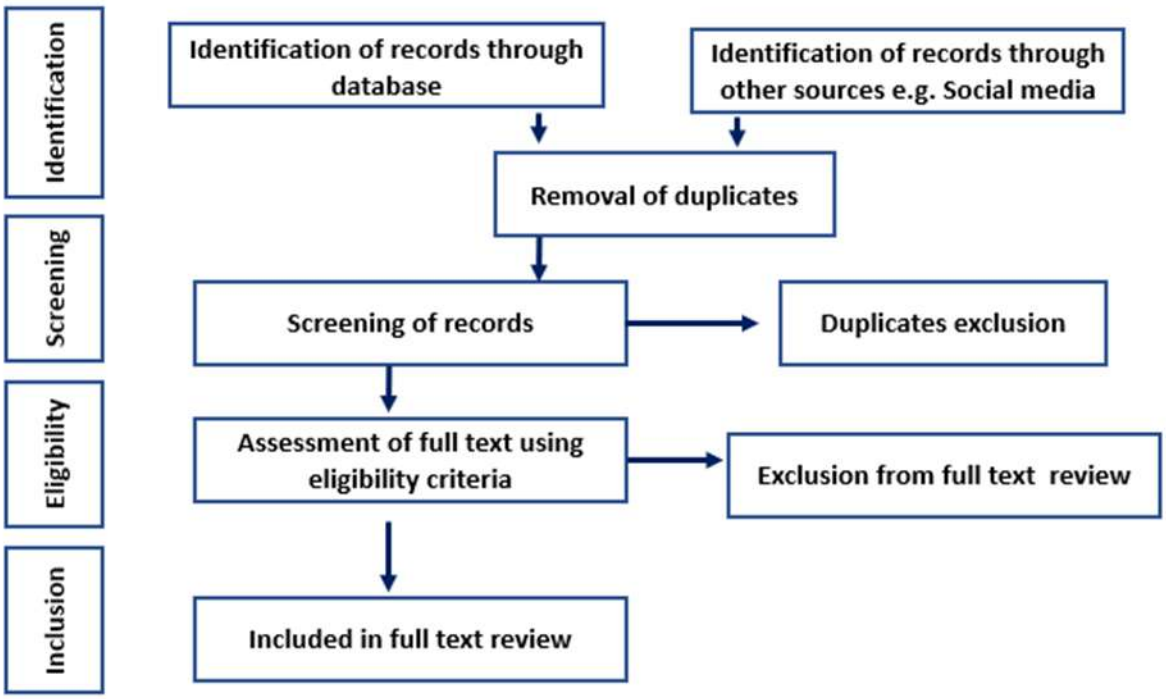

Figure 1: Literature Search Approach.

2.1 Identification of articles

The approach adopted are:

I. Literature search are peer-reviewed articles of preferably not more than 10 years.

II. Databases were searched by titles, abstracts, and keywords predetermined to be pertinent to the research questions combinations of the search terms listed in Table 2 while connected articles in reference lists were also included.

III. Given that the research question can be affected by trending and recent events, perceptions/views relevant to the issues on social media such as LinkedIn and twitter were also scooped. For instance, recent energy crises are said to be forcing people changing to eaten out to avoid high cost of energy bills.

Table 2: Literature Searches terms

IDENTIFIED ISSUES	PRIMARY SEARCH	AND/OR
Change in Dietary	Perception, consumer attitude, consumer preference, barriers, acceptance, reduction, motivation	Alternative protein, Plant protein, Meat replacer, Meat analogue, insect, meat, vegetable protein, laboratory meat, cultured meat, Algae, Novel protein, sustainable protein, plant-based, milk, plant milk.
Food waste reduction	Perception, consumer attitude, Consumer preference, barriers, reduction, acceptance	Food waste, food lost, food recycling, food bank, food recycling
Education	Perception, consumer attitude, consumer preference, barriers, acceptance	New technology, campaign, school, environmental education
Online food shopping	Perception, consumer attitude, consumer preference, barriers	Food shopping, online purchase,
Local food purchase	Perception, consumer attitude, consumer preference, barriers, participation	Local food market, direct food buying, local vegetable buying, local fruit buying, direct from farmer.

2.2 Screening, eligibility, and inclusion of articles

The search terms shown in Table 2 was used to identified relevant articles. Three steps were taken to screen these articles for relevance to our study. Duplicate articles were then removed. Studies outside UK and EU as well as those published on weak journals were also removed.

Table 3: Inclusion and exclusion criteria

Criteria	Data base
Inclusion Criteria	• Published in peer reviewed Journals in English Language • Qualitative or quantitative research. • Discussed as topical issues or thread on social media-LinkedIn and Twitter e.g. energy crises and home cooking • Studies evaluating identified issues.
Exclusion Criteria	• Abstracts or conference paper • Review articles. • Unrelated with social/behavioural issues. • Issues not related to perception of interest. • Studies outside UK and EU.

2.3 Literature review analysis approach

While going through screen literature, scooping of the data collection methods are carried out. Article are classified as qualitative, quantitative, or mixed method on the bases of approached used. Data analysis and interpretation methods as well as tools used were equally noted.

2.4 Reviewed articles

As noted in Figure 1, literature search with the PRISMA methodology involves four stages for the identification, screening, eligibility and inclusion of research materials.

During identification step, six literature databases were searched: Google Scholar, Semantic Scholar, PubMed, Web of Science, Springer, and Taylor & Francis. A combination of search items used are presented on the Table 2.

At this preliminary stage, 436 articles were identified. For the second phase of screening, areas pertinent to each of the drivers or barriers of interest were determined and evaluated by methodically reviewing each chosen paper. The number of initially selected articles was condensed by screening the article title and abstract for relevance and quality. Majority of the papers were removed due to their subject matter being unconnected to the study objectives. This screening removed 278 data sources. Finally, 158 articles were selected for full-text analysis, and their contents were summarised, studied and, if still relevant, detailed within the body of this review. The final number of papers reviewed in this paper was 87 papers and contribution of articles to each of the drivers are presented in the Figure 2.

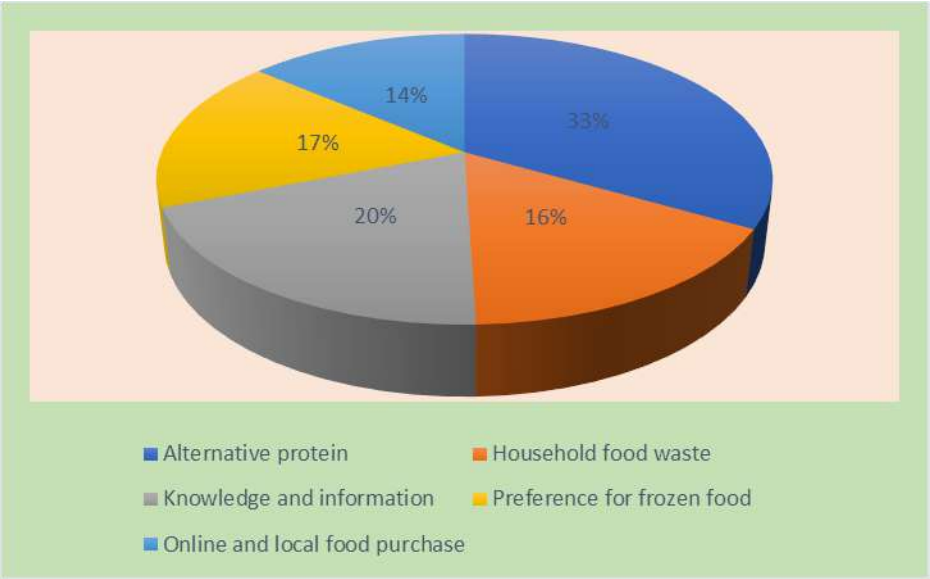

Figure 2: The contribution of the reviewed articles to the covered barriers

2.5 Perceptions, social and behavioural barriers to alternative protein

Increasing environmental, health and ethical concerns has led to increased interest on artificial protein. Meat and dairy foods, particularly beef, lamb, pork, and cheese result in 3-13 times more GHG emissions than vegetables and pulses while meat has been associated with increased risk of obesity and heart related diseases (Xu *et al.*, 2021). Besides, shifting in food choices towards alternative protein can contribute to 20% of the mitigation required to guarantee global warming does not exceed 2°C(European Commission, 2020).

This awareness results in pushing for a reduced consumption of animal related proteins. Beef consumption in EU is gradually reducing from 11 kg per capita in 2018 to 10.4 kg per capita in 2030. However, for sustainable consumption towards 2030, beef consumption should not exceed an average of 7 kg/capita/year from 11 kg/capita/year in 2018 while that of plant-based protein must increase(Nicolau *et al.*, 2021). Therefore, to encourage positive attitudinal change towards artificial protein (plant-based meat, cultured meat, insect, vegetable milk) etc, there is need to understand consumers' perception and motivation towards consumption of artificial protein (AP). These perceptions may be consumer specific (e. g., preferences, motivations), the product features (e.g., sensory attributes) and the presentation (e.g., how the meat alternative is framed) (Possidónio *et al.*, 2021). Consumer acceptance is anticipated to depend on a wide variety of factors ranging from technology, socio-cultural factors, environmental consciousness (Onwezen and Dagevos, 2024), health awareness, product familiarity(Malek and Umberger, 2023), etc. Thus, nudging, adequate

information, use of technology, policy, and social instruments (Carrington, Neville and Whitwell, 2010; Bekker *et al.*, 2017; Bryant and Sanctorum, 2021; Possidónio *et al.*, 2021) have been identified as tools that can encourage positive shift to AP consumption while lack of enough choices, high prices and insufficient information(Nicolau *et al.*, 2021; ProVeg International, 2021) pose barrier to dietary shift. Importantly, consumers acceptability of artificial meat protein varies with vegetable meat more preferred while insect protein is least accepted(Siddiqui *et al.*, 2022). Meanwhile, meat consumption has for long been culturally associated with power and masculinity and consumers largely are unaware of the relationship between livestock consumption and mitigation of climate change. A study indicated that only 12% of the Dutch and 6% of the US sample recognized the effectiveness of eating less meat in mitigating climate change and non-climate-friendly food choices associated with disbelieve in climate change (Niva, Vainio and Jallinoja, 2017). More so, the EU naming and labelling rules of plant-based products have been recognised as causing impediment to acceptability and commercialisation of some novel AP. For instance, some AP could have as much as 26 ingredients which must appear on label thereby creating confusion while documentation process is also tedious and time consuming (Lähteenmäki-Uutela *et al.*, 2021). Besides, there is currently no EU level insect food authorisation rule while only Netherlands and Belgium appear to have feasible laws on edible insects within EU (Mancini *et al.*, 2019). Summary of recent studies on AP are presented on Table 4.

Table 4: Perceptions to alternative protein

Perception studied	Study design	Sample characteristic	Main findings	Reference
Plant-base and cultured meat	Survey with 10,190 emails but 533 responses received. C = Italy	N = 533; Older participants-only 7.4% age 18-29 years	Willingness to purchase plant-based and cultured meat burgers are linked to age, sex, views of other food technologies, and attitudes towards the environment, and agriculture. Consumer preferences for meat, plant protein and cultured meat	Slade, P (2018); Escribano *et al.*, (2021)
Climate neutral milk	Focus group using choice experiments. C = Italy	N= 39 supermarkets rural and urban customers	Communication and information presentation is vital to consumer wiliness to pay for climate friendly food	Lombardi et al. (2017)
Meat consumption reduction using nudging	Field experiment C = Sweden	Two restaurants using nudging	Share of vegetarian lunches increase by 6% and treatment persists for long time.	Kurz, V (2018)

Attitude to plant-based protein consumption – flexitarian focused	Online survey, Austria, Denmark, France, Germany, Italy, Netherlands, Poland, Romania, Spain, and the UK)	N= 7590 age over 18	Willingness to eat less meat increasing (7% vegie, 30% flexitarian and 40% intend switching). Not enough plant-based choices (46%), too expensive and insufficient information	ProVeg International (2021)
Cultured meat and insect	A questionnaire-based study in a paper–pencil format. Germany	N = 718, children and adolescents aged 13.5 years.	Willingness to consume cultured meat higher than insect and food presentation has no influence.	Dupont and Fiebelkorn (2020)
Plant-based and cultured meat	Online survey, Belgium	N = 2001 (1000 per year) of national representative	AP more appealing to younger participants than old people. Acceptability of plant-based meat increased while that of cultured meat remain unchanged.	Bryant and Sanctorum (2021)
Plant-based meat alternatives	Online survey, Germany.	N= 1039	Acceptability of meat alternatives can be enhanced when they closely resemble highly processed meat products in taste and texture and are presented at competitive prices.	Dupont and Fiebelkorn (2020)
Alternative meats	Mixed method-survey and experimental. Portugal	n=138 participants, Nvivo for data analysis	Acceptability of alternative meat can be positively influenced by framing except insect protein	Possidónio et al. (2021)
Effect of different names for cultured meat.	Experimental recruited through Amazon MTurk,	N=185 participants were 57.8% male (42.2% female) and their ages ranged from 20 to 68	Associating meat with lab technology appears to be off-putting to many consumers	Bryant and Barnett (2019)
Impact of perceived naturalness	Experimental	N=6128	How cultured meat is described influences the consumers' perception.	Siegrist and Hartmann (2020)

and disgust on consumer acceptance of cultured meat				
Readiness to adopt insect meat	Web-based survey	N = 368 with binary logistic regression	Young adults with weak attachment to meat are more likely to adopt insect-based protein than older people. Male (12.8%) are more likely to adopt insect-based protein than female (6.3%)	Verbeke(2015)
Environmentally benefits of different sustainable diets	Online survey UK	N = 442, adults (66% female, 80% aged 25–54 years, 85% with higher education.)	Women are more likely to adopt sustainable diets than men. Food waste reduction, organic food consumption and purchase of locally grown food perceived more environmentally beneficial than plant-based protein consumption. Need to overcome gender stereotype as ethical consumption is considered feminine.	Culliford and Bradbury (2020)
Willingness to pay for insect-based protein	Web-based questionnaire. Greece	N = 451 consumers (52.11% female; age above 18)	Low willingness to pay for different insect-based products.	Giotis and Drichoutis(2021)
Older consumers' willingness to accept AP	Survey (UK, Spain, Poland, Netherlands, Finland)	N = 1825 Adults above 65 years	Acceptability of AP ranges from 58%; 20%; 9% and 6% for plant based, single-cell, insect-based And in vitro meat-based protein respectively	Grasso et al. (2019)
Children willingness to accept meat substitute.	Semi-structured interviews. Netherland	N = 34, Children age 8-10 years	Children opened to AP but communication about animal welfare, healthiness and environmental impact can enhance better acceptability	Pater et al. (2022)
Habits and perceptions of young meat eaters towards current and future protein alternatives	Online focus group. United Kingdom.	N=38. Young meat-eaters age (18-34)	Consumers acknowledge negative environmental impact of meat but there is knowledge gap on extent of the impact.	Ford et al. (2023)

Assessment of most promising protein source for meat alternatives	Online survey among Switzerland consumers	N= 916 using a using a professional panel provider for participant recruitment. Participants over 20 years old and over who identify as omnivores or flexitarians. Male = 448 Women = 465.	Potato, lentil, chickpea and pea are the most accepted alternative protein sources while Algae, insects and cultured meat are less accepted than plant-based proteins. Consumer acceptance of alternative protein depend on protein source.	Etter, Michel and Siegrist, (2024)
Knowledge and acceptance of algae	Focus group, United Kingdom	N=34	Consumers have limited pre-existing knowledge of algae as a food source but were open to trying consumption of algae as meat source	Mellor et al. (2022)
Framing for the protein transition	Consumer interventions and eight expert interviews. Netherlands	N = 8 + 62 consumer intervention frames	Market regulation and cultural interventions can significantly influence shift towards acceptance of alternative protein	Peeters et al. (2024)
Factors influencing intentions to consume cultured meat	Survey. Denmark, Finland, and Norway	N= 3862	Consumer with high level of food innovativeness is more likely to have positive intention towards cultured meat while social norms also play significant role towards adoption of cultured meat.	Engel et al. (2024)
Barriers and motivations to adopt alternative protein	Online survey; Australia, China and the UK	(N = 1,777); Australia = 503 China =785 UK = 489	Australia has the highest numbers of extremely unwilling consumers due to believe that meat is necessary for health and alternative protein are not as healthy as meat.	Ford et al. (2024)

2.6 Food waste reduction

Globally, food waste from households, retail establishments and the food service industry totals 931 million tonnes of which household food wastes is 570 million tonnes each year(Environment, 2021).

Besides, household food waste per capita is similar regardless of countries (high-, middle- or low-income countries). The carbon emissions associated with food waste production and distribution is 170 million tonnes of CO_2 (Katsarova, 2016).

The European Union targets a 50 % reduction in food waste disposal by 2020 and 50% reduction in food waste generation by 2030 from 2020 baseline (Tarja *et al.*, 2020). About 88 million tons of food is produced in EU worth (€143 billion) at 865 kg per person per year and 175 kg per person per year is lost and households accounts for about 53% of EU food waste (Tarja *et al.*, 2020). Therefore, for EU to achieve net zero emission food system by 2050, reduction of food waste at consumer end must be targeted using food recovery hierarchy involving avoid, reuse, recycle, reprocess, energy recovery and disposal to which behavioural change of consumers are very important.

An in-depth information of consumer knowledge, attitudes, and behaviours towards food waste is important for decision on evidence-based programs to promote sustainable food systems. Hence, a lack of localised knowledge of consumer food waste can inhibit roll out of place-based solutions that are locally relevant (Ahmed *et al.*, 2021). A study by Di Talia, Simeone and Scarpato (2019) indicated that consumers are largely unaware of the implications or environmental impact of food waste with 45.07%; 26.29% and 28.64% of respondents classified as non-aware, unaware but unwasteful and conscious consumers respectively. More so, family composition, habit, and level of education influences food waste, as younger families with higher education prone to waste more foods. Pro-environmental behaviour has also been found to positively contributes to consumer behaviour towards food waste recycling Vorobeva *et al.*(2022) suggest employment of financial incentives such as Pay-as-you-throw and Save-as-you-throw only boost system use for people with high pro-environmental behaviour. Many socio-demographic and psychological factors also determine consumer intention to avoid food waste. Thus, religious value and personal upbringing do represent strong antecedent to avoid food waste such that religious leaders and parents can be targeted in policy towards food waste reduction (Filimonau *et al.*, 2022).

Preference for exceptional aesthetic products, particularly fruits and vegetable, as well as legislation are also impediments to food waste reduction within EU and UK (Bravi *et al.*, 2020). However, recent increase in cost of living has led to consumers shifting focus towards wholesome but imperfect food products. For instance, sales of wonky vegetable lines have increased between 19.3% to 38% depending on products (Butler, 2022). More so, food sharing through food bank presents unique opportunities for food reuse. However, participants on these schemes are stereotypically associated with poverty with the believe that food banks are meant for Tax Credit claimants, disability, and unemployment people (Thompson, Smith and Cummins, 2018). Therefore, the misconceptions result in pressure from families and friends to discourage people from participating in food banking. Notwithstanding, according to the European Food Bank Federation usage and demand for food bank recently increase by 30% but mainly due to food insecurity rather than environmental concerns (European Food Banks Federation, 2022).

Some of the recent studies on consumer perceptions to food waste is presented on Table 5.

Table 5: Perceptions on food waste

Perception studied	Study design	Sample characteristic	Main findings	Reference
Consumer behaviour types towards food waste	Qualitative via computer aided interview. Italy	N=231 18-65	Consumers largely unaware of impacts of food waste	Talia et al. (2019)
Consumers attitude to food waste.	Survey	N = 512, Male 41% and female 59%	Family composition, habit, and level of education influences food waste	Marangon et al. (2014)
The role of financial incentives and pro-environmental behaviour	Survey Portugal	N = 400	Pro-environmental behaviour influences willingness to adopt food waste management strategy regardless of financial incentives	Vorobeva *et al.* (2022)
Role of socio-demographic and psychological factors in avoiding food waste	Survey	N=566	Religious value and personal upbringing do represent strong antecedent to avoid food waste	Filimonau et al. (2022)
Knowledge and perception of food waste among German consumers	Online survey using factor analysis	N = 1023 pre-set quotas for age, gender, region and income.	Perceptions or knowledge on food waste differ among different consumer clusters-guilty, careless and unwitting food wasters. Different strategies for change of attitude.	Richter. (2017)
German Consumer Behaviour on Food in Chilled Storage	Online survey	N= 2666 respondents	Consumer has high awareness of food safety but poor storage awareness. Raising awareness of storage climate parameters is a tool for nudging	Wucher et al. (2020)

			consumers into lower rates of food waste.	
Food waste reduction practices within retail sector	Interviews	N= 12 Managerial actors and food bank	Retailers are reluctant to include virtual impaired agricultural produce partly due to consumer perceptions and strict EU rule	Hermsdorf et al. (2017)
Factors influencing food waste among young consumers	Online survey with explanatory analysis with deductive methods in UK, Spain, and Italy	N= 3323; sample population aged between 18 and 35 years	In-store behaviour and food waste management at home important to food waste reduction with leftover usage having great impact	Bravi et al. (2020)
Extended theory of planned behaviour for food waste reduction prediction	Prospective survey-based design	N = 279	An extended theory of planned behaviour model is capable of predicting motivation but to a lesser extent behaviour towards fresh fruits and vegetable waste reduction.	Graham-Rowe et al. (2015)
Environmentally benefits of different sustainable diets	Online survey UK	N = 442, adults (66% female, 80% aged 25–54 years, 85% with higher education.	Younger adults are more likely than older consumers to waste food due to concerns over freshness, improper storage and excessive purchasing while older consumers may also have greater skill and knowledge to plan meals and use leftover food.	Culliford and Bradbury. (2020)
Challenges of food bank participants	Interview UK	N= 42	Food bank participation associated with poverty and deprivation	Thompson et al. (2018)

Food waste as the consequence of competing motivations, lack of opportunities, and insufficient abilities	Focus groups in Germany, Hungary, the Netherlands and Spain.	24 focus groups-6 focus groups per country with 6–8 participants per group between February and March of 2016.	Household food waste is the unintended result of balancing multiple competing goals	Farr-Wharton, Foth and Choi (2014)
Food prices and changing in consumer behaviour	Paper and online Survey.	N =146 Females -53% and 47% male.	Food prices significantly impact awareness of the importance of food.	Sacho et al. (2023)
How consumer behaviour in daily food provisioning affects food waste	An online survey of Dutch consumers who are in charge of daily food management	211 consumers.	In-store purchase behaviour is the main driver of household food waste and age has diminishing impact on food waste.	Janssens et al. (2019)
Mitigation of Plate Waste Behaviour in Restaurants	Secondary sources collected from academic journals, newspapers, and case studies	Secondary sources	Awareness, food quality, environmental concern, attitude, and subjective norms system affects consumers' intention to reduce food waste in restaurants.	Salins and Aithal (2023)
Consumers in Food Waste Campaigns	Analysis of visual food waste campaign material published in Finland and in Sweden	Virtual waste campaign analysis	The underlying assumptions of consumer must be critically evaluated for effective food waste campaign strategy.	Sutinen (2019)
Evaluation of behaviours causing expired domestic food waste	Romania		Supply knowledge, location knowledge and food literacy are factors influencing food expiring at home.	Farr-Wharton, Foth and Choi (2014)

2.7 Knowledge and Information

Behaviour change approaches are predominantly persuasion and information. With increasing knowledge of consequences of inactions, acquisition of right skills, and enabling environment consumers may be persuaded towards pro-environmental behaviours (Chen, 2015; Yuriev *et al.*, 2020). For instance, according to the Food Standard Agency, consumers are largely ignorant (Smithers and correspondent, 2016) about how to safely freeze food within the UK and this is contributing to the annual 7-million-tonne household food waste in the UK. However, a study by Quested et al. (2011) suggested given the right interventions such as clear labelling and consumer communications, household food waste can be reduced by 20-30% within UK (Quested *et al.*, 2011).

One of the unconventional areas where consumers are picking information is social media. Globally, above 2.8 billion people use social media with 88% of active users aged 18 to 29 years. Thus, social media (SM) is now driving decision behind consumers food choices (Zhang *et al.*, 2022) and SM especially Instagram has been accused of distorting (Steils and Obaidalahe, 2020) consumer perceptions by presenting fresh food as the only healthy and nutritious option. Importantly, the highest negative perceptions of frozen foods are found among millennials who take food choice inspirations from SM (BirdsEye Limited, 2018). Recent research on usefulness of consumer communication and knowledge on sustainable food choices is presented in Table 6.

Table 6: Recent studies on knowledge and communications on sustainable food

Perception studied	Study design	Sample characteristic	Main findings	Reference
Role of financial incentives and pro-environmental behaviour in household waste management adoption	Survey Portugal	N= 400	Empowerment plays a vital role in adopting an innovative waste	Vorobeva *et al.* (2022)
Attitude behavioural gap on in-store food choice	Interview Denmark	N = 12	Communication can encourage consumer shift towards organic food	Aschemann-Witzel et al. (2014)
Edible insect acceptability	Experimental Belgium	N = 189	Older people above 45 years are more opened to novel insects' meal than young adults. Willingness	Caparros et al. (2014)

			associated with knowledge.	
Investigation of factors that induce rural households to food waste	Face-to-face interview Italy	N =213 31% men and 69% women	Consumers mainly age 45-54 years have no knowledge of food waste implications	Talia et al. (2019)
Impact of information and communications on consumer's attitude toward climate neutral fresh milk	Focus group Italy	N=39 50% rural resident 50% urban resident 60% women 40% men	Communication could play major role towards adoption of sustainable foods	Lombardi et al. (2017)
Influence of social media on sustainable food consumption	Survey, Italy,	N = 162 Male -46.3% , female 53.7% Age – 18-34 years = 49.38%; Age - 35-54 years= 35.19%	Information from social media is linked to non-sustainable food behaviour	Simeone and Scarpato (2020)
Sustainable food consumption behaviour in the social media through the lens of information diffusion	Semi-structured interviews United Kingdom	24 interviews	There is link between the integrated strategy of acculturation and information diffusion on social media, which influences acculturation to sustainable food consumption behaviour among social media users.	Choudhary et al. (2018)
Social media and eating behaviour	Germany	N = 499	The more participants identified with their peers, the more their own eating was aligned with the healthy eating ascribed to a popular peer.	König et al. (2018)
Cultured Meat on the Social Network Twitter	Czech Republic	Analysis of 36,356 Tweets	The value proposition of cultured meat (clean meat, future food,	Pilařová et al. (2022)

		posted by 4128 individual users	sustainable food, alternative protein) on social media, which shapes the prejudices and perceptions of future consumers about cultured meat.	
The coverage of cultured meat in the US and UK traditional media	United Kingdom and US	Content analysis of 255 articles from 12 US and UK traditional media from 2013 to 2019	Positive narratives about cultured meat are more prominent than cautionary ones on analysed print media	Painter et al. (2020)

2.8 Preference for frozen food

About 1.3 billion tonnes of edible food is thrown away globally every year. Most of that food (61%) could have been eaten if properly planned, stored, and managed. With projected increase in global population, finding ways to combat food waste is of the utmost important. Meanwhile, food freezing as form of preservation extends food shelf life while also offers built-in opportunity to optimise utilization of food for scheduled consumption. Research has demonstrated that frozen foods results in 47% less household food waste than fresh food categories (Martindale, 2014, 2017). More so, literature suggests there is an increase of preference for frozen food consumption mainly being driven by perishability, price, preference and stretching of shopping frequency. For instance, among American consumers, while fresh food sales increased by 10% in 2021; frozen food sales increased by 21% with 30% of consumers increasing freezer capacity (Renner *et al.*, 2021) while frozen vegetable purchase also increase by 10% in the UK compared to 6 % sales rise recorded for fresh vegetable (Linsell, 2022). A similar trend was observed in Italy where about 54% of consumers have increased consumption of frozen food especially among young people and families with young children (European Supermarket Magazine, 2022). However, this was possibly associated with experience of Covid-19 pandemic lockdown which led to changing of perception.

However, the change in perception is purely driven by cost savings due to increased cost of energy and food stuffs. Despite the increase trends, supermarkets are not likely to increase frozen food space due to higher profit margin on chilled foods and increased running cost of freezers (Linsell, 2022). Can increase preferences for frozen food be sustained? What if cost of energy goes down and inflation rate normalised? What are the berries to frozen foods adoption within EU and UK?

A recent study between Albanian and Kosovo consumers suggested more preference for fresh food than frozen foods (32%) (Hasani *et al.*, 2022). The perception is attributed to lack of trust in food safety institutions within the countries while consumers also expressed concerns over safety of imported frozen foods due to lack of information on integrity of supply chain. Importantly, Albanian consumers are even willing to pay above baseline price for fresh foods compared to Kosovo consumers. Mores so, a study across eight EU countries indicate consumer preference for fresh fish due to perceptions that fresh fish is healthier compared to frozen or prepared fish (Vanhonacker, Pieniak and Verbeke,

2013). Consumers rated frozen fish higher in other metric such as availability, cheapness, and quality except for Romanian consumers who rated frozen food poorly. However, habit and traditions were found to have influence on perceptions.

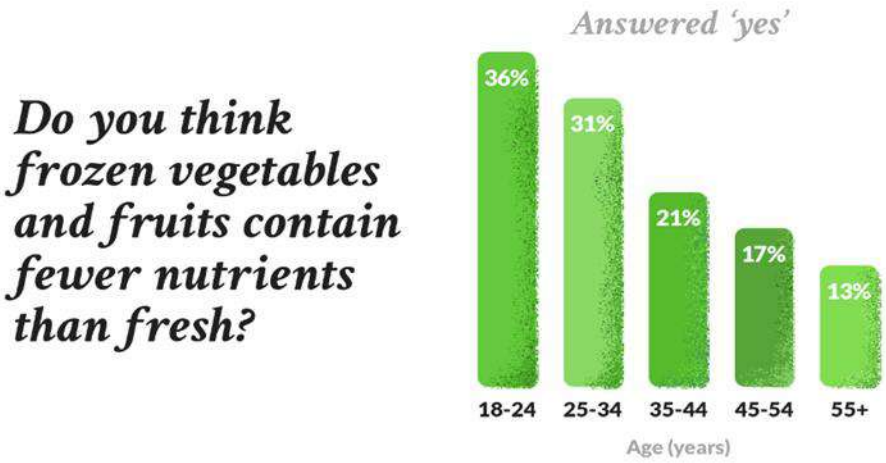

Figure 3: UK consumers perceptions on frozen foods (Birdseye Limited)

Portuguese consumers also show preference for frozen foods (FFs) as indicated on the frequency of purchase (Gonçalves *et al.*, 2021). While fresh foods are purchased weekly, the frequency of frozen food is monthly. More so, about 94.2% of Portuguese consumers believe fresh product to have better nutritional and textual quality than frozen foods but prefer frozen foods for preservation capacity and longer shelf-life. This is like the public perceptions on FFs in the UK. Except ice cream and desserts, UK consumers especially young adults (48% age 16-24 and 42% age 25-34) consider FFs as inferior. However, the study shows older consumers appear to have positive perceptions of FFs as only 19% age 55 years and above rated FFs inferior. Meanwhile, a recent survey indicated 9% rise in purchase of FFs amongst millennia households (BirdsEye Limited, 2018) but this is mainly driven by convenience and lifestyles while majority are still poorly educated on nutritional quality of FFs as indicated on Figure 4.

Below are some recent studies on public perceptions on frozen food adoption.

Table 7: Recent studies on public perceptions on preference frozen food

Perception studied	Study design	Sample characteristic	Main findings	Reference
Perception on Quality and Safety of Frozen Foods	Survey + focus group Albania and Kosovo	N=380 participants aged 18-64	More preference for fresh food due to lack of trust in food safety institutions and poor information level	Hasani et al. (2022)
Investigation of consumers' perceptions and barriers to fresh,	Survey across 8 EU countries	N= 3,213 65% female and 35% male predominantl	Fresh fish perceived as most healthy	Vanhonacker et al. (2013)

frozen, preserved, and ready-meal fish products.		y living in small towns		
Portuguese consumers perceptions on frozen food products	Online survey Portugal	N= 136 individuals, all adult	About 94.2% believe frozen food has better nutritional and textual quality while 53.2% only prefer it for preservation and shelf-life.	Goncalves et al. (2021)
Public perception of frozen food products	Online survey UK		Young adults predominantly rated Ffs as inferior while older consumer have positive perception of FFs	Trenda (2022)
Extrinsic Cues and Consumer Judgments of Food Product Introductions	Survey and factorial experiment Norway	N = 348 Adults	Extrinsic cues corporate social responsibility, endorsement, and country of origin have positive and significant effect on purchasing intention of frozen chicken fillet	Hansen and Sallis (2011)
Consumers impact on food quality under frozen conditions in Germany	Survey Germany	N = 2053 Age 18-69	Older consumers more efficient towards quality storage and handling habits of frozen food	Kolzer et al. (2020)
Consumption of salmon within EU	Consumer focus groups and 38 semi-structured expert interviews	N=160 for focus group (40 per country) and 38 for expert interview	Culture, family traditions, gender, age, habits, marketing and even regulations, play a significant role in salmon consumption decision processes.	Nicolau et al. (2021)
Relationship between childhood exposure to nature and pro-environmental behaviour	Survey New-Zealand	N= 230 (Adults 18-25, female (68.3%) and male (31.7%).	Time spent in connectedness with nature as a child does not influence positive pro-environmental behaviour, but adulthood time spent in	Van Heezik et al. (2021)

			connection with nature does.	
Restorative experience and pro-environmental behaviour in children	Survey Spain	N= 832 Children 6-12 years, male (86%), girls (14%)	Positive experiences in nature, especially restoration and fascination are motivation factors for pro-environmental behaviour in children	Collado and Corraiz. (2015)
Ecological awareness and pro-environmental behaviour in children	Survey Spain	N=1406 Children age 6-13 years	Experience and contact with nature promote pro-environmentalism in children.	Corraliza et al. (2019)
Consumer Perspectives on Processing Technologies for Organic Food	Focus group with Germany and Switzerland consumers	9 nine focus group including 5 in Germany and 4 in Switzerland. Participants were 50% between 18 and 45 years and 50% between 46 and 75 years of age.	Consumers have limited knowledge about organic food processing technologies but were attracted to their benefits.	Hüppe and Zander (2021)
Consumer acceptance of cultured meat	Italy; Web-based survey.	490 consumers	Lack of information and scepticism are major barriers to consumers acceptance of cultured meat. Thus, information and education on new food are suggested.	Palmieri et al. (2021)
Willingness to consume insects among students in France and Ireland	France and Ireland Online survey	N= 183 participants (France: n = 103; Ireland: n = 80)	France consumers (43.7%) are more positive than 21.3% from Ireland.	Ranga et al. (2024)
Consumer knowledge gaps and behaviour	Online survey Germany	N =2,053	Older consumers are more efficient towards quality storage of frozen food while knowledge	Kölzer et al. (2020)

on handling of frozen food			gap exist among young adults.	
German Consumer Behaviour on Food in Chilled Storage and reduction of food waste.	Online survey Germany	N = 2666 respondents.	Consumers had a high awareness of food safety, leading to short storage durations but the storage features on climate-controlled compartments are relatively unknown among German consumers.	Wucher et al. (2020)
To what extent does country-specific contexts and degree of scientific knowledge influence seafood purchase behaviour of consumers across Europe	Interactive poster surveys and 40 semi-structured interviews. Germany, Belgium & Spain	N = 383	Increased scientific knowledge does not necessarily lead to change in sustainable purchasing behaviour. Inadequacy of clear and accessible information seems to be a major barrier to social acceptance of sustainable seafood products in Europe.	Petereit et al. (2022)

2.9 Perceptions Social and Behavioural Barriers to Online Purchase of Food

Consumers are appreciating the convenience of being able to shop anytime, anywhere, accessibility to wider range of products, prices comparison and sharing of opinion on goods with other consumers. Hence, changes in consumer behaviour towards convenience and impacts of Covid-19 lockdown which forced people to shop online and become "new normal" have been seen as drivers of changing shopping habits. As a result, demand for last-mile delivery is rising and is projected to grow by 78% globally by 2030 (World Economic Forum, 2020) while 100 biggest cities in the world takes 36% of the increment. The food delivery services impact the environment in two major ways- waste (particularly packaging) and emissions. Under the current delivery practice, carbon dioxide emissions from delivery traffic would rise by 32%; traffic congestion will increase by over 21% resulting on extra 11 minutes of commute time per passenger per day (World Economic Forum, 2020). However, measure of road density and proximity of last-mile delivery services to regional warehouse are influential variables that can reduce impacts of delivery services (Wygonik and Goodchild, 2018).

Across EU countries, the share of e-shoppers among internet users is increasing, with the highest proportions seen in the youngest age group 16-24 (80 %) while 79% of those in the age group 25-54 are also e-buyers. Netherland (89%) has the highest percentage of e-shoppers while Bulgaria has lowest in the EU with only 33% of internet users purchasing items online (EUROSTAT, 2022) Among the e-buyers, food item is the second most popular items being purchased online across EU as indicated in Figure 4.

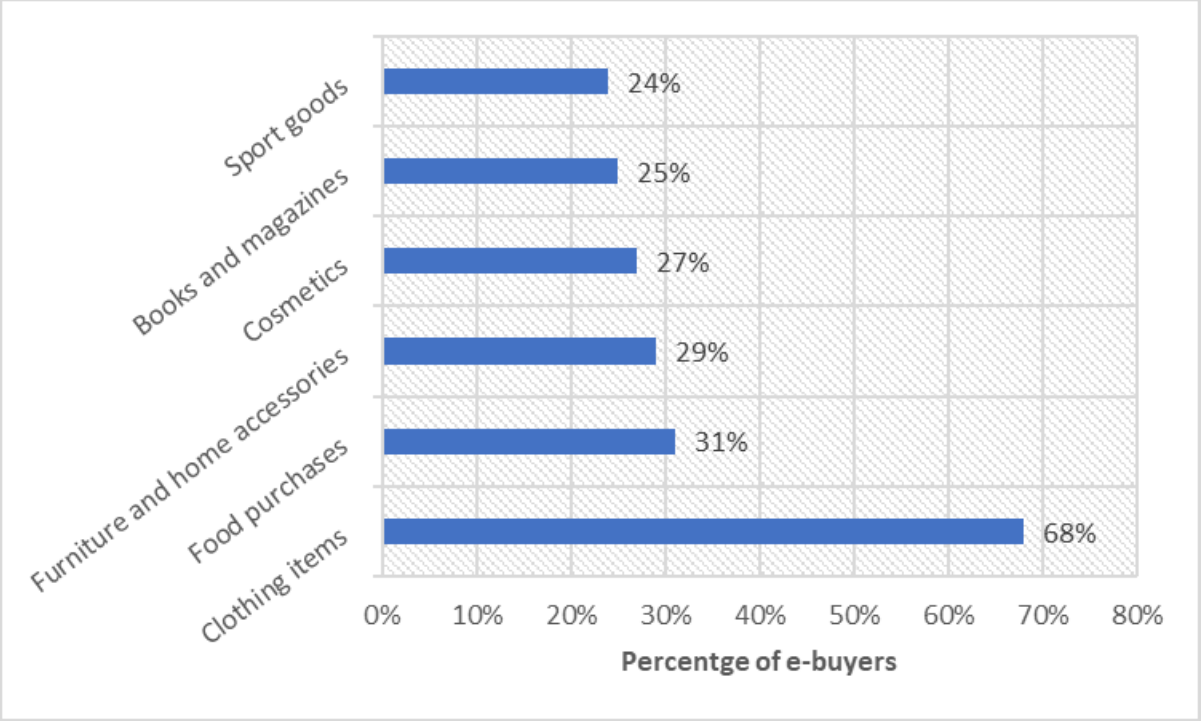

Figure 4: Percentage of e-buyers. Source (EUROSTAT, 2023).

Notwithstanding, compared to shopping under bricks-and-mortal, online shopping has been found to be more environmentally sustainable depending on food type and means of last-mile transportation. Using activity-based methodology to evaluate the environmental impacts of food shopping approach (Siragusa and Tumino) (Siragusa and Tumino, 2022) observed a 10% to 30% reduction in last-mile emission associated with food delivery. More so, compared to food shopping with personal car, it has been suggested that online food shopping reduces shopping related travelling distance by 54– 93% while emission is reduced by 18–87% depending on food type (Wygonik and Goodchild, 2018; Jaller and Pahwa, 2020).

In terms of sales value, online purchase of food items is slower compared to other sectors. For instance, there has been slower growth in online sales within the food sector as online sales (as proportion of all retailing) has remained around 5% since late 2016 (Office for National Statistic, 2021). This is largely due to payment security; online ordering problems; preference to see product and brand loyalty; short shelf life with delayed delivery at the expenses of buyers; missing, damaged or deliveries of near expired products and expensive delivery charges(Williams, 2019).

A recent study by Gruntkowski and Martinez (Gruntkowski and Martinez, 2022) among German consumers indicated that, despite positive push from Covid-19 experience, the perceived risk and mistrust still have negative influence on online grocery purchase intention. More so, extensive price competition from discount companies does force food retailers to lower price. This denies food retailer opportunity of passing extra online logistic costs to the consumers. Thus, German food retailers only operate with 1% profit margin compared to 5% and 6% in France and Netherlands respectively (Grant, Fernie and Schulz, 2014). Importantly, about 60% of consumers from Italy and United Kingdom express concern with tangibility of online food products while 55% perceive product quality as unsafe. Some of the recent studies on online shopping are presented in Table 7.

Table 8: Recent studies in online shopping

Perception studied	Study design	Sample characteristic	Main findings	Reference
Perception on online grocery shopping	Online Survey Germany	N= 402 (68.2% aged 20–25; 9.7% aged 36–49; 19.1% aged 50–65) c	Perceived risk still high among consumers and negatively influence online grocery purchase intention.	Gruntkowski and Martinez. (2022)
Enablers of online food sales	Case studies and interview Germany	N=18	Competitiveness and perceived unsafe products quality impede growth of online food retail	Grant et al. (2014)
Consumers perceptions on E-Commerce	Online survey EU countries	N= 21,657	Perceptions of risks still holds consumers back from online transactions	Cardona, Duch-Brown and Martens (2015)
Influence of Covid-19 experience on online purchase intention.	Online Survey Portugal	N=358 Male-31.8% Female-68.2%	Covid-19 experience, and sociodemographic factors have positive impact on online purchase intention	Gomes and Lopez (2022)
Online shopping in UK	Online survey United Kingdom	N=261	Consumer trust and confidence have positive influence on online shopping	Ramachandran, Karthick and Kumar (2011)
Situational factors influencing adults online shopping	Mixed method Online survey and interview	N= 215	Mobility and distance to a store are the most significant situational factors influencing older adults to buy groceries online.	Kvalsvik. (2022)
Influence of Covid-19 lockdown on changing consumer behaviours	Online survey (Italy, France, Germany, Spain, UK)	N = 5,232	Above 60% of EU consumers have experienced change in consumer behaviour towards online purchase triggered by covid-19	Herbert et al. (2021)
Online shopping behaviour of individual customers.	Self-administered questionnaire distributed via	N= 213. Female = 57.3%; male = 42.7%.	Age and income level considerably influence online shopping experience while marital status and income level	Braimllari and Nerjaku (2021)

	email to 400 consumers Albania	About 55.4% were 18- 24 years old and 26.8% were 25-35 years old.	influence the frequency of online shopping	
Influence of Covid-19 on online shopping behaviours of young adults from developed and developing countries.	UK, Netherlands, US and Germany	N= 515 and 117 young adults from developed and developing countries.	Consumers expressed solid intention to buy goods online with a home delivery option as the safer purchase channel compared with in-store shopping.	Rossolov et al. (2022)

2.10 Summary of literature survey and unanswered research questions

1) What are the perceptions, social and behavioural challenges towards adoption of AP in EU?
    a) What is the acceptance level of AP across EU countries?

Knowns from literature review

- Beef consumption in EU is gradually reducing.
- Belief in the effectiveness of eaten less animal protein for climate change mitigation is low.
- Vegetable-based protein is most acceptable, follow by cultured meat while insect is the least accepted.
- In Europe, about 48–74% of consumers are identified as omnivores, 20–42% as flexitarian while only 6–14% as vegetarian or vegan or pescetarian (Michel, Hartmann and Siegrist, 2020; Morach *et al.*, 2021; ProVeg International, 2021). The proportion also differs across countries.
- The presentation, communication, and information clarity can enhance acceptability of AP.
- Framing could be explored as option to push for AP acceptability.

Unknown from literature review

- The acceptability of AP among school children across EU country relatively unknown across EU countries.

    b) Are there any socio, cultural or behavioural barriers to acceptance of AP within EU?

Knowns from literature review

- Prices, food purchasing habits, product availability, perceived personal benefits, and policies are the factors that have influence on European citizens' willingness to change their diet.
- Age and sex are linked to the willingness to purchase AP. Women and young adults more likely to adopt AP than men and older consumers respectively.
- Lack of enough AP food choices, high prices and insufficient information are barrier to AP acceptability across the EU.
- Meat consumption culturally associated with masculinity and power and serves as barriers to men adoption of AP.
- The aspects most often mentioned as a motivation for rejecting insects in addition to disgust are appearance, odours, and taste.
- Lack of practice and knowledge in preparation are major barriers to consumption.
- Besides, communication about animal welfare, healthiness and environmental impact of AP can enhance positive perception towards AP.

Unknown from literature review

- How often do people consume AP?
- Will people still prefer meat if AP have similar taste and affordability with meat?
- Do people know benefits associated with AP?
- What do we need to change perception of people on AP?

c) Cultured meat and insects have great prospects but have low acceptability among EU consumers.

Knowns from literature review

- Acceptability of meat and insect-based protein are low compared to plant-based alternative protein.
- Nudging with adequate information, use of technology, policy, and social instruments can be used to encourage positive shift to AP consumption while lack of enough choices, high prices and insufficient information pose barrier to dietary shift.

Unknows from literature review

- Can nudging work as push for AP in the EU? What are consumers expectations about these 2 AP?
- Are there differences on motivation to adopt AP across demographic strata within EU?

2) What are the perceptions, social and behavioural challenges towards reduction of households' food waste across EU?
    a) Are there social or behavioural barriers to food waste reductions in EU?

Knowns from Literature reviews

- EU consumers (45.07%) are largely unaware of the social and environmental implication of food waste.
- Family composition, habit, and level of education influences food waste.
- Younger families with higher education tend to waste more food due to lifestyle.
- Religious values and personal upbringing influences tendency to avoid food waste.
- Preference for aesthetic quality products is a barrier to food waste reduction.
- Young adults have more concern over freshness than older consumers and tend to waste more food.
- EU legislation on food wholesome requirements is an impediment to food waste reduction

Unknows from literature review

- Are consumers really aware of the frequency of their households' food waste?
- Is the primary reason for food waste same across consumers demography and across EU consumers?

    b) What do EU citizens know and think of food waste?

Knowns from Literature reviews

- Knowledge on food waste differ among different consumer clusters.
- There is poor food storage awareness among consumers.
- Leftover food usage has great impact on food waste reduction but knowledge on leftover reuse is low among young consumers.

Unknows from literature review

- What proportion of EU consumers use leftover food?
- What are the motivations for using leftover food?

    c) Social pressure especially from family is preventing people from participating in food bank as this is seen as food of poor.

Knowns from Literature reviews

- Participation in food banking is associated with poverty and deprivation.

- Demand for food bank increases by 30% mainly from food insecurity not for environmental consideration.

Unknows from literature review

- What do EU consumers think of participation on food bank?
- What proportion of EU households have detail understanding of correct storage of food?

3) What are the perceptions, social and behavioural challenges towards adoption of pro-environmental behavioural knowledge within EU?

Knowns from literature review

- Is there any impediment to the adoption of new technology/skills within EU?
- Poor consumer information/ knowledge on safe storage of frozen food contributing to food waste.
- With clear labelling and consumer communications household food waste can be reduced by 20-30%.
- Social media has become source of food choice inspiration by EU consumers especially millennia consumers.
- Willingness to consume insect-based protein by older people associated with knowledge.

Unknows from literature review

- What do we think of media campaigns within EU and What percentage of EU consumers make food choices decisions based on social media?
- What skills are required for consumers to avoid food waste?

4) What are the perceptions, social and behavioural challenges towards adoption of frozen foods in EU?

Knowns from Literature reviews

What is the citizens acceptability of frozen foods across EU?

- Frozen foods results in 47 % less household food waste than fresh food categories.
- Consumption of frozen foods is increasing among consumers being driven by increasing cost of living.
- Preference for fresh food is higher than frozen food.
- Fresh food perceived to be healthier than frozen food.

- Habits and tradition influence perceptions on frozen foods across EU.
- Young adults consider frozen foods inferior.

Unknows from literature review

- There is recent surge in acceptability of frozen food. Is this accidental due to rising cost of living? Would the trend continue if economy stabilise?
- What's the trend in FFs acceptability along demographic strata of EU and UK?

The knowns and unknowns of the research questions as detailed on literature have been highlighted above. The theoretical models which underpin behavioural change e.g. towards embracing pro-environmental behaviours are discussed below.

2.11 Theoretical Overview

Perception is the way we sense the outside and become aware of happening around us. From Social Science view, Perception is "the process of attaining awareness or understanding of sensory information and it emanated from the Latin words perception, *percipio*, and means receiving, collecting, action of taking possession, and apprehension with the mind or senses". According to Ou (2017) perception involves three stages: selection, organisation and interpretation. The human system is confronted with millions of information daily; information of interest is selected, and organised into meaningful pattern, before being interpreted to attach meaning to the selected stimuli. Importantly, interpretation of selected stimuli is usually guided by cultural background and life experiences.

"Culture provides us with a perceptual lens that greatly influences how we interpret and evaluate what we receive from the outside world" (Samovar et al., 2000, cited in Ou, 2017, p. 57). Therefore, different experiences and background make people ascribing dissimilar meanings to same stimulus leading to perception diversity. Hence, in the process of attributing meaning to stimuli, people with similar cultural background will possibly attribute same meanings to the same stimulus resulting in similar perceptions to issues such as pro-environmental behaviours. Pro-environmental is defined as "behaviour that minimizes the negative impact of one's own behaviour on the environment and do those behaviours that benefit the environment"(Kollmuss and Agyeman, 2002; Steg and Vlek, 2009).

However, the following (Table 8) have been extensively used in understanding perceptions towards pro-environmental behaviours:

Table 9: Pro-environmental behaviour theories

Theoretical types	Theories
Theoretical exploration	Value-believe-norm theory
	Behavioural theories related to pro-environmental context
	Pro-environmental behaviour decision model
Theoretical Development	Psychological theory
	Sociological theory
	Economic theory
Theoretical integration	Combination of rationality and sensibility
	The combination of external and internal triggers

Source: (Kollmuss and Agyeman, 2002; Tian and Liu, 2022)

2.11.1 Theory of Reasoned Action(Kwon and Silva, 2020)

The theory of Reasoned Action explains relationship between attitudes and behaviours within human action. It predicts how individuals will act based on their pre-existing attitudes and behavioural intentions and assumes that the decision of an individual to engage in a behaviour will be based on their expected outcome from performing such behaviour (Bleakley and Hennessy, 2012).

The theory of reasoned action tries to elaborate and predict the behavioural intentions. The components which construct theory of reasoned action are Behavioural Intentions (BI), Attitudes (A), and Subjective Norms (SN). The theory suggests that a person's behavioural intentions will be depending on his attitudes and Subjective norms. That is BI = A+SN.

It was derived from the theory from previous research in social psychology, persuasion models, and attitude theories. The guiding principle is that the intention to perform a certain behaviour precedes the actual behaviour (Octav-Ionut, 2015). Figure 5: Theory of reasoned action suggests that stronger intentions result in increased effort to carry out the behaviour, which also increases the chances for the behaviour to be performed.

Guiding Concepts

Behaviour: behavioural intention is the main motivator of behaviour, while the two key determinants on behavioural intention are people's attitudes and norms.

Attitude: a key determinant of behavioural intention and an indication of how people feel towards a particular behaviour. The theory specifies that there is a direct relationship between attitudes and

outcomes, such that if one believes that a certain behaviour will lead to a favourable outcome, then one is more likely to have a positive attitude towards the behaviour and vice versa.

Behavioural belief

Behavioural belief allows us to understand **people's motivations** for their behaviour in terms of the behaviour's consequences e.g. eating less meat is good for the environment

Evaluation: people perceive and value the potential outcomes of a performed behaviour. Such evaluations are conceived in a binary "good-bad" fashion-like manner.

Subjective norms: Society acceptability of behaviour. It is the perceived social pressure. Subjective norms are also one of the key determinants of behavioural intention and refer to the way perceptions of relevant groups or individuals such as family members, friends, and peers may affect one's performance of the behaviour.

Normative belief: Reference group approval of action.

Motivation to comply: Motivation to comply addresses the fact that individuals may or may not comply with social norms of the referent groups surrounding the act

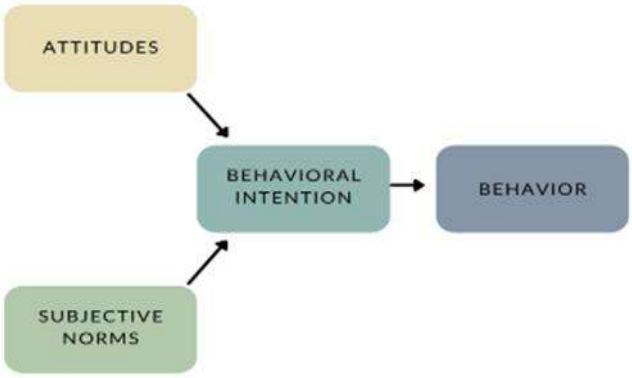

Figure 5: Theory of reasoned action

2.11.2 Theory of Planned Behaviour

TPB widely applies an expectancy-value model of attitude-behaviour relationships, and it has recorded various degree of success in predicting varieties of behaviours. It describes the determinants of an individual's decision to exhibit certain behaviours (Octav-Ionut, 2015).

It links beliefs to behaviour and postulates that attitude, subjective norms, and perceived behavioural control, together shape an individual's behavioural intentions. TPB has been applied to studies of the relations among beliefs, attitudes, behavioural intentions, and behaviours in various human domains (Yuriev *et al.*, 2020).

The Theory of Reasoned Action and Theory of Planned Behaviour as well as those elaborated in the Table 9, have been extensively used to explain consumer related issues such as household food waste reduction, participation in recycling, motivation or preference for frozen foods, etc.

2.12 Behavioural science data collection and analysis approaches

The research methodology approaches commonly found in the literature are qualitative, quantitative, or mixed methods(Terrell, 2015). These three methodologies have been reported for various investigations on behavioural science. However, the predominantly used method is quantitative research methods. Previous reviews of studies on application of behavioural theories indicated that between 91%-97% use quantitative while 3%-9% adopt quantitative research approach (Kwon and Silva, 2020; Ulker-Demirel and Ciftci, 2020). However, it is pertinent to note that these two approaches are expansive rather than being dichotomic. The research studies that seem to adopt a qualitative method often use statistical methods to analyse text or image-based data by coding words or characteristics into groupings (Prosman, Scholten and Power, 2016; Denehy *et al.*, 2017). Besides, the research works that appears to adopt quantitative methods usually include qualitative survey questions which are categorical or short answers, especially with regards to the questions related to "why" and "how"(Claudy, Peterson and O'Driscoll, 2013; Wolske, Stern and Dietz, 2017).

Data collection methodology is determined by combination of research purpose and practical limitations in potential research settings and resources available. Thus, literature have shown there are compromise between what should be done from a scientific perspective to address research question, and limitations imposed by ethical and practical settings (Ones *et al.*, 2017). Data collection method predominantly employed in the literature are first-hand survey and questionnaire while interview and experiment trailed. Literature surveys on perceptions on food waste, alternative protein, frozen foods adoption and skills acquisition reveals that survey, interview, experiment and focus group data collection methods are adopted 71.42%, 7.14%, 14.28% and 7.14% respectively.

Regarding the analytical method, the predominance of approaches is in the following order: regression analysis (Dupont and Fiebelkorn, 2020), correlation analysis (Ones *et al.*, 2017) and structural equation(Martindale, 2017). The mostly adopted sample sizes are 100-500 (Hansen and Sallis, 2011;

Nicolau *et al.*, 2021), followed by 1000-5000 (Kölzer *et al.*, 2020; Wucher *et al.*, 2020) for large data collection. Sample sizes for experiment and interviews are generally found to be less than 50 (Hermsdorf, Rombach and Bitsch, 2017). Besides, the IBM SPSS and Microsoft Excel were used mostly for statistical analysis.

Presented on Table 10 is the strengths and weaknesses of different data collection approaches.

Table 10: Strengths and weaknesses of data collection methods

Research Method	Application	Strengths	Weaknesses
Survey	Knowledge Attitude Intention behaviour	• Widely used and reported. • Wider sampling can be done. • Relatively straightforward method for descriptive information. • Adaptable to gathering generalisable information. • No or little observer subjectivity.	• It requires standardized question presentation and response choices thereby captures attitude at a single point. • It relies on self-reports and may not be accurate representation of attitude. • Less suitable to explore why people hold certain perceptions
Interview	Motive Experience Attitude Opinion Interpretation	• Generalisation of findings. • Opportunities for further probing rather than self-reporting.	• Time consuming. • Needs more resources. • Small sampling only possible.

		• Suitable for comparison or refining theory. • Suitable for generation of new hypothesis	
Focus group	Attitude Opinion Interpretation	• A form of qualitative research. • Traditionally done face to face but online discussions now possible. • Measures reaction and not just opinion. • Replicability- format, questions, and style can be replicated. • Time saving compared to interview. • Engaging and allows richer sense of public perceptions. • Brings together small groups of members of the public to explore and discuss a particular issue.	• Participants getting stuck on groupthink. • Participants may not give honest responses reflecting their true thoughts and feelings. • Expensive. • May not be representative of the target population.
Participant observation	Behaviour Environment	• Allows the researcher to obtain a more accurate perspective of the social issues.	• Time consuming. • Expensive to conduct.

		• Helps to discover other issues that influence behavioural intention. • Opportunity for in-depth understanding of values, beliefs, culture and ways of life of a sampled population. that underpin perceptions. • Qualitative and quantitative content analysis.	
Experiment	Identify cause-and-effect relationship	• Embedded messaging experiments quite useful. • Can provide detail information on public perceptions regarding a policy or technology. • Geocoding of respondent useful to explore proximity and explore local actors.	• Expensive. • May not be representative of the target population.

Hence, based on the frequency of use, limitations and other constraints self-administered questionnaire survey is preferred for data collection method for this work. This is because it has been extensively used, less time consuming and will help in identifying country specific issues regarding consumer related sustainable consumptions. It would also help in comparing and identifying best practices among surveyed countries.

3 DATA COLLECTION

3.1 Participants recruitment of each country

3.1.1 Participants recruitment of the UK

Participants were recruited through both in-person drop-in sessions at the University of Birmingham and online survey platform promoted by London South Bank University.

At University of Birmingham campus, students were recruited in October 2023 by circulating participant invitation poster in cafes and study areas and through snowballing approach of the project team's network. Participants were not paid but offered free pizza when submitting the survey in-person. A total of 114 respondents were recruited in this way.

London South Bank University recruited participants from July to August 2024 to complete the survey online, with £10 shopping voucher provided to the first 200 respondents. A total of 403 respondents were recruited this way, and 8 were also recruited by the equivalent online survey intended for the Slovenia respondents. A few responses were also collected by students who gave a different country of residence in the online survey.

3.1.2 Participants recruitment in Hungary

An online survey was employed to gather feedback from Hungarian consumers regarding public perception and the social behavioural barriers hindering the adoption of sustainable food practices. Campden BRI Hungary leveraged its consumer testing panel to collect survey responses. Panellists participating in consumer testing within the sensory laboratory of Campden BRI Hungary constitute a representative sample of the general public. Age was utilized as a selection criterion, with a primary focus on respondents aged 21-50 who are likely to represent purchasing power. The online survey was conducted from December 2023 to April 2024. A total of 100 respondents were recruited in this way.

3.1.3 Participants recruitment in Norway

In Norway, the survey was distributed physically at the Norwegian University for Science and technology (NTNU), over the course of two days the 14th and the 15th of February 2024.

Students were targeted at two different campuses, one campus for humanities and social science studies, and at a campus for science and technology studies.

The researchers put up a stand from around 9am until 3pm, spending one day at each campus. Students were given baked goods and coffee in exchange for answering the students. The survey was printed together with the information and the consent form. The students were given the survey and could fill it in during a break and return it to the stand later the same day. Two researchers were present during the survey each day, to distribute the surveys and provide information of the survey and the project.

In total 95 students responded to the survey out of around 140 copies distributed.

3.1.4 Participants recruitment in Italy

Students at the Università Politecnica delle Marche were recruited to in-person drop in sessions in May 2024. The recruitment targeted the students from engineering department and agriculture department where the project team has most contacts. A total of 166 respondents were recruited this way.

Two Italy respondents happened to be recruited by taking the online survey intended for Slovenia.

3.1.5 Participants recruitment of Slovenia

An online survey was employed to gather feedback from a group of university students from Slovenia, who were visiting WP3 partner Università Politecnica delle Marche in May 2024. In total, 30 students from Slovenia responded. A few responses were also collected by students who gave a different country of residence in this online survey.

Overall, in Hungary, the survey participants are general public as they were recruited from their existing consumer testing panel using online surveys. In the UK, the in-person survey drop-in sessions targeted university students as the main consumers in 2050, whilst the online survey was open to general public too. The other countries, including Norway, Italy and Slovenia used in-person drop-in sessions and targeted university students.

3.2 Survey Question List

Questions asked were of the following type:

Non-discriminating Multiple Choice (MC): Respondents can tick any number of options from a list.

Discriminating Multiple Choice (DMC): Respondents can tick exactly one of several options.

Ranking Questions (R): Respondents are supposed to pick the top five options in a list of several options and number them from 1 to 5 in order of significance.

Free Description (F): Respondents answer in writing as they see fit.

There are also the following variations:

With Other Option (+O): A multiple-choice or ranking question with an "Other" option. If respondents tick (or number for ranking questions) the other option, they should describe their "other" choice in writing. Note that respondents occasionally failed to do so.

With Justification (+J): The respondent should justify or elaborate on their answer in writing. Some questions require justification for only specific answers, in this case these options are specified in the below table.

Below is the table of the questions. Minor variations of the questions in the below table existed in the paper surveys sent out to different countries to reflect the specific country's context, and between the paper and online surveys as some format of ranking questions in the paper version need to be adjusted to suit the online format. The below table was written based on the Italy paper survey.

Table 11: Question list with descriptions

Question Number	Question	Question Type	Response Options
0	Age:	**DMC**	11-20, 21-30, 31-40, 41-50
	Gender:	**DMC+O**	Female, Male, Other (specify), Do not want to disclose
	Education Level:	**DMC**	(i) A-levels (or equivalent) (ii) Undergrad (UG) (iii) Postgrad (PG)

	Degree title	**F**	
	Ethnicity	**DMC**	
	Profession	**DMC**	(i) Student (ii) Professional (iii) Do not want to disclose…
	Annual Income (GBP per annum)	**F**	
	Dietary Preference	**DMC+O**	Vegetarian……, Vegan……, Pescatarian……, Meatatarian……, others……
1	What do you understand by food sustainability?	**F**	……
2	What sustainable consumption habits have you adopted (Mark as many as applicable to you)	**MC**	i) Reduce food waste at your household level ii) Use online platforms and services that helps reduce food waste (e.g Donate food to foodbanks, Too Good To Go, Oddbox, etc) iii) Consume locally produced fruits and vegetables iv) Consume frozen food v) Consume alternative proteins vi) Any other, please specify……
3		**DMC**	(i) Yes, (ii) No
4	If your response is **Yes** in #3, please state the level of preference of alternative protein sources by putting them in order of high preference to low (1 being the highest to 5 being the lowest preference).	**R** (technically respondents were asked to give a level of preference not rank for the paper survey but the results were analysed as ranking).	i) Plant-based (e.g. of food products are tofu, Quorn, Tempeh etc.) ii) Insect-based iii) Algae-based iv) Microbial fermentation v) Cell cultivated/cultured meat (from stem-cell)
5	If your response is **Yes** in #3, please state the motivation behind choosing alternative proteins. Please rank the following motivations of choosing alternative protein in	**R+O**	i) Health benefits ii) Economic benefits iii) Environmental benefits iv) Animal-welfare v) Quality and safety vi) Any other motivation? Please specify……

	order, 1 being the highest value to 5 being the lowest value.		
6	If your response in #3 is **Yes**, how often do you consume alternative proteins in a week?	**DMC**	i) 1-2 meals ii) 2-5 meals iii) More
7 (Online surveys of UK and Slovenia only)	How often do you consume animal proteins?	**DMC**	i) 0 means ii) 1-2 meals iii) 3-5 meals iv) More than 6 meals
8	If your response to #3 is **No**, please elaborate your concerns, and why do you not prefer alternative proteins (particularly the ones from insect, algae, cultured meat)	**MC+O**	i) Taste ii) Affordability iii) Quality iv) Availability v) Any other reason Please specify……
9	If your response to #3 is **No**, would you consider trying alternative proteins, especially the ones which you have not tried before	**DMC**	i) Yes ii) No iii) Maybe
10	What benefits do you think consuming alternative proteins would bring?	**F**	……
11	What could help change your perception and consumption habit about alternative proteins?	**MC+O**	i) Taste ii) Affordability iii) Learning more about the benefits of alternative proteins iv) Any other reason Please specify……
12	Do you consume frozen food?	**DMC**	i) Yes ii) No
13	If your response to #12 is **Yes**, then please select which of these listed options do you consume:	**DMC+O**	i) Fruits and vegetables ii) Frozen meat iii) Frozen fish iv) Ice-creams / lollies etc v) Frozen ready-to-eat meals vi) Frozen baked foods vii) Others
14	If your response to #12 is **Yes**, how often do you consume frozen food in a week?	**DMC**	i) 1-2 meals* ii) 2-5 meals iii) More than 5 meals

15	If your response to #12 is **Yes**, what are the reasons for choosing frozen options where fresh options are available? Please select from the options below and **rank** them based on the most important reason; 1 being the most important and 5 the least important reason.	**R+O**	i) Better price ii) Convenience iii) Minimise waste iv) Unavailability of fresh options v) Any other reason. Please specify……
16	If your response to #12 is **No**, what are your reasons for not choosing the frozen options? Please select from the options below and **rank** them based on the most important reason; 1 being the most important and 5 the least important.	**R+O**	i) Nutritional quality ii) Taste iii) Quality iv) Freshness/wholesomeness v) Other reasons. Please specify……
17	Do you think frozen food has equal, better, or worse nutritional quality compared to the fresh food?	**DMC+J**	(i) Better (ii) Equal (iii) Worse Comments (Why):……
18	How often has social media influenced your choice of food?	**DMC**	i) Most Often ii) Often iii) Sometimes iv) Never
19	What kind of food is wasted in your household? Rank them in order of the volume of wastage, 1 being the highest volume to 5 being the least volume.	**R+O**	i) Fresh fruit and vegetables ii) Meat/meat products iii) Fish iv) Milk v) Dairy products vi) Bread/Bakery products vii) Leftover cooked meals viii) Out-of-date/expired pantry food ix) Others, Please specify……
20	Do you have an estimated idea about the food waste frequency in your household in a week?	**DMC**	i) Weekly ii) 2-3 times weekly iii) Daily
21	What are the primary reasons for food waste at your end? You	**MC**	i) Incorrect meal plan (shopping)

	can select as many options as applies.		ii) Incorrect meal plan (portioning) iii) Bulk shopping iv) Spoiled/stale food v) Improper Storage
22	Do you consume leftover food and repurpose the leftover ingredients to make a meal?	**DMC**	i) Yes ii) No
23	If your response in # 22 is **No**, please select from the options listed below why?	**MC+O**	i) Not enough ingredient to prepare full meal ii) Not good in taste as fresh alternative iii) Safety concern iv) No idea on how to use leftover v) Any other Please specify……
24	Do you use any apps that help you filter and choose leftover recipes based on the ingredients you have at hand?	**DMC**	(i) Yes, (ii) No
25	What measures do you take to prevent food waste?	**MC**	i) Meal planning ii) Cooking with leftovers iii) Donating to local food banks iv) Community fridge sharing v) Freezing food
26	Would you accept food for personal consumption from a local food bank if you qualify?	**DMC**	(i) Yes, (ii) No
27	What are your thoughts about accepting food from local food banks for yourself/family?	**F**	……
28	Do you use or purchase wonky fruits and vegetables from supermarket or farmers' market or from online platforms (example of online market Oddbox)?	**DMC**	(i) Yes, (ii) No
29	Do you purchase locally produced fruits and vegetables, meat from local butchers, or milk from local farmers? (Examples for purchasing produce from other than supermarket chains are local	**DMC**	(i) Yes, (ii) No

	farmers market, vendors who sell only locally produced food products)		
30	If your response to # 30 is **No**, then please elaborate on the reasons.	**MC+O**	i) More expensive than supermarket ii) Lack of varieties as only seasonal produce iii) Other reasons Please elaborate……
31	Do you use online apps to purchase leftover food from restaurants, bakeries, which otherwise would be thrown away (example- Too Good to Go, Karma); or apps that remind you to consume food that is close to expiration date; or use apps to share food that would otherwise go to waste with your neighbours, friends, local food banks (FoodCloud, Olio, Nowaste, any other examples)	DMC (+J if "Yes"	(i) Yes Please elaborate…… (ii) No
32	If your response to # 32 is **No**, then please elaborate on the challenges towards adoption of online platforms as shared in 32. (Kindly **rank** as applicable to you)	R+O	(i) Lack of information (ii) Hesitant to use because never used before (iii) Not convenient (iv) Have used it and did not like it. (v) Other reasons Please specify…….
33	How do you shop for your grocery? Select all that applies.	MC+O	i) In-person from supermarket ii) In-person from local vendor iii) Mix of both iv) Online
34	What is the primary method of grocery shopping for you?	DMC	(i) Online (ii) In-person
35	How often do you visit supermarkets or local vendors in a week?	DMC	(i) Once every two weeks (ii) Once a week (iii) 2-3 times a week (iv) More than 4 times a week
36	What is the average distance of travel to the supermarkets?	DMC	(i) Within 1 mile (ii) 1-2 miles (iii) More than 2 miles

37	Do you think online shopping has more environmental benefits? Please give your reasons.	DMC+J	(i) Yes, (ii) No Reasons:……
38	Do you use purchase meal-kits or food boxes with ingredients online? Please give your reasons.	DMC+J	(i) Yes, (ii) No Reasons:……
39	Do you think you will stay with your preferred method in the future or are you willing to/looking for change?	DMC+J	(i) Stay on, (ii) Try new ways Please elaborate why……
40	What are the key challenges of online shopping?	MC+O	(i) Limited product availability online (ii) Scheduling delivery that suits your schedule (iii) Difficult in changing old habits – being able to choose products by looking yourself (iv) Loss of social interaction (v) Do not like extra packaging that comes with online shopping (vi) Difference in the price of items (vii) Any other, Please specify……
41	What are the key benefits of online shopping?	MC+O	(i) Convenience (ii) Saves time (iii) Good for environment (reduced energy consumption as well as air pollutants) (iv) Reduction in food wastes (v) Easier meal planning (if you purchase meal kit) (vi) Any other Please specify……
42	What positive and negative impacts that food packaging brings?	F (x6)	Positive: (1) (2) (3) Negative: (1) (2) (3)
43	Do food packaging materials affect your food purchase choice? Meaning, do you actively look for labels to identify recycled materials and	DMC	(i) Yes, (ii) No

	biodegradable materials used for packaging.		
44	If your response to #43 is **Yes**, please elaborate on what features are important to you when choosing a packaging material?	MC+O	(i) Biodegradable and compostable (ii) Recyclable (iii) Packaging volume (iv) Packaging which increases shelf life (compostable packaging reduces shelf life) (v) Reusability of packaging material – bottles, trays, etc (vi) Ease of storage (vii) Use-by or best-by dates labelling (viii) Other features Please specify……
45	If your response to #44 is **No**, please elaborate on why do you not choose sustainable packaging materials while purchasing food.	MC+O	(i) Time consuming to check recycling instructions on packaging (ii) Labels are not clear or adequately labelled (iii) Lack of knowledge and information on sustainable packaging (iv) Compromise product quality for more eco-friendly packaging (v) Compostable packaging increases cost of the product (vi) Do not compose or recycle at home (vii) Other reasons Please specify……
46	How often do you follow the recycling instructions on the packaging materials?	DMC	(i) Always (ii) Often (iii) Sometimes (iv) Never (v) Not sure

4 METHODOLOGY FOR DATA ANALYSIS

4.1 Interpretation of Ranking Questions Algorithm

4.1.1 The Algorithm

The results tables for the ranking questions were essentially produced by counting each number that is assigned to each option for each response and adding these up. However, many respondents to the paper survey failed to read or understand the question, with some ticking the answers instead of numbering and some repeating numbers and skipping numbers (as though they were giving a rating rather than ordering for the importance of the relevant factors). In order to extract as much information as possible, these results were processed by an algorithm. The algorithm gave an estimate for the number of people who would have picked each option for first, second, third rank etc. It works as follows:

I. Reduce the numbers in the responses of each respondent to the minimum possible whilst preserving order, e.g.

A B C D E
1 4 5 4 5

becomes

A B C D E
1 2 3 2 3.

II. For each category, check if there is a 1. Then assign 1/n to each category count of first, second, ..., nth ranks where n is the total number of ones.

(in our case there is 1 one in 1 2 3 2 3 so

A B C D E
1 2 3 2 3

gives that category A has 1/1=1 first rank and categories B, C, D, E have 0 first ranks)

III. Repeat for the number 2 and set m to be the total number of twos. But this time assign 1/m to rank (n+1), ... , rank m. (In our example we have two 2s so we get ½ a second rank and ½ a third rank for both category B and category D).

We repeat step III some more times but with m and n being updated appropriately. This allows us to obtain a table (in our case we obtain:

Rank	A	B	C	D	E
1st	1	0	0	0	0
2nd	0	½	0	½	0
3rd	0	½	0	½	0
4th	0	0	½	0	½
5th	0	0	½	0	½).

We apply this algorithm for every respondent. Then by adding the tables for each respondent answering the question elementwise, we obtain our final table.

In the case a respondent has ticked instead of numbering, we start the algorithm using only ones for their ticks meaning their response will be evenly distributed. Whilst it is unlikely someone who mistakenly ticked has exactly the same preference for each tick, including results in this way does help us differentiate between more and less important categories. This is because the options they tick will get higher values in their rankings compared to the ones they did not tick, even if the trends between the ones they did tick are unseen.

4.1.2 Presentation of Results

The algorithm described previously was applied to each country for each ranking question.

The total number of responses for the ranking questions were counted for each country for each for each of these questions so that the proportion of the respondents who gave ones, twos etc to each category could be calculated. These percentages were then added up to create cumulative results. This makes the results more understandable because you can say that if you worked on making a category x less important to respondents (e.g. “Better Price” in question 15 for Italy) then you affect so many (25% in our example) people most significantly; so many (45% in our example) are affected with moderate significance; so many (63% in our example) with less significance, etc. Therefore, you can immediately understand the effect you would have on the habit of a population by changing a factor that affects their choices.

5 DEMOGRAPHIC ANALYSIS OF SURVEY PARTICIPANTS

This section describes the makeup of the 954 respondents to the survey in terms of age, nationality and gender. These were recorded in question 0 of the surveys.

5.1 Demographics of Whole Population

5.1.1 Countries of Residence

In our survey, no more than 3% of respondents were not residents of a (geographically) European country. Majority of respondents are residents of the UK. Nevertheless, the 168 Italian, 100 Hungarian, 95 Norwegian and 30 Slovenian respondents still provide useful information about public perception and preferences from these countries in the Europe.

Table 12: Countries of residence counts and percentages

Country	Count	Percentage
UK	525	55.0
Italy	168	17.6
Hungary	100	10.5
Norway	95	10.0
Slovenia	30	3.1
Bosnia/Slovenia	1	0.1
South Africa	4	0.4
Macedonia	3	0.3
North Macedonia	1	0.1
America	1	0.1
Ukraine	1	0.1
Denmark	1	0.1
France	1	0.1
Germany	1	0.1
Greece	1	0.1
India	1	0.1
Rwanda	1	0.1
Unknown/Unclear/Blank	19	2.0

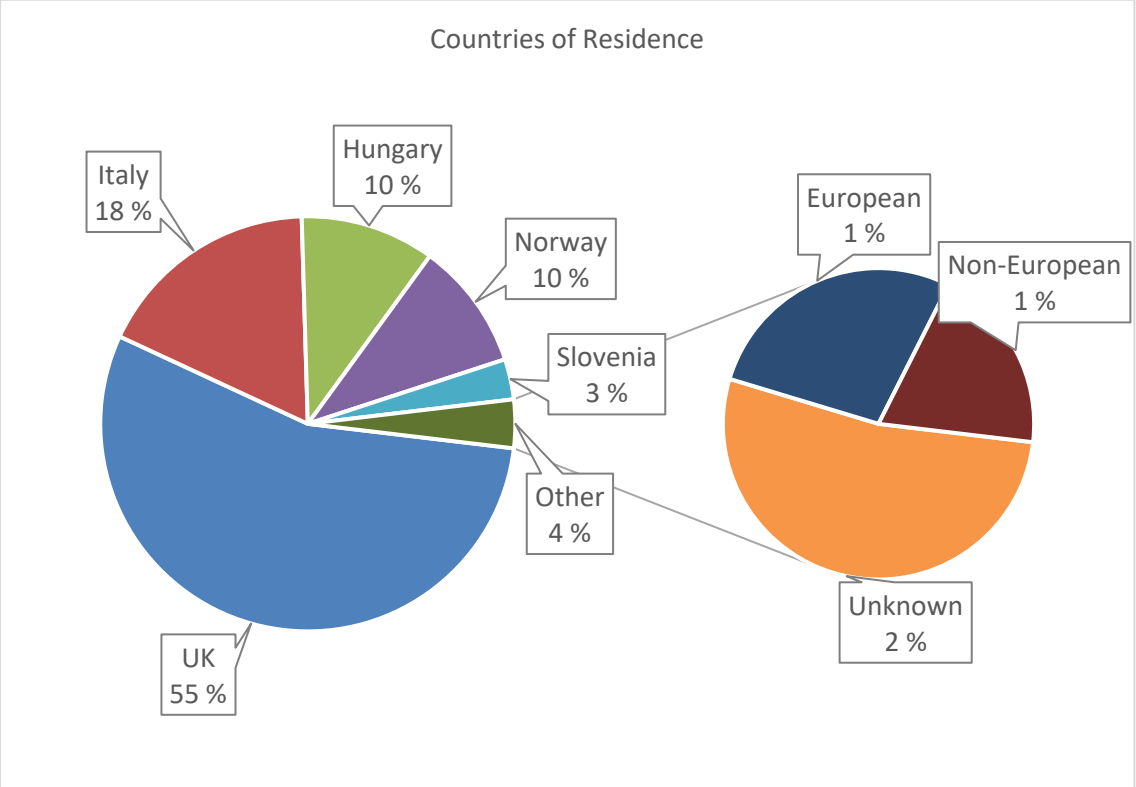

Figure 6: Countries of residence of respondents

5.1.2 Gender Split

In our collected respondents, there were 12% more male than female among those who revealed their gender, thus results may be somewhat more representative of men than women. However, the difference is small compared to larger variations which occur within each country.

Table 13: Gender split counts and percentages

Gender	Count	Percentage
Male	492	51.6
Female	441	46.2
Other	3	0.3
Unknown	18	1.9

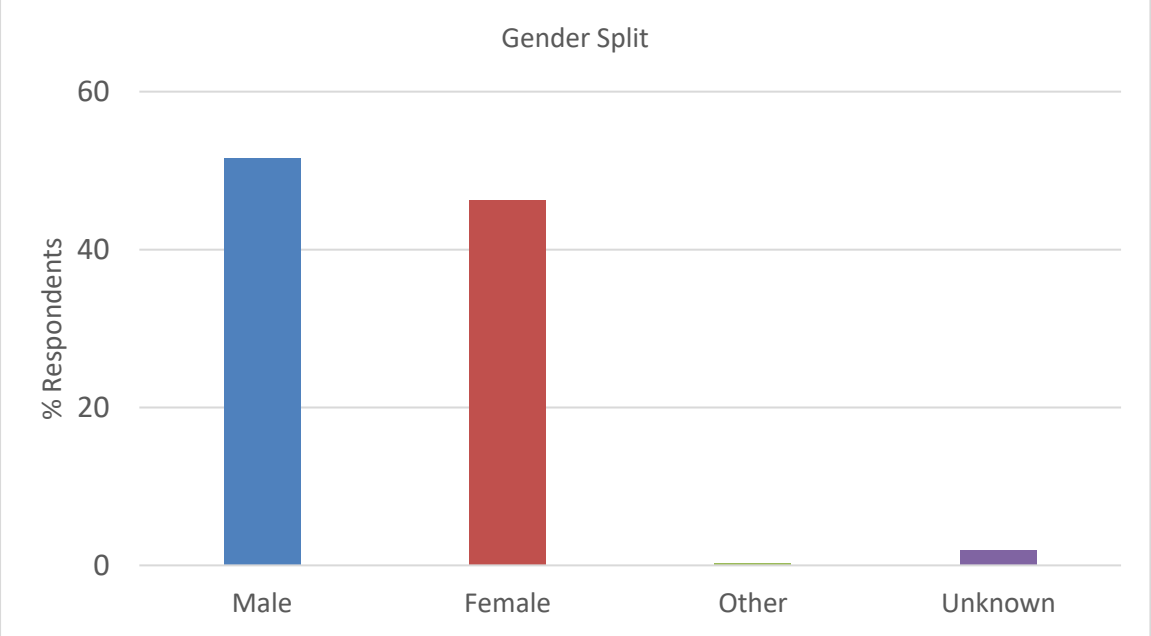

Figure 7: Gender split of respondents by percentage

5.1.3 Age Distribution

The majority of the respondents were of age 21-30, but a reasonable number were also of age below 20 or 31-40.

Table 14: Age ranges counts and percentages

Age Range	Count	Percentage
Below 20	117	12.3
21-30	541	56.7
31-40	185	19.4
41-50	73	7.7
>50	18	1.9
Unknown	20	2.1

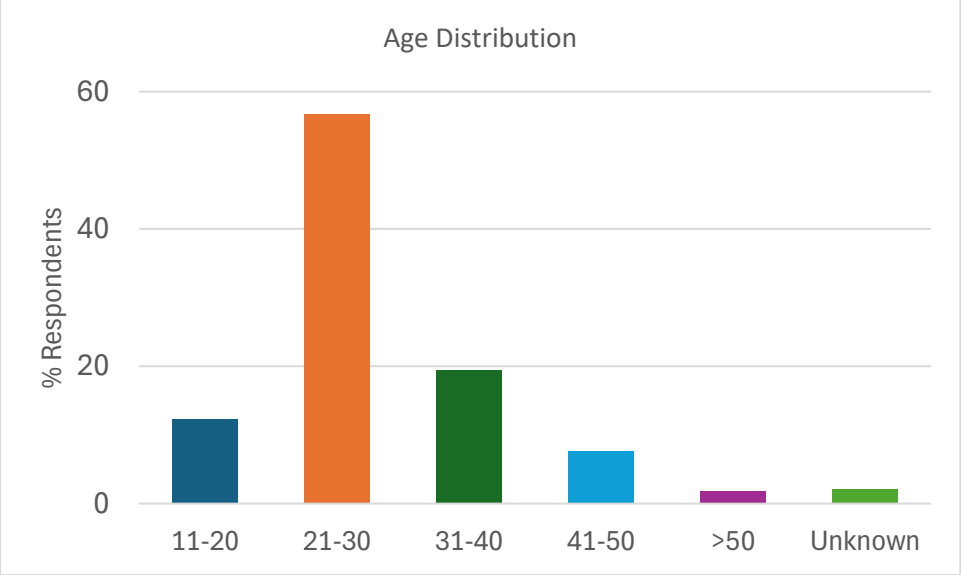

Figure 8: Age distribution of respondents by percentages

5.2 Demographics by Country (Hungary, Italy, Norway, Slovenia and UK Only)

5.2.1 Gender Split by Country

The relative numbers of male and female respondents are seen to vary dramatically within different countries. This could result in trends between genders being reflected between countries of different respondent gender makeup. In particular, Hungary and Slovenia have roughly twice as many females as males whereas the Italy respondents were predominantly male. Norway and the UK have the smallest disparity between the numbers of male and female respondents.

Gender counts:

Table 15: Gender split by country counts

Country	Female	Male	Other	Unknown
Hungary	64	36	0	0
Italy	60	101	2	5
Norway	48	41	0	6
Slovenia	21	9	0	0
UK	224	293	1	7

Gender proportions:

Table 16: Gender splits by country percentages

Country	% Female	% Male	% Other	% Unknown
Hungary	64	36	0	0
Italy	36	60	1	3
Norway	51	43	0	6
Slovenia	70	30	0	0
UK	43	56	0	1

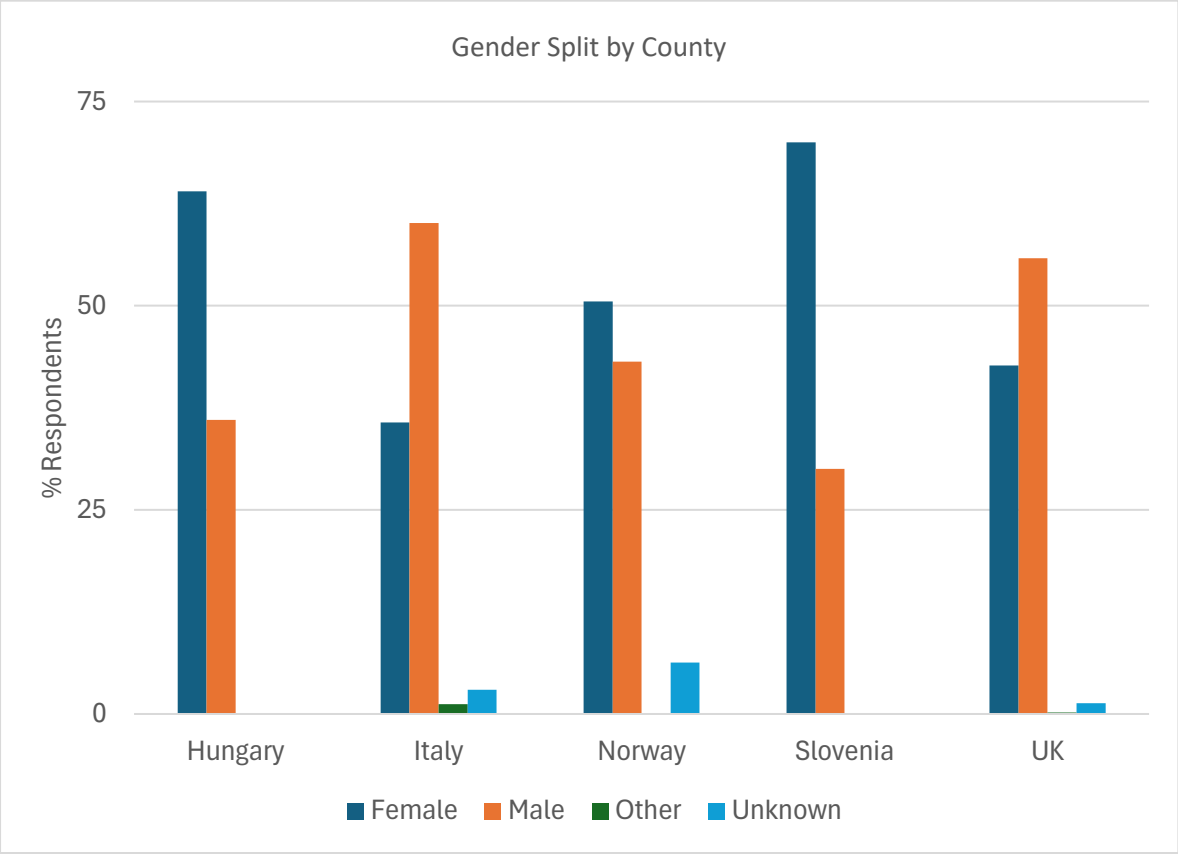

Figure 9: Gender splits by country, by percentage

5.2.2 Age Distributions by Country

Italy, Norway and Slovenia are seen to have very similar age distributions. For these countries, the vast majority of respondents in each of these countries are of age 21-30 with a few of age 11-20 and a very small amount of a higher age than 30. Thus, the responses for these countries are representative of a student aged population.

Conversely, the UK and Hungary have wider age distributions with higher typical ages. The UK still has (just) more than half of its' respondents in the 21-30 age category, but it has more older respondents

than Italy, Norway and Slovenia with a significant population of respondents of ages 31-40. Hungary has most of its' respondents spread quite evenly between ages 21 and 50 and so may be representative of a more middle-aged population.

Ages by count:

Table 17: Age ranges by country counts

Country	11-20	21-30	31-40	41-50	Above 50	Unknown
Hungary	1	34	27	33	0	5
Italy	42	116	6	0	2	2
Norway	16	73	0	1	0	5
Slovenia	4	25	0	0	1	0
UK	51	271	145	36	14	8

Ages by proportion:

Table 18: Age ranges by country percentages

Country	% 11-20	% 21-30	% 31-40	% 41-50	% Above 50	% Unknown
Hungary	1	34	27	33	0	5
Italy	25	69	4	0	1	1
Norway	17	77	0	1	0	5
Slovenia	13	83	0	0	3	0
UK	10	52	28	7	3	2

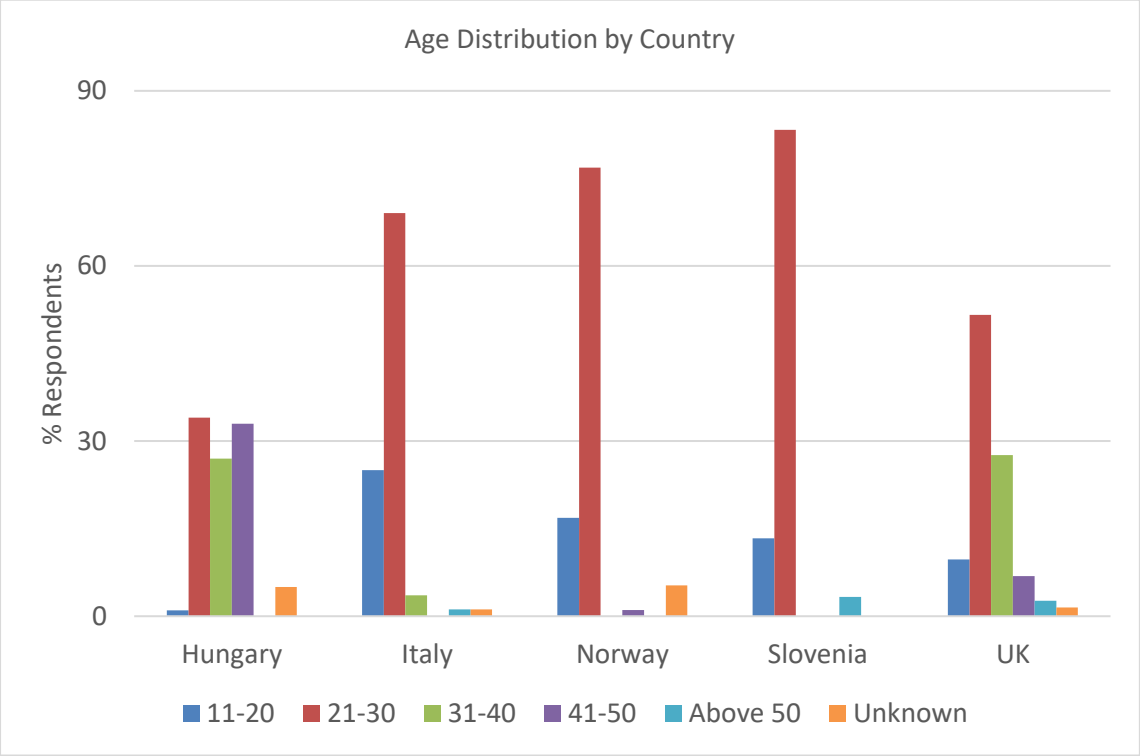

Figure 10: Age distribution by country, by percentage

6 RESULTS

6.1 Results by Country

The results in this section give the numbers of respondents per each country who responded in each possible way to each question.

The results exclude unclear responses unless otherwise stated. This means that for questions with one option to be chosen by the respondent the total responses of each type will add up to 100% of respondents (rather than less due to unclear results).

These results do not include analysis of the responses to questions where the respondent writes down an answer rather than ticking a box. Analysis for these questions is include in the "Non-Quantitative Results by Country" section, as are analytics of the "Other" responses people gave. However, the number of times the "Other" option is chosen may be included in this section.

6.1.1 Question 1: Understanding of food Sustainability.

Question 1 asked: "What do you understand by food sustainability?" It has been analysed as a text question, using the word cloud diagram to discuss the most popular opinions concerning food sustainability.

Food sustainability results in Hungary

Food sustainability results in Norway

Food sustainability results in Italy

Food sustainability results in UK

Food sustainability results in Slovenia

Food sustainability results in all 5 countries

Figure 11: Popular opinions concerning food sustainability

The results of the questionnaire in Italy and Slovenia show that effective reduction of food waste is generally recognised by the respondents as the key to assessing whether food is sustainable. In contrast, in Hungary, Norway and the UK, respondents were mainly concerned with food production under the theme of food sustainability.

Overall, respondents' understanding of food sustainability is broad, multidimensional, and multifaceted. And “Production”, “Consumption” and “Waste” are the three main aspects that respondents generally considered in the future food sustainability. In “Production” process, negative impacts on the environment received as a major concern, including GHG emission, footprint and carbon evaluation indicators. In terms of consumption, whether to consume local food or to avoid consuming food far from home emerged as the respondents' assessment of the sustainability of food. In additional, avoiding waste and eating healthy are mentioned several times in the three main areas.

6.1.2 Question 2: Sustainable Habits of Respondents

Question 2 asked: “What sustainable consumption habits have you adopted? (Mark as many as applicable to you)”.

Results

Table 19: Number of Respondents per Country for each Sustainability Habit by count

Country	Reduce food waste at your household level	Use online platforms and services that helps reduce food waste (e.g. Donate food to foodbanks, Too Good To Go, Oddbox, etc)	Consume locally produced fruits and vegetables	Consume frozen food	Consume alternative proteins*	Others	Total Responses
Hungary	93	12	63	59	22	6	100
Italy	137	42	108	85	71	10	167
Norway	86	46	32	76	49	7	95
Slovenia	27	1	23	14	9	0	30
UK	320	292	235	212	143	11	518

Table 20: Number of Respondents per Country for each Sustainability Habit by percentages

Country	% Reduce food waste at your household level	% Use online platforms and services that helps reduce food waste (e.g. Donate food to foodbanks, Too Good To Go, Oddbox, etc)	% Consume locally produced fruits and vegetables	% Consume frozen food	% Consume alternative proteins*	% Others
Hungary	93	12	63	59	22	6
Italy	82	25	65	51	43	6
Norway	91	48	34	80	52	7
Slovenia	90	3	77	47	30	0
UK	62	56	45	41	28	2

*Note that some respondents did not say they consumed alternative proteins in this question but did in question 3. This may be because they did not consider it a sustainability habit, or only recognised what proteins were considered APs once they read the description in question three.

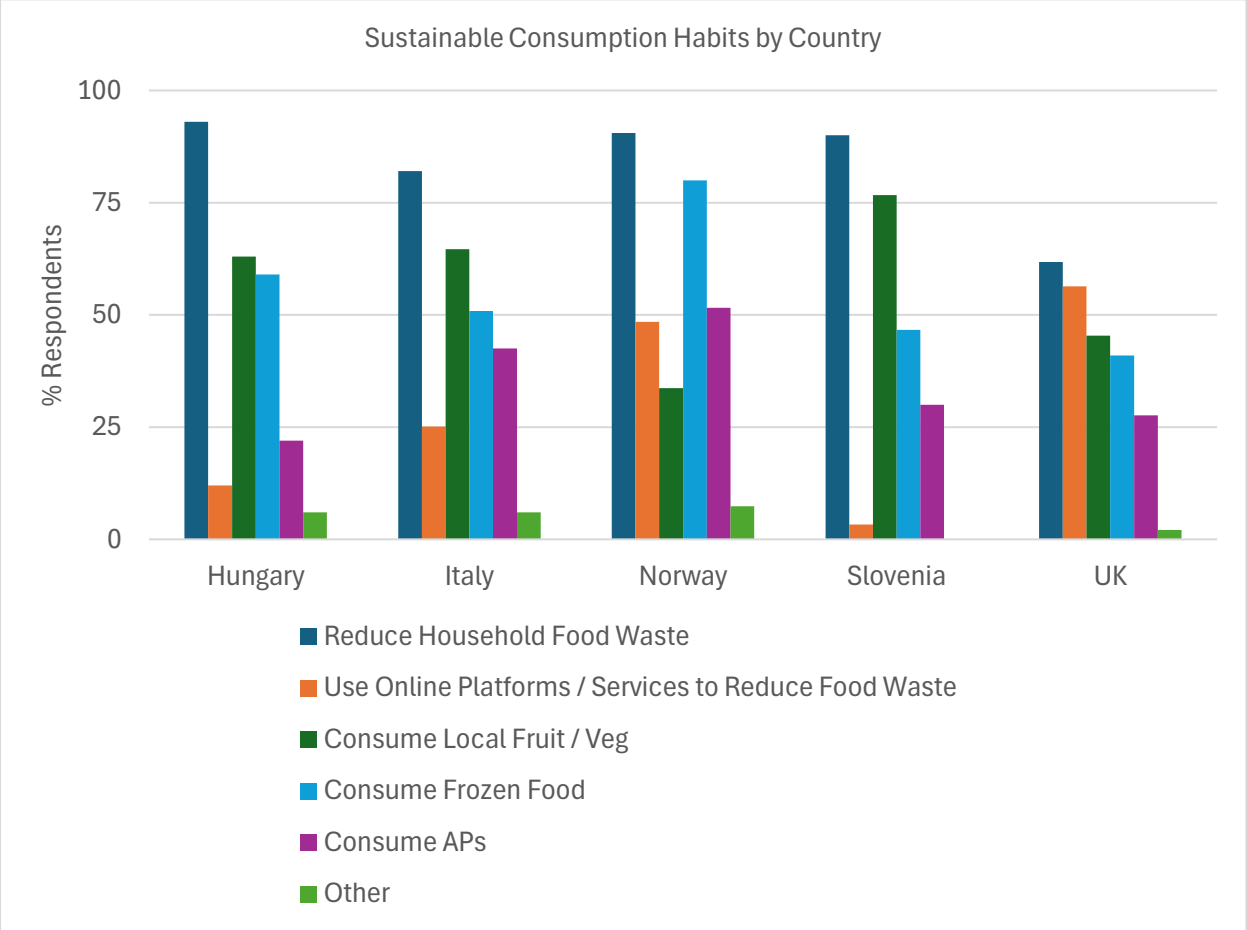

Figure 12: Sustainable Consumption Habits by Country

The results to question 2 illustrate that the majority of people in these countries already take efforts to reduce their household waste. They also reveal that in Hungary and Slovenia using online platforms and services to reduce food waste is distinctly uncommon. The results suggest that the habits for which emphasis should be placed to obtain the greatest increase in sustainability (without considering the different magnitudes of effects of the habits) are:

- Using food waste reduction apps and services for Hungary, Italy and Slovenia.
- Consuming local fruit and vegetables for Norway
- Consuming APs for the UK (although this is contradicted by results to question 3).

Whilst the results here imply the habit with least adherence is consuming APs, more respondents said they consumed APs in question 3 than here, so it is difficult to establish a certain least adopted consumption habit from the categories we gave

6.1.3 Question 3: Alternative Protein Consumers vs Non-Consumers

Question 3 asked respondents: "Do you consume alternative proteins?" and had a "Yes" or "No" option.

Table 21: Responses whether consume, by count

Country	No	Yes	Total Responses
Hungary	46	54	100
Italy	55	111	166
Norway	40	55	95
Slovenia	10	19	29
UK	79	434	513

Table 22: Responses to whether consume by percentage

Country	% No	% Yes
Hungary	46	54
Italy	33	67
Norway	42	58
Slovenia	34	66
UK	15	85

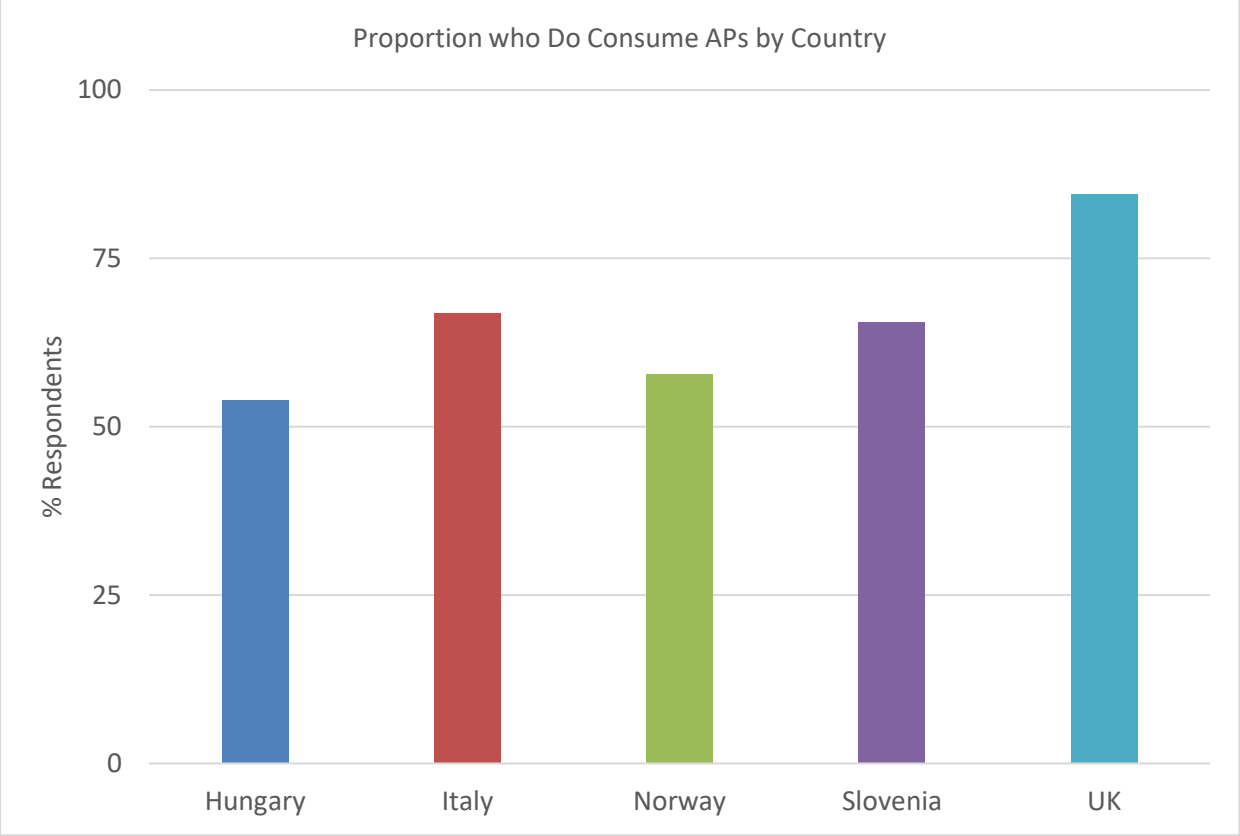

Figure 13: Responses to whether consume by country with percentage

We see that more than a quarter of respondents claim not to consume alternative proteins in every country except the UK. Hungary has the lowest proportion of respondents who claim to consume alternative proteins.

6.1.4 Question 4: Ranking of Preferred Alternative Protein Sources

Question 4 asked: "If your response is **Yes** in #3, please state the level of preference of alternative protein sources by putting them in order of high preference to low (1 being the highest to 5 being the lowest preference)". It has been analysed as a ranking question, using the algorithm discussed in the "Interpretation of Ranking Questions Algorithm" section.

Table 23: Alternative Protein Sources Preference by Counts

Country	Rank	Plant-based	Insect-based	Algae-based	Microbial fermentation	Cell cultivated / cultured meat	Net Responses
Italy	1	92	5	2	3	6	107
	2	6	8	33	19	8	
	3	1	15	20	28	7	
	4	5	18	16	12	17	
	5	0	25	4	7	32	
Hungary	1	37	8	1	1	7	54
	2	1	6	18	17	12	

	3	2	3	15	24	10	
	4	4	11	17	11	11	
	5	10	26	3	1	14	
UK	1	269	117	35	26	28	475
	2	95	96	122	66	65	
	3	40	95	151	104	51	
	4	38	58	105	167	73	
	5	28	78	29	79	227	
Norway	1	53	0	0	1	0	54
	2	0	1	14	5	4	
	3	0	3	7	10	4	
	4	0	8	3	3	10	
	5	0	12	0	6	6	
Slovenia	1	24	2	2	0	1	29
	2	4	10	4	7	4	
	3	1	6	14	4	4	
	4	0	3	6	17	3	
	5	0	8	3	1	17	

Table 24: Alternative Protein Sources Preference Cumulative by Percentages

Country	Ranking	% Plant-based	% Insect-based	% Algae-based	% Microbial fermentation	% Cell cultivated / cultured meat
Italy	1	86	5	1	3	5
	≤2	92	12	32	21	12
	≤3	93	26	50	47	19
	≤4	97	43	65	59	35
	≤5	97	66	68	65	64
Hungary	1	69	15	2	2	13
	≤2	70	26	35	33	35
	≤3	74	31	63	78	54
	≤4	81	52	94	98	74
	≤5	100	100	100	100	100
UK	1	57	25	7	5	6
	≤2	77	45	33	19	20
	≤3	85	65	65	41	30
	≤4	93	77	87	77	46
	≤5	99	93	93	93	93
Norway	1	98	0	0	2	0
	≤2	98	2	26	11	7

	≤3	98	7	39	30	15
	≤4	98	22	44	35	33
	≤5	98	44	44	46	44
Slovenia	1	83	7	7	0	3
	≤2	97	41	21	24	17
	≤3	100	62	69	38	31
	≤4	100	72	90	97	41
	≤5	100	100	100	100	100
All Responses (including other countries)	1	66	18	5	4	6
	≤2	81	35	33	20	18
	≤3	88	53	61	43	29
	≤4	94	67	81	74	45
	≤5	99	87	87	87	87

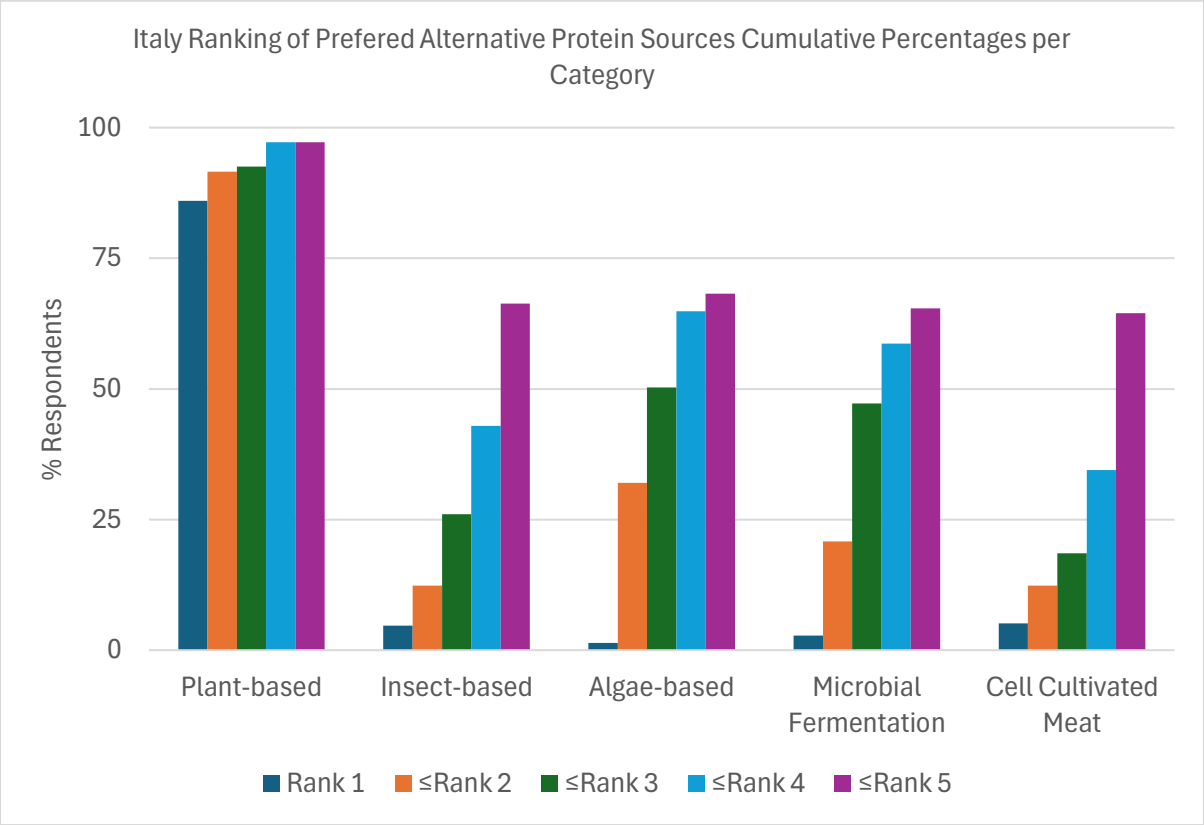

Figure 14: Preferred Alternative Protein Sources Cumulative Percentages per Category in Italy

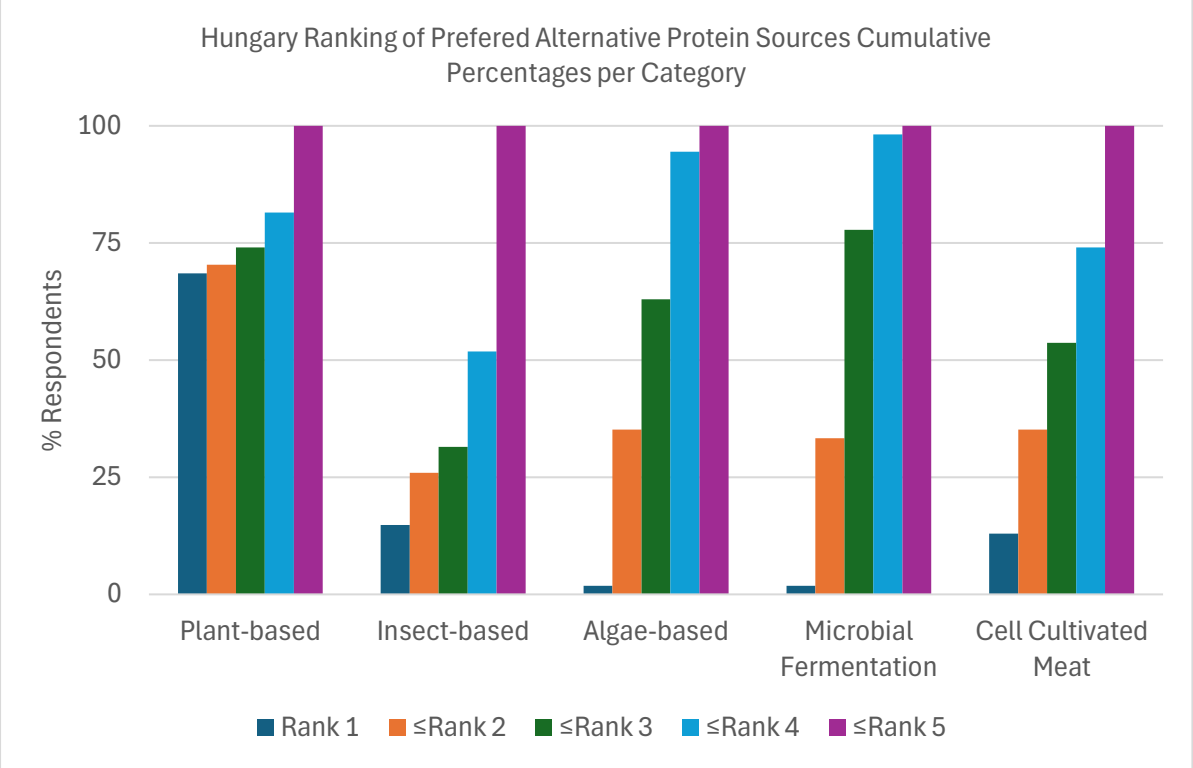

Figure 15: Preferred Alternative Protein Sources Cumulative Percentages per Category in Hungary

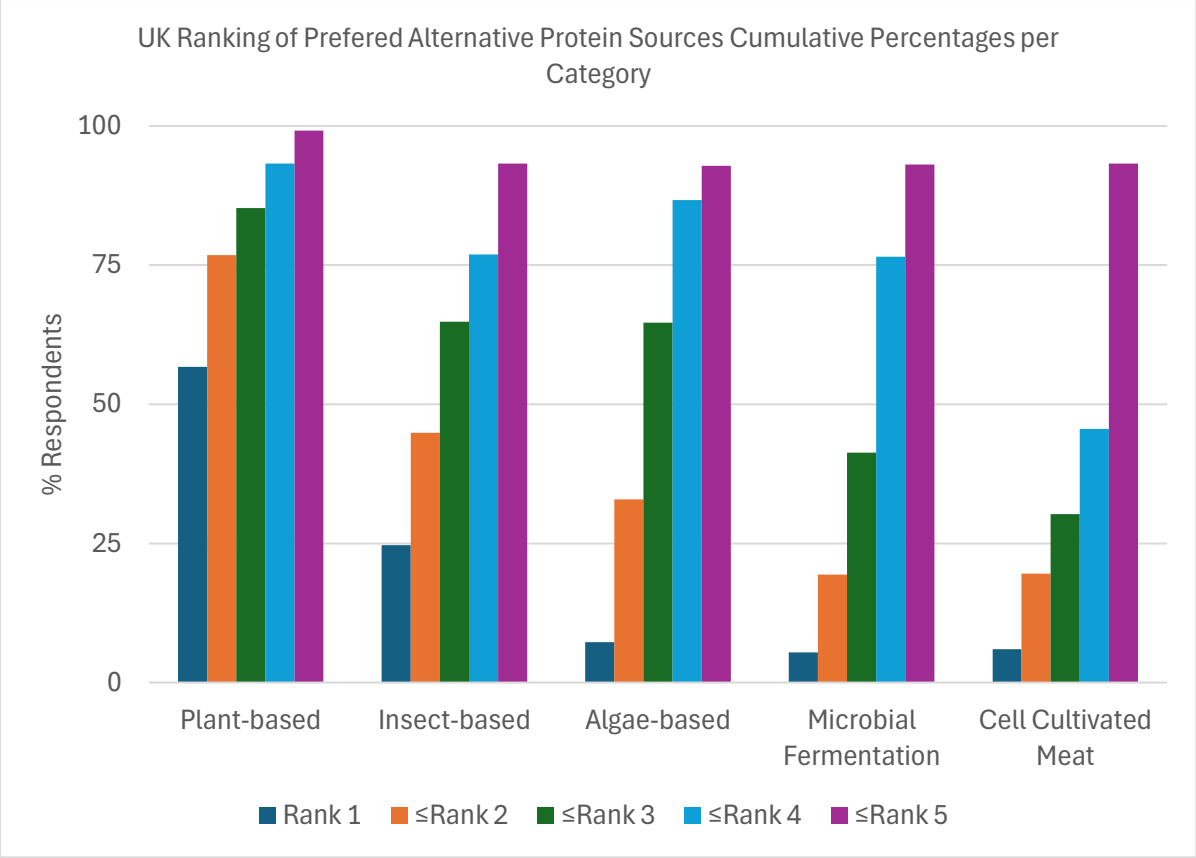

Figure 16: Preferred Alternative Protein Sources Cumulative Percentages per Category in UK

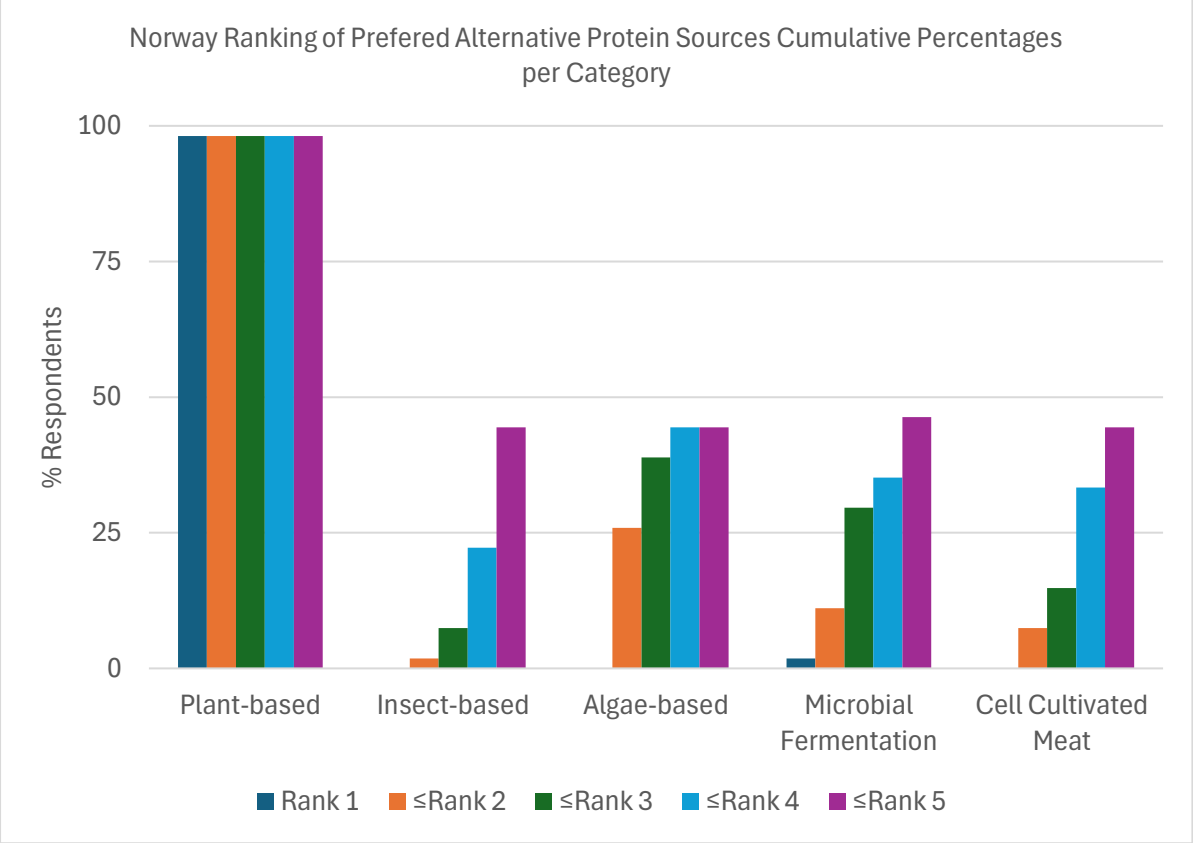

Figure 17: Preferred Alternative Protein Sources Cumulative Percentages per Category in Norway

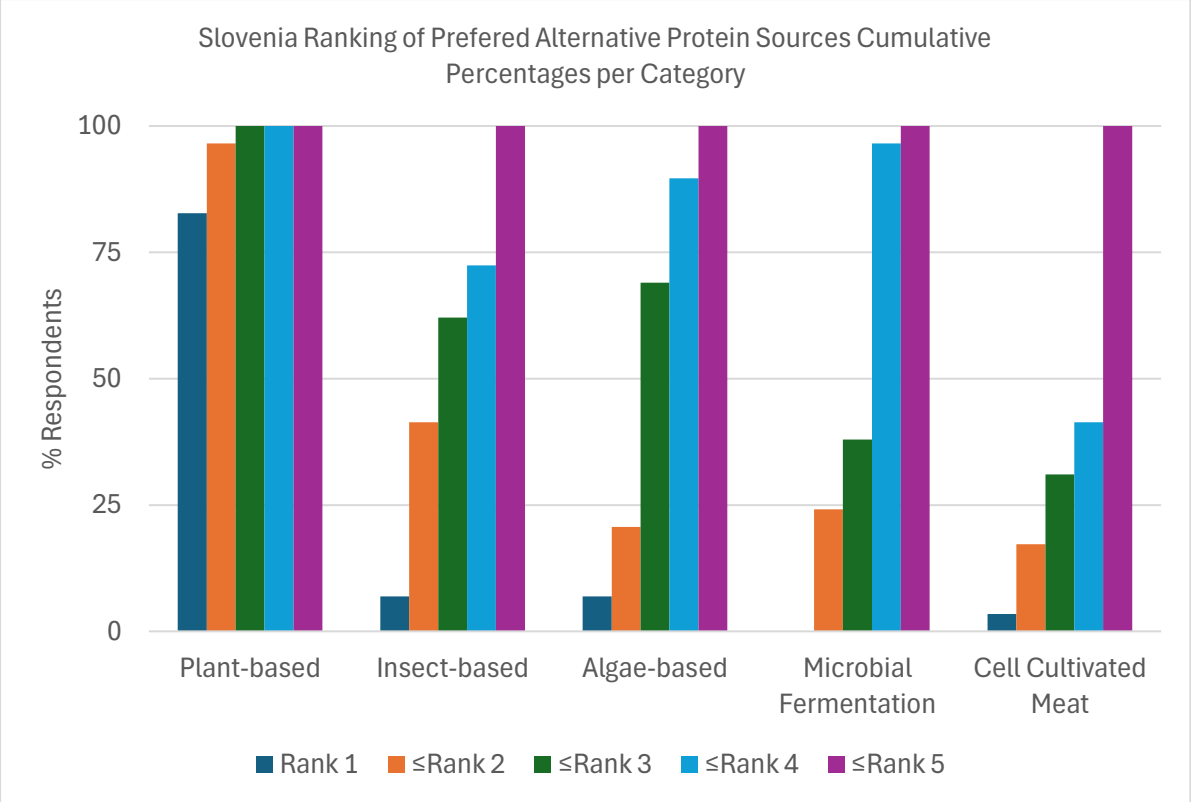

Figure 18: Preferred Alternative Protein Sources Cumulative Percentages per Category in Slovenia

"Plant-based" alternative proteins generally show a high level of acceptance. Consumers from Italy, Norway, and Slovenia who are open to trying alternative proteins have not shown a preference for options other than plant-based alternatives. In Hungary, however, consumers are also willing to try insect-based and cell-cultivated/cultured meat products. Notably, consumers from the UK displayed the highest acceptance of insect-based alternative proteins compared to the other four countries in our study.

6.1.5 Question 5: Order of Motivations for Choosing Alternate Proteins

Question 5 asked: "If your response is **Yes** in #3, please state the motivation behind choosing alternative proteins. Please **rank** the following motivations of choosing alternative protein in order, 1 being the highest value to 5 being the lowest value."

It has been analysed as a ranking question, using the algorithm discussed in the "Interpretation of Ranking Questions Algorithm" section

Table 25: Alternative Proteins Motivation by Counts

Country	Ranking	Health Benefit	Economic benefit	Environmental benefit	Animal welfare	Quality and safety	Net Responses
Italy	1	55	13	19	14	8	149
	2	17	18	25	15	18	
	3	17	16	20	19	16	
	4	7	14	16	20	24	
	5	4	24	7	20	20	
Hungary	1	23	4	9	11	7	97
	2	8	7	15	15	9	
	3	3	12	11	14	14	
	4	7	12	10	11	14	
	5	13	19	9	3	10	
UK	1	224	108	67	34	35	497
	2	107	129	89	66	66	
	3	52	118	157	70	53	
	4	38	51	111	169	74	
	5	43	43	29	109	218	
Norway	1	10	26	16	2	1	92
	2	14	11	15	5	0	
	3	11	5	9	11	3	
	4	9	5	3	13	6	
	5	2	4	0	4	25	
Slovenia	1	17	2	1	1	1	30
	2	4	9	3	3	3	
	3	1	2	13	3	3	

	4 5	0 0	2 7	3 2	11 4	6 9	

Table 26: Alternative Proteins Motivation Cumulative by Percentages

Country	Ranking	% Health Benefit	% Economic benefit	% Environmental benefit	% Animal welfare	% Quality and safety
Italy	1	51	12	17	13	7
	≤2	67	29	41	27	24
	≤3	83	44	59	44	39
	≤4	89	56	74	63	62
	≤5	93	79	81	81	81
Hungary	1	43	7	17	20	13
	≤2	57	20	44	48	30
	≤3	63	43	65	74	56
	≤4	76	65	83	94	81
	≤5	100	100	100	100	100
UK	1	48	23	14	7	7
	≤2	71	51	33	22	22
	≤3	82	76	67	36	“33
	≤4	90	87	91	73	49
	≤5	99	96	97	96	95
Norway	1	19	46	28	4	2
	≤2	44	66	56	14	3
	≤3	63	76	72	35	8
	≤4	79	85	78	59	18
	≤5	82	93	79	66	63
Slovenia	1	77	9	5	5	5
	≤2	95	50	18	18	18
	≤3	100	59	77	32	32
	≤4	100	68	91	82	59
	≤5	100	100	100	100	100
All Responses (including other countries)	1	47	22	16	8	7
	≤2	68	47	36	24	21
	≤3	80	68	67	40	33
	≤4	88	80	87	73	50
	≤5	97	94	94	92	91

Respondents with other motivation are encouraged to express in this question via text. Some of the respondents, who are vegetarians, argued that Alternate Proteins are the basis of their three meals. Some participants also expressed their preference concerning of alternate proteins good taste.

In most countries, “health concern” remains the primary factor influencing local consumers' choice of alternative proteins. However, based on survey data from Norway, we found that economic benefits are the primary consideration for local consumers when choosing alternative proteins. In contrast, consumers from Slovenia and Hungary did not rank high of concerns about “economic benefits” when deciding whether to opt for alternative proteins. Regarding the impact of "environmental benefits" on consumer choices, the majority of consumers also considered it a relatively important factor (ranked 2nd or 3rd as a primary reason). In discussions about the motivations for consuming alternative proteins, we found significant variation across countries in the emphasis on "animal welfare." Consumers from Hungary appeared to value this factor more than those from the other four countries. Additionally, "food safety and quality" seemed to have a limited impact on consumers' decisions to choose alternative proteins.

6.1.6 Question 6: Alternative Protein Consumption Frequency

Question 6 asked: “If your response in #3 is Yes, how often do you consume alternative proteins in a week?” and had the options of:

i) 1-2 meals
ii) 2-5 meals
iii) More than 5 meals

In the paper surveys but

i) 1-2 meals
ii) 3-5 meals
iii) More than 6 meals

In the online surveys.

For rough comparison purposes we have used “Low”, “Moderate” and “High” to represent the three possible choices for the different countries, but it is not fair to compare the UK and Slovenia with Italy, Hungary and Norway because Slovenia/the UK had all/most responses from the online version whereas the other countries had the majority of their responses from paper surveys.

The question was only to be answered by those who said they did consume alternative proteins. On this basis the question didn’t include “0 meals”, however some respondents ticked 1-2 meals and wrote “less” – they are included in 1-2 meals.

Results:

Table 27: Responses to the frequency of by country, by count

Country	Low	Moderate	High	Total Responses
Hungary	32	19	3	54
Italy	50	49	10	109
Norway	17	23	15	55
Slovenia	13	4	1	18
UK	179	252	39	470

Table 28: Responses to the frequency of by country, by percentage

Country	% Low	% Moderate	% High
Hungary	59	35	6
Italy	46	45	9
Norway	31	42	27
Slovenia	72	22	6
UK	38	54	8

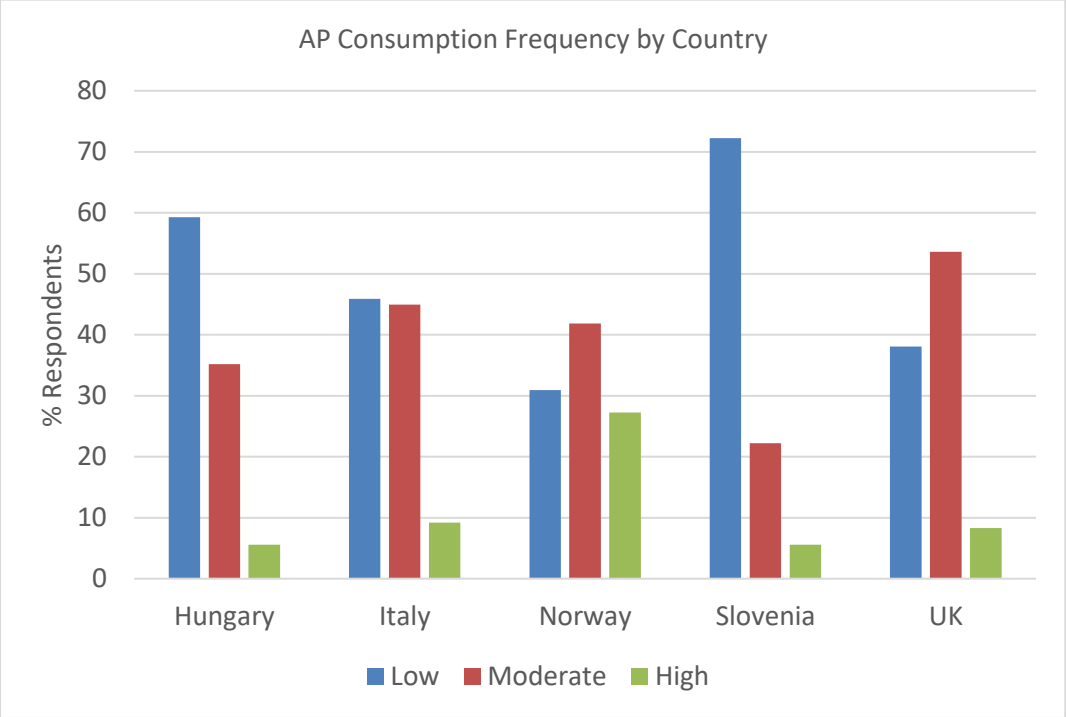

Figure 19: AP Consumption Frequency by Country with percentages

Of Italy, Hungary and Norway we see the frequency of consumption of APs for the respondents was highest in Italy and lowest in Norway.

Slovenia was also seen to have a much higher frequency of AP consumption amongst its respondents than the UK. Whilst the UK results did include a minority of results on paper, the difference in Slovenia and the UK is too significant to be caused by this. However, we must bear in mind there were only 18 Slovenia responses so the Slovenia results might not represent the population of Slovenia completely accurately.

The mode consumption of APs was the low (1-2 meals) option for Hungary, Italy and Slovenia and the moderate option (2-5 or 3-5 meals depending on the survey) for Norway and the UK.

6.1.7 Question 7 (Online Version in UK and Slovenia only)

Question 7 of the paper version had a different question from the online version used by UK and Slovenia. To avoid confusion, only question 7 of the online survey used by the UK and Slovenia is analysed here.

Question 7 of the online version used by UK and Slovenia asked: "How often do you consume animal proteins?" and had the options of:

v) 0 means
vi) 1-2 meals
vii) 3-5 meals
viii) More than 6 meals

Results

*Table 29: Responses to animal protein consumption frequency by UK and Slovenia, by count**

Country	0 meals	1-2 meals	3-5 meals	More than 6 meals	Responses
Slovenia	2	5	12	9	28
UK	44	192	134	30	400

*There are two responses from residents in Italy excluded from the table due to the small number of respondents.

Table 30: Responses to animal protein consumption frequency by UK and Slovenia, by percentage

Country	How often do you consume animal proteins?	% 1-2 meals	% 3-5 meals	% More than 6 meals
Slovenia	7	18	43	32
UK	11	48	34	8

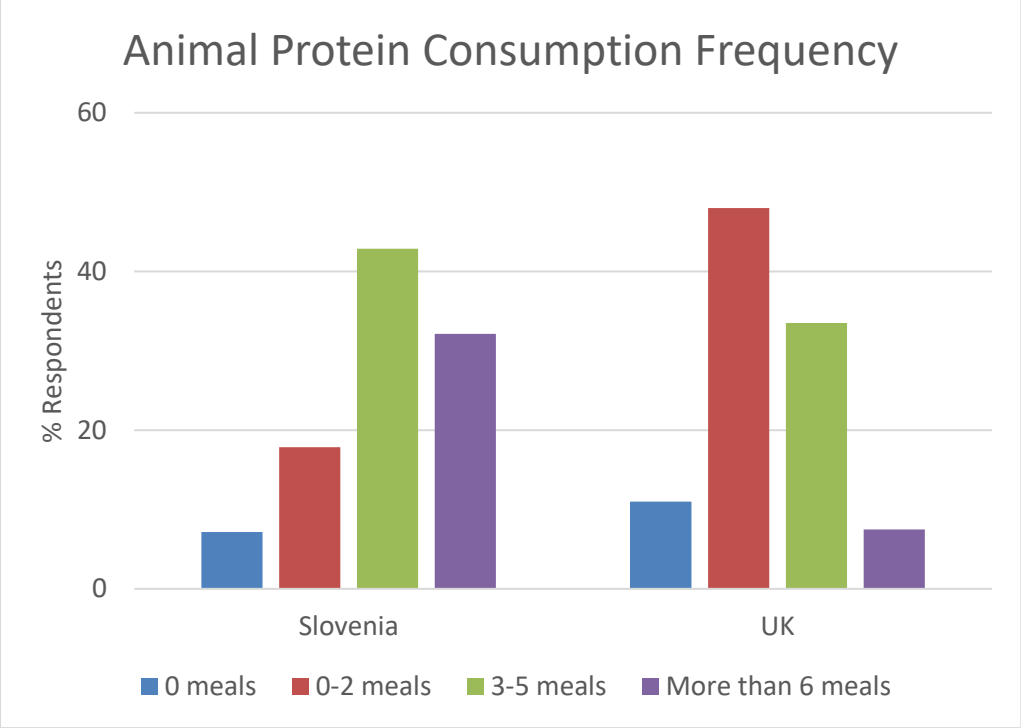

Figure 20: Animal Protein Consumption Frequency

We see that the frequency of consumption of animal proteins in meals was greater for the Slovenia respondents than the UK respondents. The median and mode choice was 3-5 meals for Slovenia but only 1-2 meals for the UK.

This result mirrors that of question 6, where the UK respondents were seen to have a higher consumption of alternative proteins in meals than the Slovenia respondents. However, the overall protein consumption of respondents from these two countries also appears to vary, as seen below.

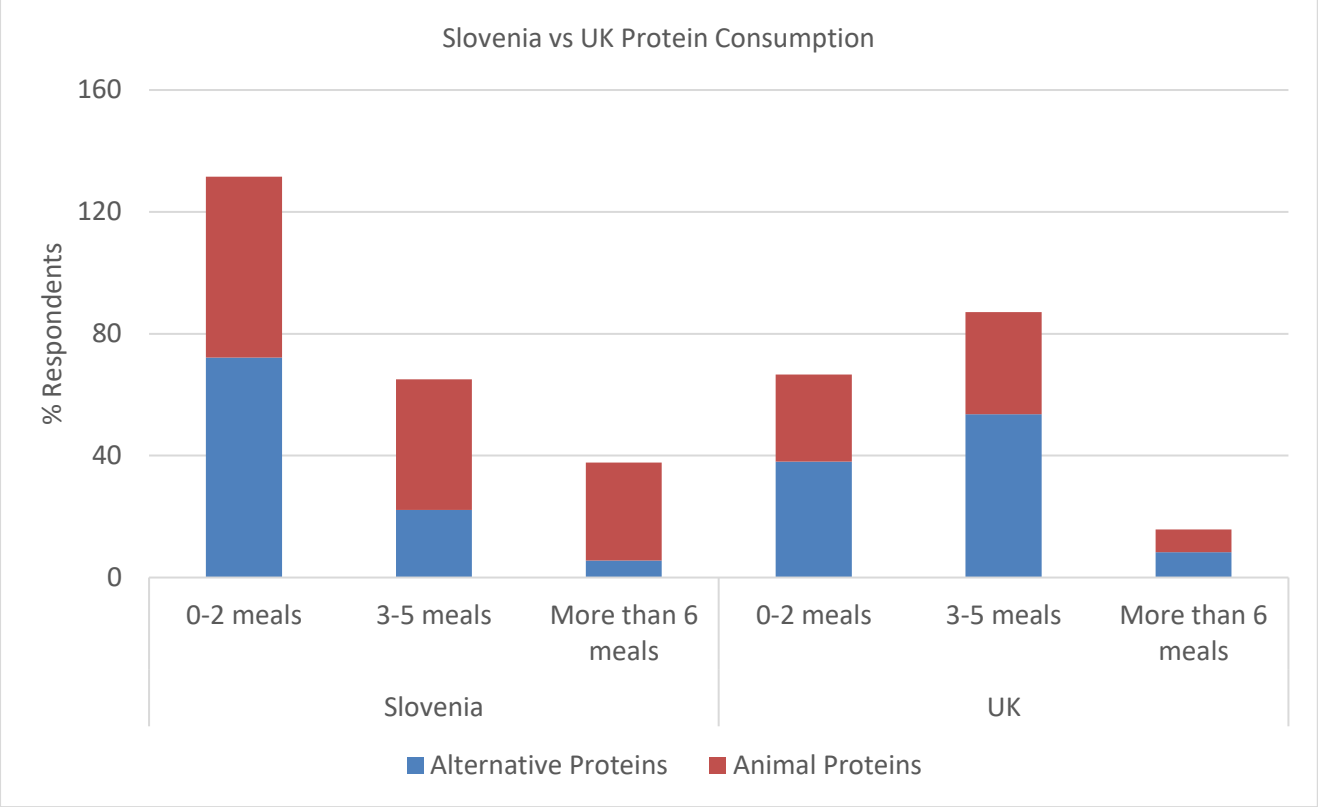

Figure 21: Slovenia vs UK Protein Consumption Frequency

6.1.8 Question 8: Concerns against Alternative Proteins

Question 5 asked: "If your response to #3 is **No**, please elaborate your concerns, and why do you not prefer alternative proteins (particularly the ones from insect, algae, cultured meat)"

In addition to the concerns mentioned in the questionnaire, respondents also indicated that they have less information about AP, including factors such as raw materials, the production process, the manufacturing process, and how to purchase it, which would also affect their attempts to try AP.

Results

Table 31: Concerns of respondents against Alternative Proteins, by count

Country	Concerns against AP					Total Responses
	Taste	Affordability	Quality	Availability	Other	
Hungary	22	14	5	14	18	44
Italy	27	14	21	19	11	59
Norway	25	24	11	26	10	45
Slovenia	7	0	4	2	1	14[2]
UK	83	138	144	91	34	440

[2] Only 10 said no to question 8. Some respondents mixed up the questions they were supposed to be answering.

Table 32: Concerns of respondents against Alternative Proteins, by percentage

Country	% Taste	% Affordability	% Quality	% Availability	% Other
Hungary	50	32	11	32	41
Italy	46	24	36	32	19
Norway	56	53	24	58	22
Slovenia	50	0	29	14	7
UK	19	31	33	21	8

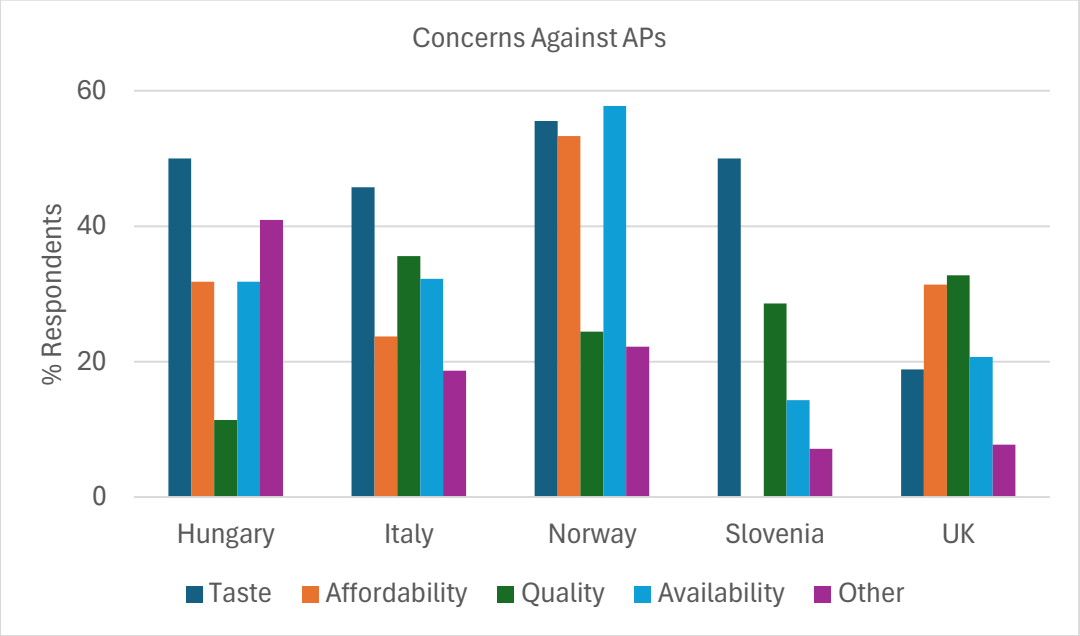

Figure 22: Concerns of respondents against Alternative Proteins by country

It is important to note that the sample size for this question was much smaller because it was only answered by respondents who said they did not consume APs. Slovenia had a very small sample size of 14 and so results might not be meaningful for it. Furthermore, the online survey only allowed one answer per respondent (whereas the paper surveys allowed any number of responses). This mainly affects the UK and Slovenia results which were mostly from the online survey.

The results imply that taste is the most significant concern against APs for Europe, however this is not true in the UK and the differences in results for each country could suggest that addressing concerns against APs in Europe may be done most effectively with a unique approach for individual countries. This would nevertheless require more data from other countries, a larger sample size and more consistency in data collection to confirm.

The results do reveal that quality and affordability are the most important factors in the UK whereas taste is more important in Hungary, Italy and Norway (but with availability most significant in Norway).

6.1.9 Question 9: Willingness to Try Alternative Proteins

The question asked respondents: "If your response to #3 is **No**, would you consider trying alternative proteins, especially the ones which you have not tried before?" and had options "Yes", "No" and "Maybe".

Results:

Table 33: Responses to willingness to Try Alternative Proteins by country, by count

Country	No	Maybe	Yes	Total Responses
Hungary	20	14	12	46
Italy	11	24	20	55
Norway	2	13	22	37
Slovenia	6	5	4	15
UK	108	63	268	439

Table 34: Responses to willingness to Try Alternative Proteins by country, by percentage

Country	% No	% Maybe	% Yes
Hungary	43	30	26
Italy	20	44	36
Norway	5	35	59
Slovenia	40	33	27
UK	25	14	61

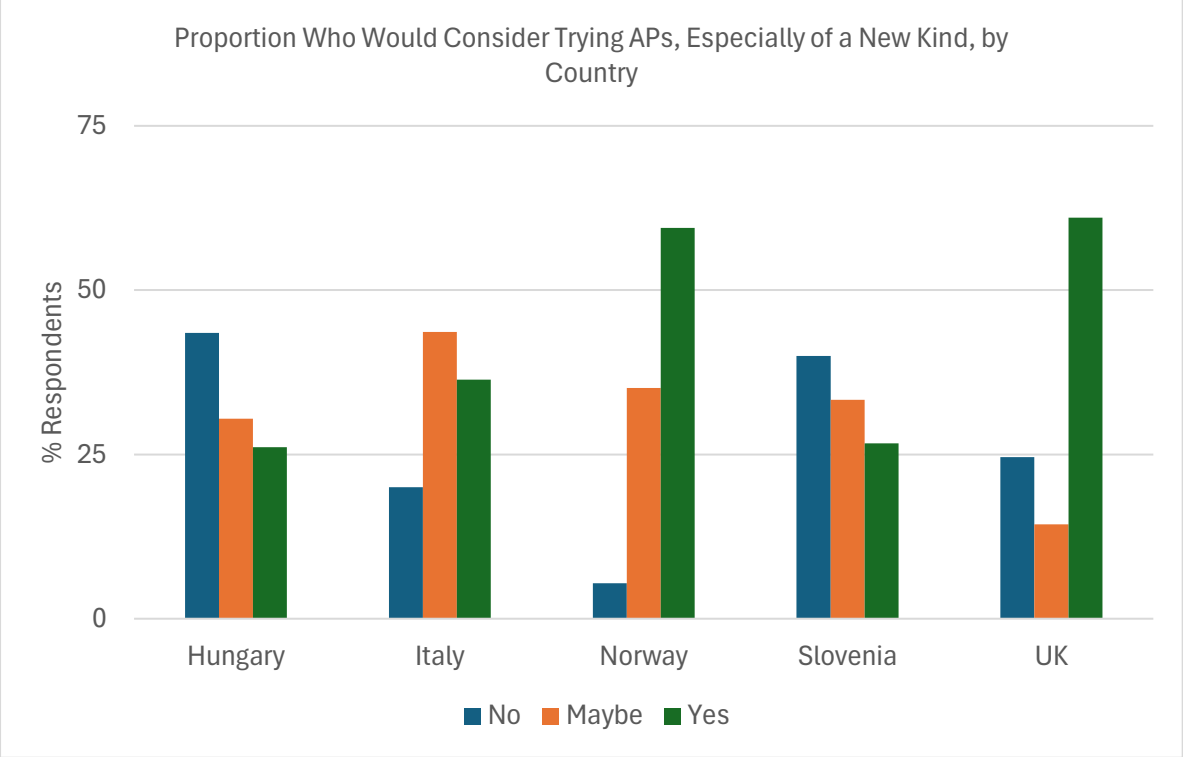

Figure 23: Responses to Willingness to Try Alternative Proteins by country, by percentage

These results reveal that people in Slovenia and Hungary who do not consume APs are particularly averse to trying them compared to people in the UK and Norway. However, it should be noted from question 3 that the UK already has the highest proportion of AP consumers, and this question was asked to all respondents.

6.1.10 Question 10: Benefits of Alternate Proteins.

Question 10 asked: "What benefit do you think Ap bring?" It has been analysed as a text question. The responses were found to be highly focussed, so the presentation of results with a word cloud was deemed unnecessary.

"Sustainability (reduced emissions, less environmental damage from livestock farming)", "health considerations" and "cheaper prices" are the three main benefits that AP could bring to our daily life that were generally recognized by the respondents. However, a limited number of participants also expressed concerns about AP replacing traditional protein sources.

6.1.11 Question 11: Factors Influencing Change in AP Consumption

This question asked respondents: "What could help change your perception and consumption habit about alternative proteins?" and allowed any number of responses from the selection.

Results

Table 35: Responses to Factors Influencing Change in AP Consumption by country, by count

Country	Taste	Affordability	Quality	Availability	Further learning about AP	Others	Total Response
Hungary	26	18	13	13	26	7	46
Italy	64	53	67	40	43	13	147
Norway	48	59	25	52	27	7	80
Slovenia	18	17	14	14	1	2	28
UK	181	200	206	175	44	13	509

Table 36: Responses to Factors Influencing Change in AP Consumption by country, by percentage

Country	% Taste	% Affordability	% Quality	% Availability	% Further learning about AP	% Others
	57	39	28	28	57	15
Italy	44	36	46	27	29	9
Norway	60	74	31	65	34	9
Slovenia	64	61	50	50	4	7
UK	36	39	40	34	9	3

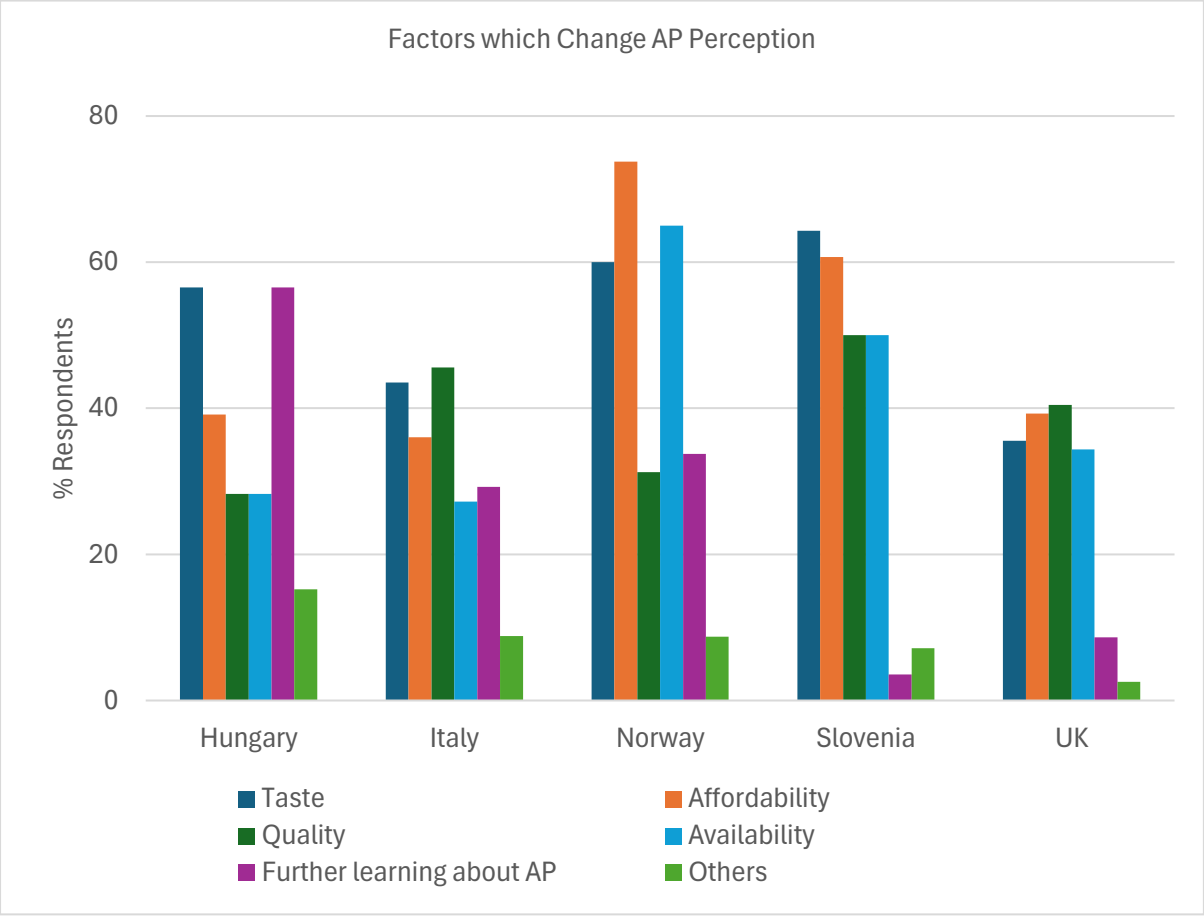

Figure 24: Responses to Factors Influencing Change in AP Consumption by country, by percentage

For Hungary, taste and further learning about APs were identified as factors which would help change the respondent's perception of APs twice as often as any other factor (except affordability). For Italy, quality was identified as such a factor most frequently, followed marginally by taste. For Norway, affordability was the most identified factor followed by availability and taste and these three factors were each identified about twice as often as any other factor. For Slovenia, taste was the most identified factor followed marginally by affordability. For the UK, quality was the most identified factor, but all factors have similar significance for the UK except further learning about APs.

6.1.12 Question 12: Frozen Food Consumers vs Non-consumers

This question asked respondents "Do you consume frozen food?" and had a "Yes" or "No" option.

Results:

Table 37: Responses to whether consuming frozen food by country, by count

Country	No	Yes	Total Responses
Hungary	3	97	100
Italy	13	155	168
Norway	2	93	95
Slovenia	1	29	30
UK	33	476	509

Table 38: Responses to whether consuming frozen food by country, by percentage

Country	% No	% Yes
Hungary	3	97
Italy	8	92
Norway	2	98
Slovenia	3	97
UK	6	94

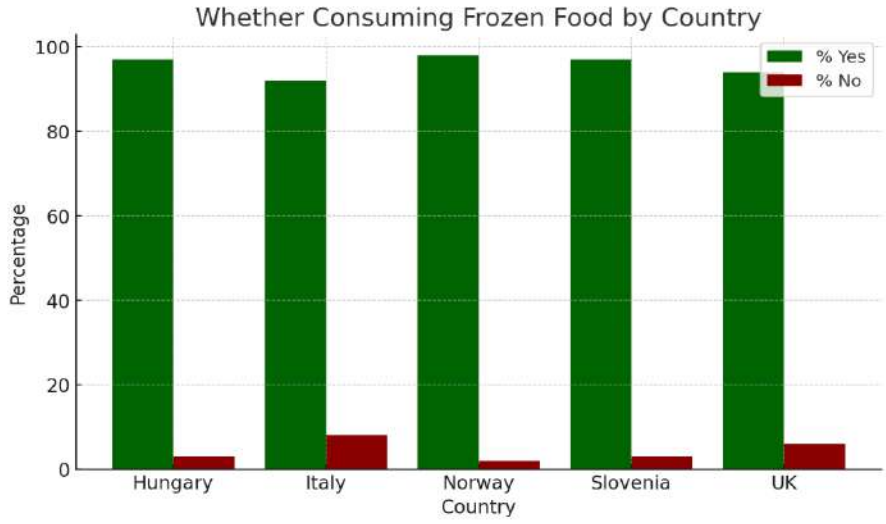

Figure 25: Responses to whether consuming frozen food by country, by percentage

The vast majority of respondents indicated that they do indeed consume frozen foods although more than 5% of Italy and UK respondents indicated that they do not. Norway had the highest number of respondents who indicated they consume frozen foods which is interesting given the favourable climate of Norway for preserving food at lower temperatures (compared to, say, Italy).

6.1.13 Question 13: Frozen Food Products Respondents Consume

This question asked respondents "If your response to #12 is **Yes**, then please select which of these listed options do you consume:

i) Fruits and vegetables
ii) Frozen meat
iii) Frozen fish
iv) Ice-creams / lollies etc
v) Frozen ready-to-eat meals
vi) Frozen baked foods
vii) Others

Note that for the UK paper survey, "iv) Ice-creams / lollies etc" was not given as an option.

Results

Table 39: Responses to Frozen Food Products Respondents Consume by country, by count

Country	Fruits and Veg	Frozen Meat	Frozen Fish	Ice-creams / Lollies etc	Ready Meals	Baked Foods	Others
Hungary	93	68	54	78	44	46	1
Italy	90	103	110	107	34	38	3
Norway	78	70	76	53	52	66	5
Slovenia	22	20	17	26	13	15	4
UK	253	317	249	158 (recorded from the online version only)	204	168	15

Table 40: Responses to Frozen Food Products Respondents Consume by country, by percentage

Country	% Fruits and Veg	% Frozen Meat	% Frozen Fish	% Ice-creams / Lollies etc	% Ready-meals	% Baked Foods	% Others
Hungary	97	71	56	81	46	48	1
Italy	58	67	71	69	22	25	2
Norway	84	75	82	57	56	71	5
Slovenia	76	69	59	90	45	52	14
UK	50	63	49	40*	40	33	3

*Calculated only from those who took the online version of the survey.

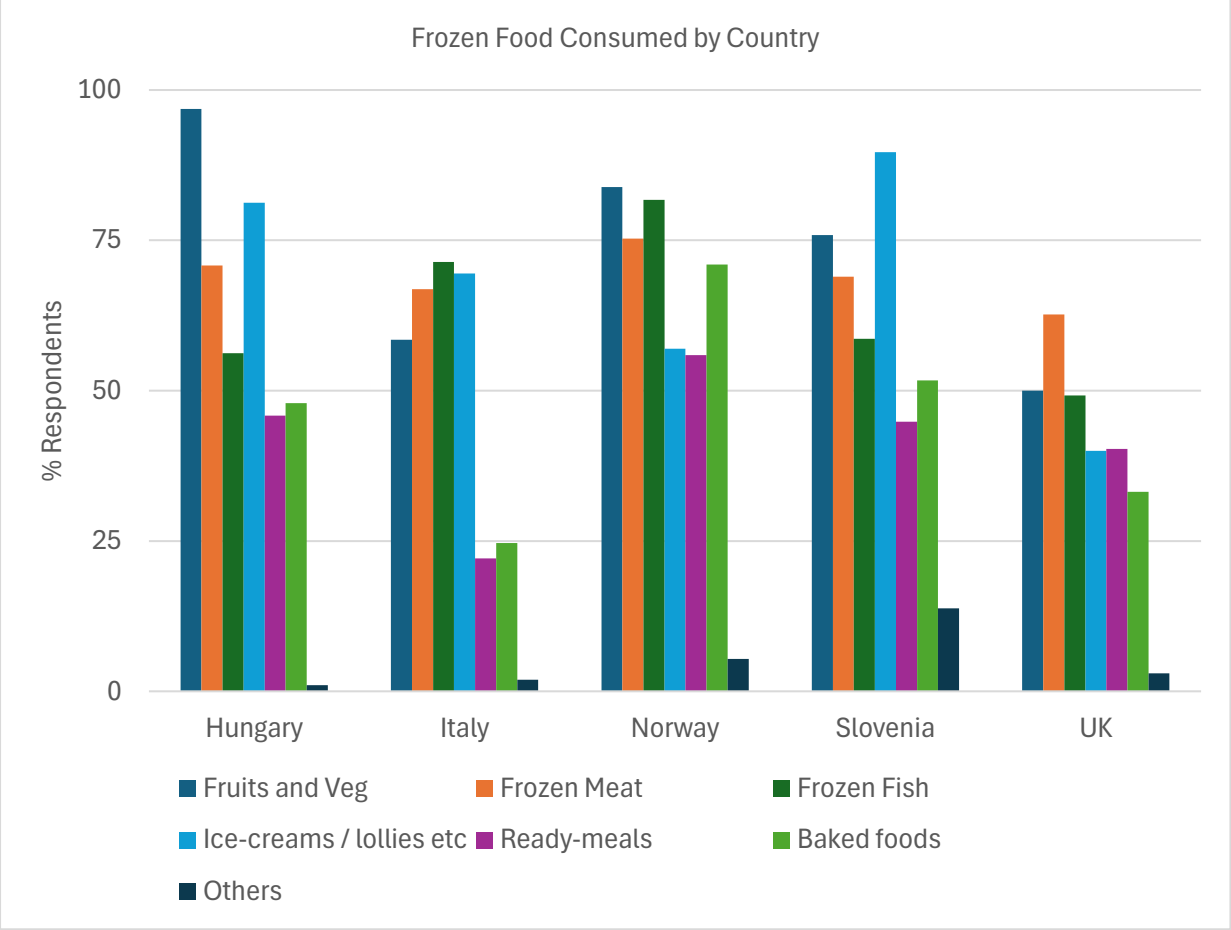

Figure 26: Responses to Frozen Food Products Respondents Consume by country, by percentage

Frozen baked foods and ready meals are seen to be most popular amongst Norway respondents and least popular amongst Italy respondents. These two options were the least consumed pair for each country besides Norway (and ignoring the "other" option). Frozen fruit and vegetables and frozen meat were seen to be consumed by at least half of the respondents of every country. Frozen fruit and vegetables were very popular amongst Hungary and Norway respondents, more so than any other category of food for these two countries.

6.1.14 Question 14: Frozen Food Consumption Frequency

This question asks: "If your response to #12 is **Yes**, how often do you consume frozen food in a week?"

The options were:

i) 1-2 meals
ii) 2-5 meals
iii) More

Note that a few respondents ticked 1-2 meals but commented "less" – all such respondents are included in the "1-2 meals" option.

Results

Table 41: Responses to Frozen Food Consumption Frequency by country, by count

Country	1-2 Meals	2-5 Meals	More than 5 Meals	
Hungary	70	22	5	97
Italy	80	67	6	153
Norway	31	44	15	90
Slovenia	19	9	1	29
UK	209	239	51	499

Table 42: Responses to Frozen Food Consumption Frequency by country, by percentage

Country	% 1-2 Meals	% 2-5 Meals	% More than 5 Meals
Hungary	72	23	5
Italy	52	44	4
Norway	34	49	17
Slovenia	66	31	3
UK	42	48	10

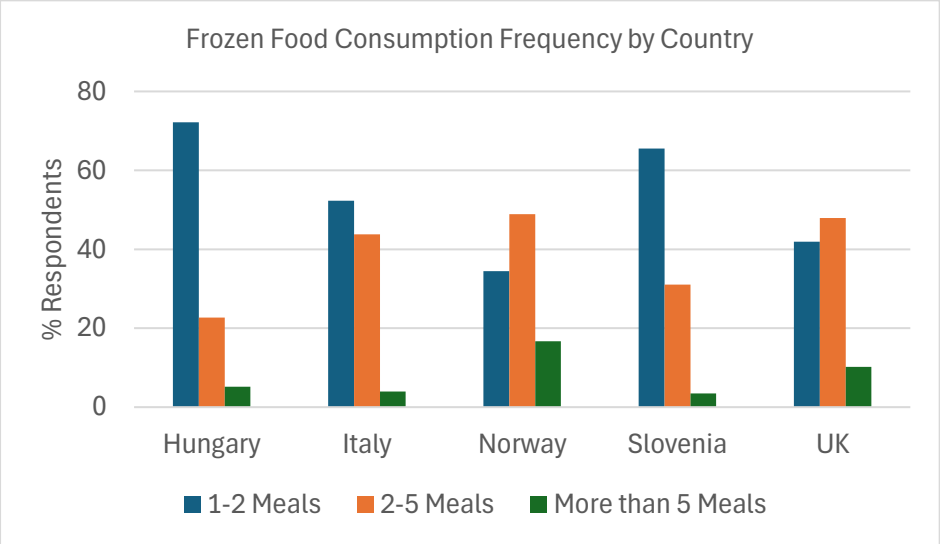

Figure 27: Responses to Frozen Food Consumption Frequency by country, by percentage

The Norway results indicate a higher frequency of frozen food consumption for Norway than the other four countries. Both Norway and the UK have a mode and median response of 2-5 meals, whereas the

other three countries have median and mode responses of 1-2 meals. Thus, it appears Norway and then the UK have the highest frequencies of frozen food consumption.

The Hungary results have the highest number of respondents who claimed to only eat frozen food 1-2 times per week and it appears to be the country where frozen food is consumed least often. This could only be disputed by the marginal differences in the numbers of respondents who claimed to eat more than 5 frozen meals per week between Hungary, Italy and Slovenia, which would suggest Italy had a lower frozen food consumption frequency.

6.1.15 Question 15: Ranking of Reasons to Choose Frozen Food over Fresh

Question 15 asked: "If your response to #12 is Yes, what are the reasons for choosing frozen options where fresh options are available? Please select from the options below and rank them based on the most important reason; 1 being the most important and 5 the least important reason."

Results

Table 43: Responses to Reasons to Choose Frozen Food over Fresh by country, by count for each rank

Country	Rank	Reasons Respondents Choose Frozen Options				Net Responses
		Better price	Convenience	Minimise waste	Unavailability of fresh option	
Italy	1	38	44	42	25	149
	2	30	34	27	21	
	3	26	23	21	12	
	4	18	5	16	32	
Hungary	1	12	49	19	17	97
	2	24	17	35	20	
	3	36	12	26	18	
	4	22	17	14	38	
UK	1	199	198	61	39	497
	2	130	141	136	62	
	3	87	103	160	93	
	4	44	42	93	243	
Norway	1	36	32	21	3	92
	2	25	27	21	6	
	3	12	18	23	4	
	4	2	2	7	25	
Slovenia	1	13	12	3	2	30
	2	7	12	7	4	
	3	7	4	13	6	
	4	3	2	7	18	

Table 44: Responses to Reasons to Choose Frozen Food over Fresh by country, by cumulative percentages of ranks

Country	Rank	Reasons Respondents Choose Frozen Options Cumulative Percentages			
		% Better price	% Convenience	% Minimise waste	% Unavailability of fresh option
Italy	1	25	30	28	17
	≤2	45	53	47	31
	≤3	63	68	61	40
	≤4	74	72	71	61
Hungary	1	12	51	20	18
	≤2	37	68	56	38
	≤3	74	80	82	57
	≤4	97	98	97	96
UK	1	40	40	12	8
	≤2	66	68	40	20
	≤3	83	89	72	39
	≤4	92	97	91	88
Norway	1	39	35	23	3
	≤2	67	64	46	9
	≤3	80	83	71	14
	≤4	82	85	78	40
Slovenia	1	43	40	10	7
	≤2	67	80	33	20
	≤3	90	93	77	40
	≤4	100	100	100	100
All Responses (including outside the above countries)	1	36	38	17	10
	≤2	60	64	44	23
	≤3	79	84	71	38
	≤4	89	92	87	80

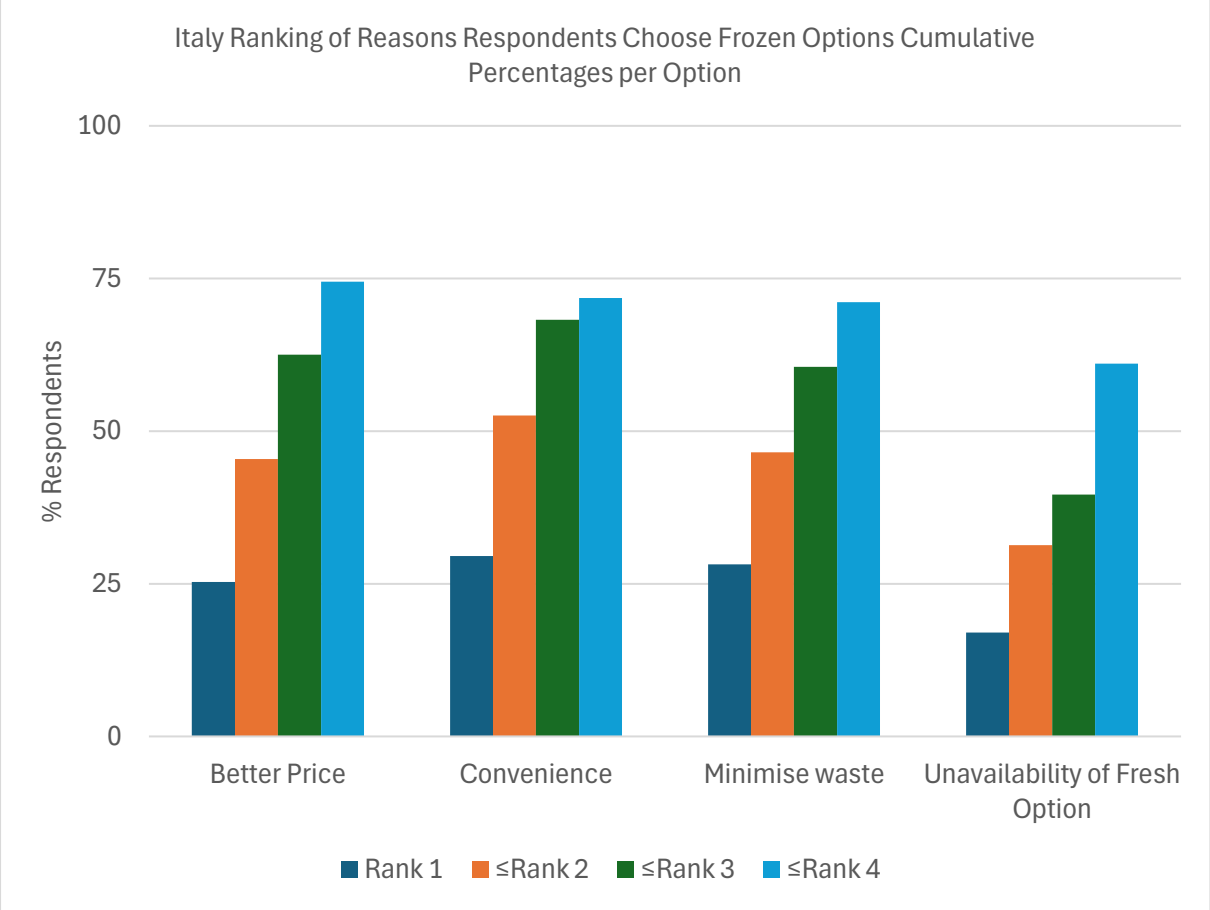

Figure 28: Responses to Reasons to Choose Frozen Food over Fresh by cumulative percentages of ranks in Italy

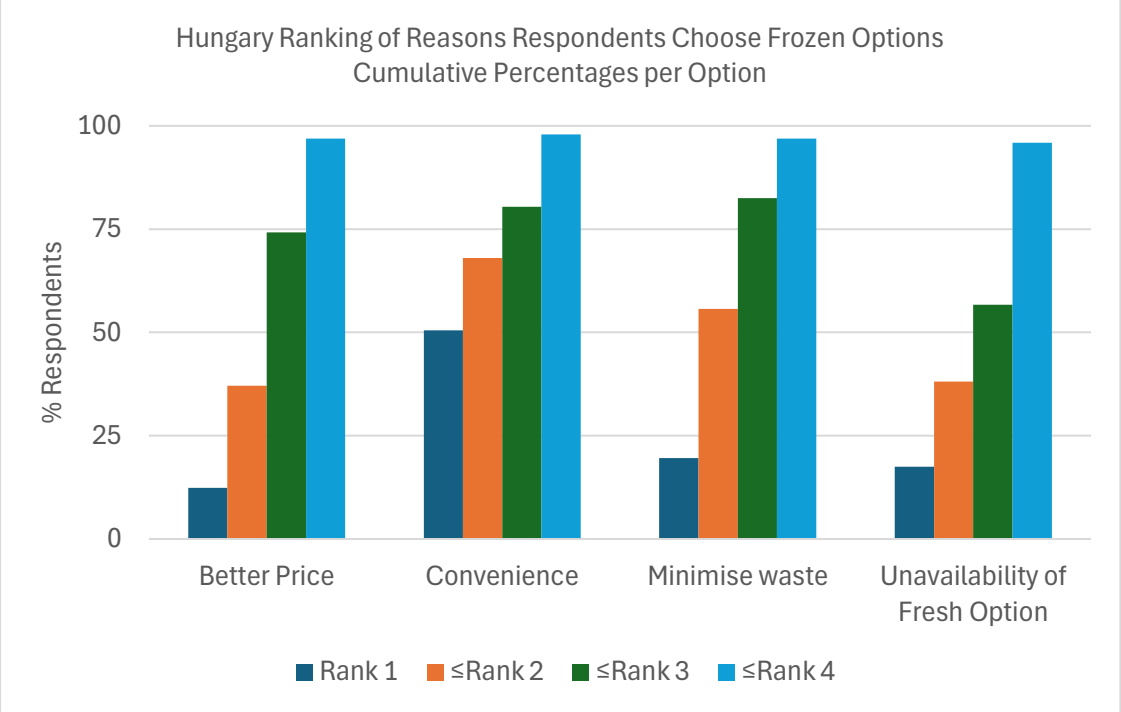

Figure 29: Responses to Reasons to Choose Frozen Food over Fresh by cumulative percentages of ranks in Hungary

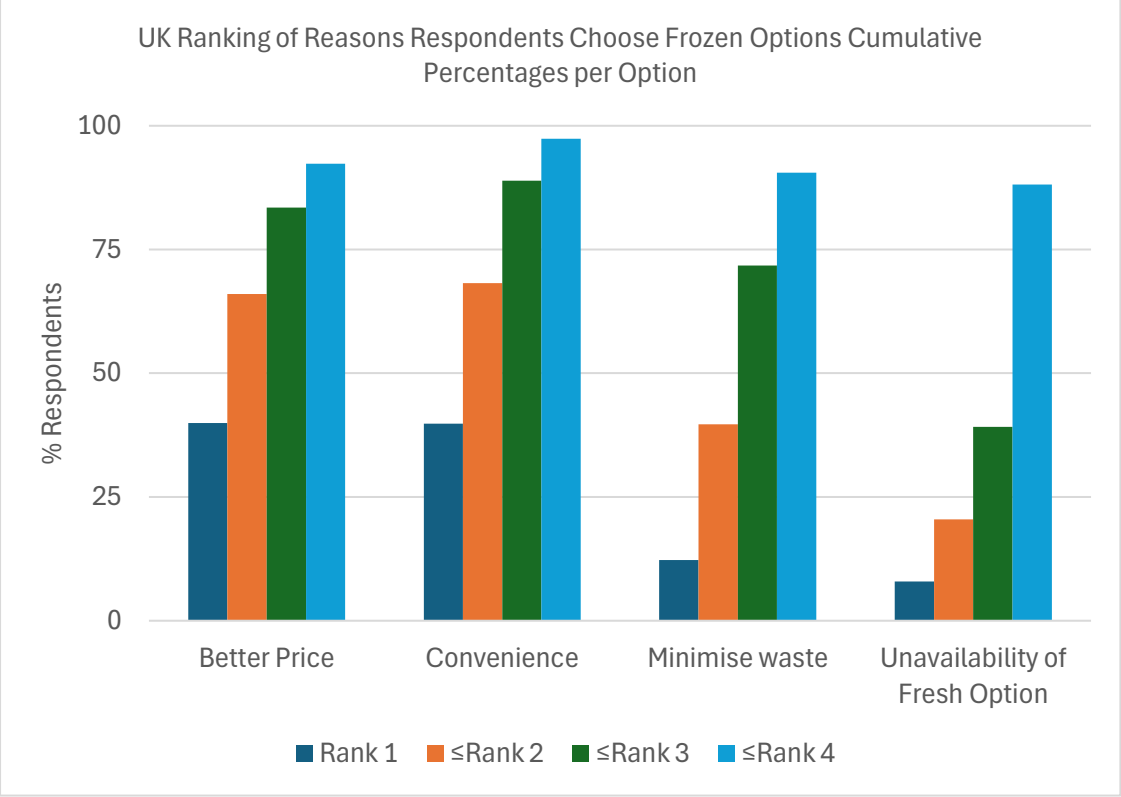

Figure 30: Responses to Reasons to Choose Frozen Food over Fresh by cumulative percentages of ranks in UK

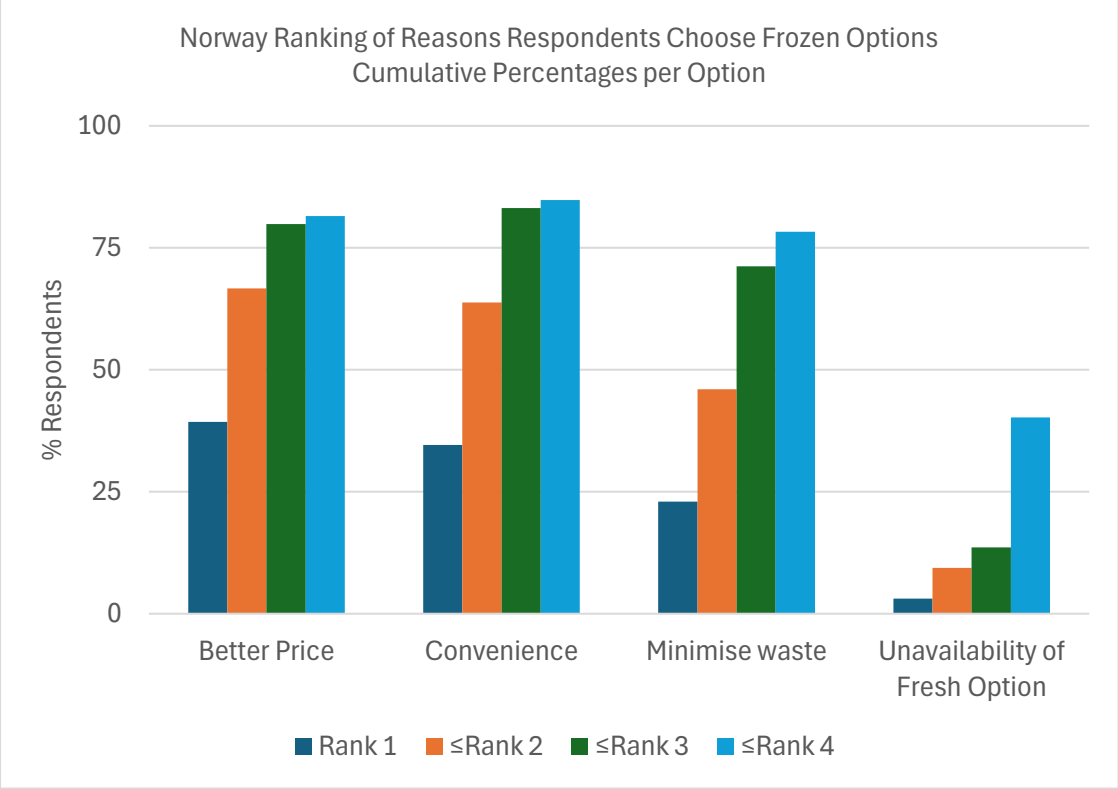

Figure 31: Responses to Reasons to Choose Frozen Food over Fresh by cumulative percentages of ranks in Norway

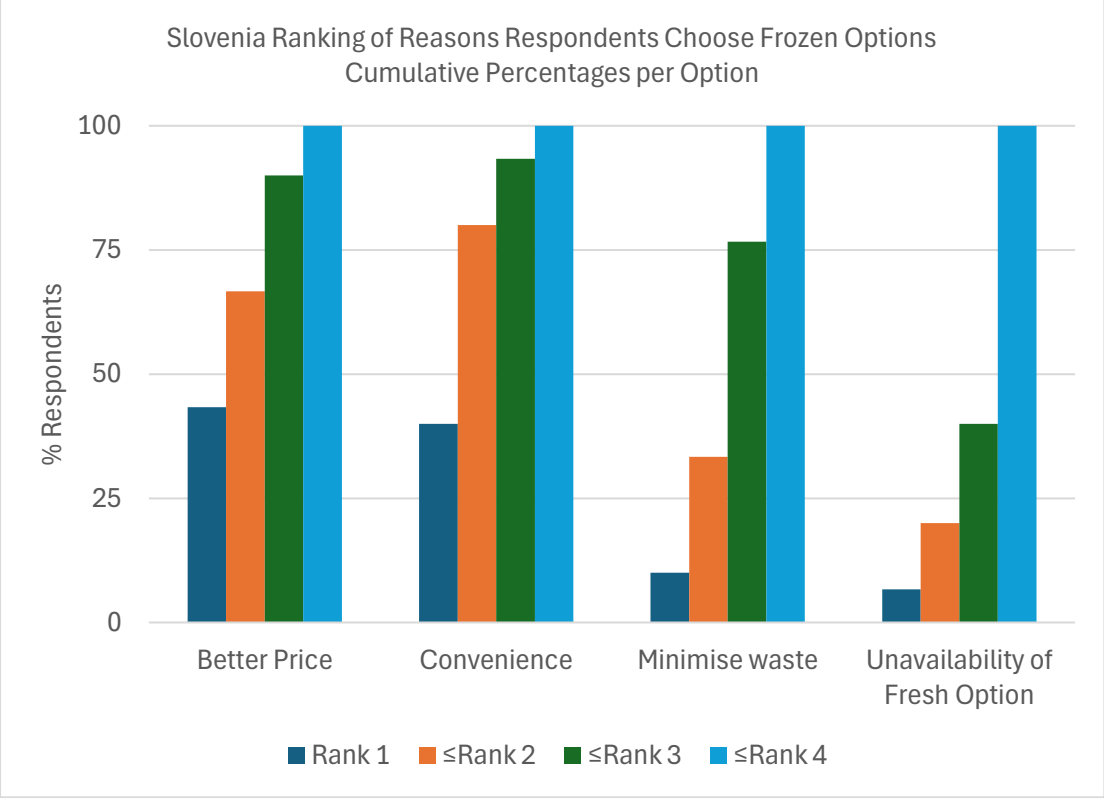

Figure 32: Responses to Reasons to Choose Frozen Food over Fresh by cumulative percentages of ranks in Slovenia

Convenience has the highest cumulative percentages for first to third ranks for Italy and the UK (although it is joint in its' first position). It also has the highest cumulative percentages for first to second ranks for Hungary. Thus, the assertion that convenience is the predominant reason the respondents choose frozen food options for these countries is sensible. However, it could be argued that the minimise waste option was significant for more Hungary respondents than convenience from the cumulative percentages for the third rank. Our interpretation of this lies on whether the respondents would consider an option they put as third rank significant enough to change their actions regarding choosing frozen food. Note that it is irrelevant if the cumulative percentage for the fourth rank is not the highest, as for the respondents who answered correctly, they would always tick all options with some rank from 1 to 4 even if an option was not significant to them.

For Norway, better pricing had the highest cumulative percentages for the first to second rank (but was beaten by convenience in the third rank). Similarly, for Slovenia better pricing had the highest percentage for the first rank but the cumulative percentage for the second rank was higher for the convenience option. This makes it more difficult to establish the predominant reason respondents choose frozen food for these countries. If we were to say that only the respondents first choice was significant enough to change their actions, we could say that better pricing was the most significant reason respondents choose frozen food for these countries. Our opinion could change if we said their first two reason or first three reasons would be significant enough to cause them to change their actions.

Minimising waste has the third highest cumulative percentages for any rank and country (except in the case of Hungary) and unavailability of fresh options consistently has the lowest cumulative percentages. Thus, we determine that minimising waste was the third most significant reason respondents choose frozen food (except possibly for Hungary), and we determine that the least significant reason for any country was the unavailability of fresh options.

6.1.16 Question 16: Ranking of Reasons Against Choosing Frozen Foods

Question 16 asked: "If your response to #12 is **No**, what are your reasons for not choosing the frozen options? Please select from the options below and rank them based on the most important reason; 1 being the most important and 5 the least important." Since only 1 respondent answered no for Slovenia, 2 for Norway and 3 for Hungary we only consider it worth comparing Italy and the UK.

Results

Table 45: Responses to Reasons Against Choosing Frozen Foods by country, by count for each rank

		Reasons Against Choosing Frozen Foods				
Country	Ranking	Nutritional quality	Taste	Quality	Freshness / wholesomeness	Net Responses
Italy	1	3.5	0	3	4	13
	2	1.5	2	3	2	
	3	0	3	4	1	
	4	3	2	2	1	
UK	1	17	13	0	2	32
	2	10	12	5	5	
	3	0	2	19	9	
	4	4	3	6	15	

Table 46: Responses to Reasons Against Choosing Frozen Foods by country, by cumulative percentages of ranks

Country	Rank	Reasons Against Choosing Frozen Foods Cumulative Percentages			
		% Nutritional quality	% Taste	% Quality	% Freshness / wholesomeness
Italy	1	27	0	19	31
	≤2	38	15	38	46
	≤3	38	38	65	50
	≤4	62	54	77	54
UK	1	53	42	0	6
	≤2	83	80	16	21
	≤3	84	87	75	50
	≤4	97	97	94	97

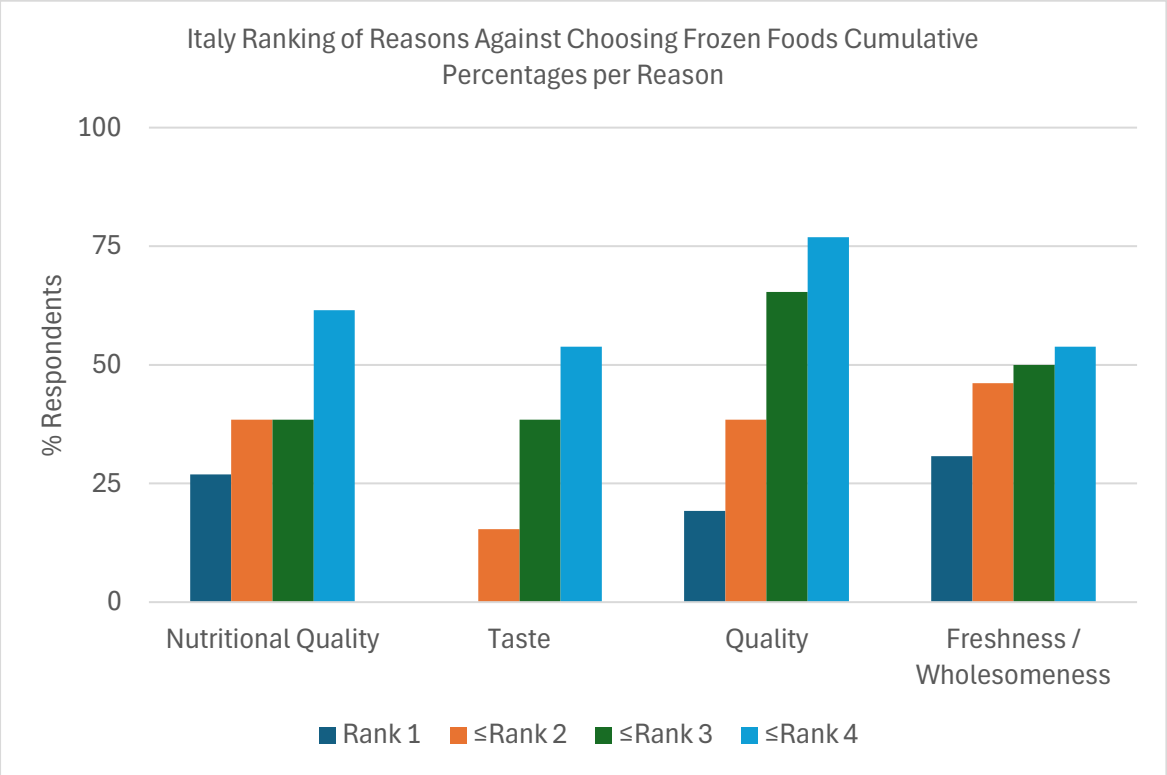

Figure 33: Reasons Against Choosing Frozen Foods Cumulative Percentages per Reason in Italy

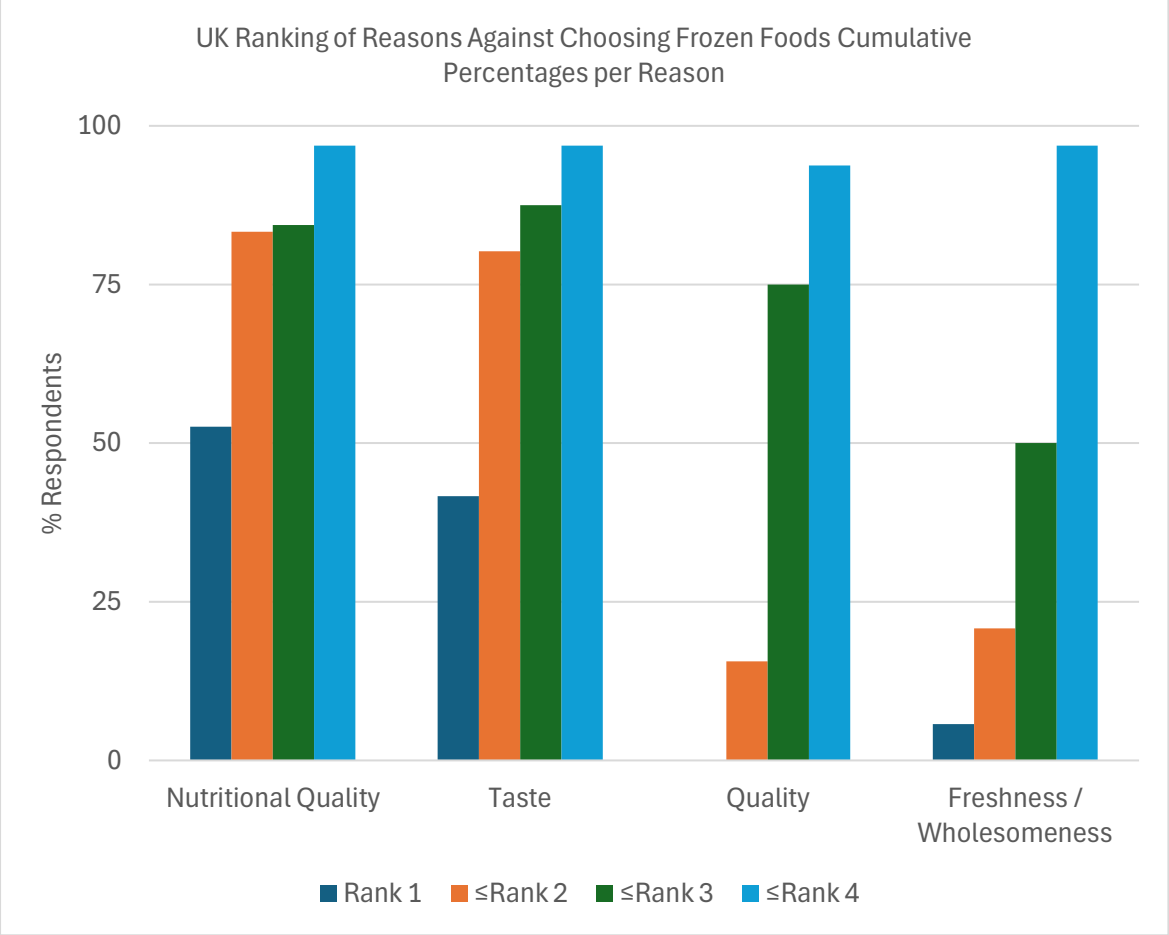

Figure 34: Reasons Against Choosing Frozen Foods Cumulative Percentages per Reason in UK

For the Italy respondents it is unclear which reason against choosing frozen food was most significant as the sample size was very small, and the highest cumulative percentage varies country depending on the rank chosen. Furthermore, the cumulative percentages are quite close for each rank except for taste. Taste was the least important factor for Italy respondents, as the cumulative percentages for it are lowest for each rank for taste by a non-trivial amount.

For the UK, nutritional quality was a very important factor, with 53% of respondents giving it the top rank and 83% the top two. Whilst nutritional quality had the highest cumulative percentages in the first two ranks, taste had the highest cumulative percentage in the third rank. This showed us that taste was an important factor for most (88%) of UK candidates, even if it was not a very important factor for these candidates. Quality and freshness were less important factors for UK respondents.

6.1.17 Question 17: Perception of Frozen Food Nutritional Quality

Respondents were asked: "Do you think frozen food has equal, better or worse nutritional quality compared to the fresh food?" and were required to tick the relevant answer.

Hungary has very few responses, as in the Hungary paper survey this question took text-based answers, and many respondents just skipped this type of question.

Results

Table 47: Responses to Perception of Frozen Food Nutritional Quality by country, by count

Country	Better	Equal	Worse	Total Responses
Hungary	0	2	1	3
Italy	3	57	93	153
Norway	3	38	28	69
Slovenia	1	8	20	29
UK	136	228	128	492

Table 48: Responses to Perception of Frozen Food Nutritional Quality by country, by percentage

Country	% Better	% Equal	% Worse
	0	67	33
Italy	2	37	61
Norway	4	55	41
Slovenia	3	28	69
UK	28	46	26

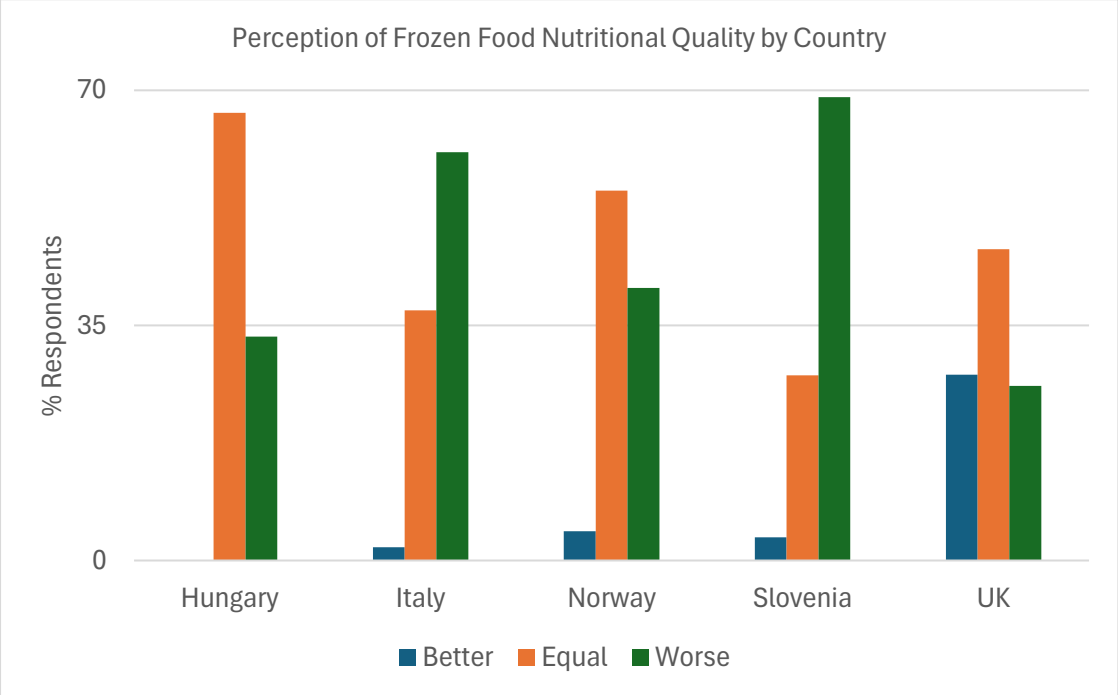

Figure 35: Responses to Perception of Frozen Food Nutritional Quality by country, by percentage

Respondents who chose 'worse' thought that the multiple processing of food would lead to the loss of nutrients. They also pointed out that the method and duration of refrigerated storage also affected the nutrient content of the food. The limited respondents who chose 'better' commented that

freezing preserves the energy in the food and keeps it fresher. Respondents who chose 'the same' emphasized that freezing technology may be a key factor in determining whether there are differences in nutrients between fresh and frozen foods.

6.1.18 Question 18: Social Media Influence on Food Choices

Respondents were asked" How often has social media influenced your choice of food?" with options of:

v) Most Often
vi) Often
vii) Sometimes
viii) Never

Results

Table 49: Responses to Social Media Influence on Food Choices by country, by count

Country	Never	Sometimes	Often	Most Often	Total Responses
Hungary	19	53	18	10	100
Italy	57	70	27	7	161
Norway	14	50	25	5	94
Slovenia	9	13	6	2	30
UK	55	171	181	100	507

Table 50: Responses to Social Media Influence on Food Choices by country, by percentage

Country	% Never	% Sometimes	% Often	% Most Often
	19	53	18	10
Italy	35	43	17	4
Norway	15	53	27	5
Slovenia	30	43	20	7
UK	11	34	36	20

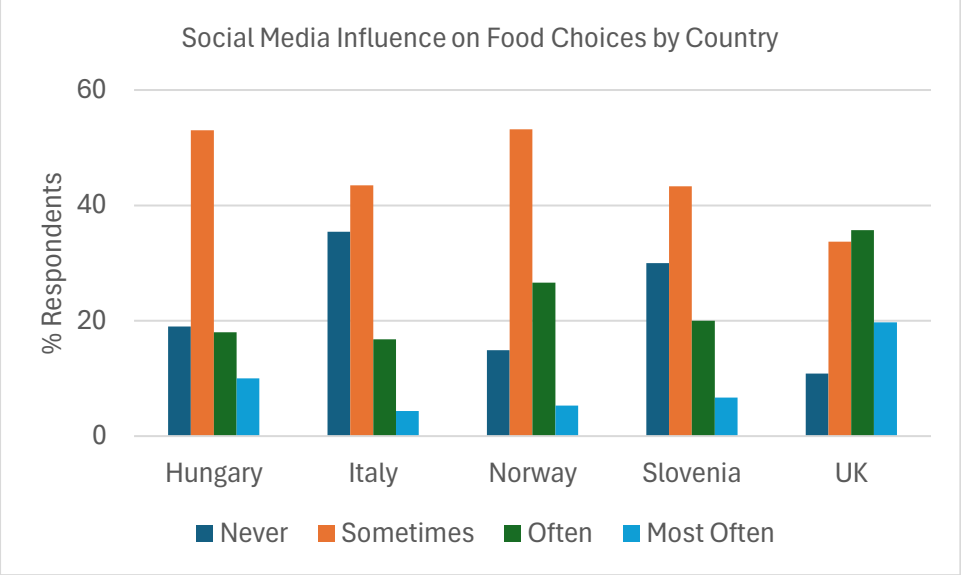

Figure 36: Social Media Influence on Food Choices by Country

Our results show us that social media had the biggest impact on food choices for the UK respondents, and the least impact on the Italy respondents. Except for the UK, the median and mode response was 'Sometimes' but in the UK, it was 'Often'.

6.1.19 Question 19: Ranking of Food Waste by Quantity

This question asked "What kind of food is wasted in your household?

Rank them in order of the volume of wastage, 1 being the highest volume to 5 being the least volume."

Results

Table 51: Responses to Food Waste by Quantity by country, by count for each rank

Country	Rank	Food Waste Category						
		Fruit and Veg	Meat & Meat Products	Fish	Milk	Dairy products	Bread and Bakery Products	Net Responses
Italy	1	69	4	7	18	15	30	157
	2	23	19	13	20	25	23	
	3	11	23	11	16	19	23	
	4	7	16	17	16	9	10	
	5	10	16	12	9	10	9	
	6	6	9	12	10	7	10	
Hungary	1	44	7	1	3	7	29	

	2 3 4 5 6	21 10 3 1 0	14 20 7 0 0	5 5 5 0 0	6 13 7 0 0	19 16 3 2 0	22 15 7 1 0	91
UK	1 2 3 4 5 6	101 20 4 3 2 3	93 7 10 4 5 3	53 1 2 6 4 6	62 14 7 4 2 2	37 7 10 3 3 2	56 11 12 4 1 1	401
Norway	1 2 3 4 5 6	43 17 9 6 1 3	2 5 7 7 20 12	1 3 5 10 14 17	8 10 12 17 7 4	11 19 24 9 3 2	23 21 11 9 4 3	88
Slovenia	1 ≥2	7 0	0 0	0 0	2 0	0 0	9 0	18

Table 52: Responses to Food Waste by Quantity by country, by cumulative percentages for each rank

Country	Ranking	Food Waste Category Cumulative Percentages					
		% Fruit and vegetables	% Meat and meat products	% Fish	% Milk	% Dairy products	% Bread and bakery product
Italy	1 ≤2	44 58	2 14	4 12	11 24	10 25	19 34

	≤3	65	29	20	34	38	49
	≤4	70	39	30	44	43	55
	≤5	76	49	38	50	49	61
	≤6	80	55	46	57	54	68
Hungary	1	48	8	1	3	8	32
	≤2	71	23	7	10	29	56
	≤3	82	45	12	24	46	73
	≤4	86	53	18	32	49	80
	≤5	87	53	18	32	52	81
	≤6	87	53	18	32	52	81
UK	1	25	23	13	15	9	14
	≤2	30	25	14	19	11	17
	≤3	31	27	14	21	13	20
	≤4	32	28	15	22	14	21
	≤5	32	30	17	22	15	21
	≤6	33	30	18	23	15	21
Norway	1	49	2	1	9	13	27
	≤2	68	7	4	21	35	50
	≤3	78	15	9	34	61	63
	≤4	86	23	21	53	72	74
	≤5	87	45	37	61	76	78
	≤6	90	59	56	66	78	82
Slovenia	1	39	0	0	11	0	50
	≤6	39	0	0	11	0	50

For every country except Slovenia, fruit and vegetables had the highest cumulative percentages across all ranks. Thus, the respondents for Italy, Hungary, Norway and the UK must consider this the food

type which they throw away the most. For Slovenia, bread and bakery products were identified* more often as food waste items than any other food category.

*It is important to note that question 19 was a tick question in the online version, hence the Slovenia results only have answers in the first row and the UK has disproportionate answers in the first row. This is why I use the phrase “identified” instead of “ranked” for Slovenia.

6.1.20 Question 20: Food Waste Frequency

Respondents were asked "Do you have an estimated idea about the food waste frequency in your household in a week?” with options of:

i) Weekly (or less) *
ii) 2-3 times weekly
iii) Daily

*It should be noted that the paper surveys had “Weekly” as the least option not “Weekly or less” but many who ticked “Weekly” commented “less”. Furthermore, the online survey had a “Never” option as the least option. Thus, these results are combined into “Weekly (or less)”.

Results

Results by count:

Table 53: Responses to Food Waste Frequency by country, by count

Country	Weekly (or less)	2-3 times per week	Daily	Total Responses
	43	49	8	100
Italy	124	32	6	162
Norway	70	22	0	92
Slovenia	15	14	1	30
UK	171	264	68	503

Results by proportion:

Table 54: Responses to Food Waste Frequency by country, by percentage

Country	% Weekly (or less)	% 2-3 times per week	% Daily
	43	49	8
Italy	77	20	4
Norway	76	24	0
Slovenia	50	47	3
UK	34	52	14

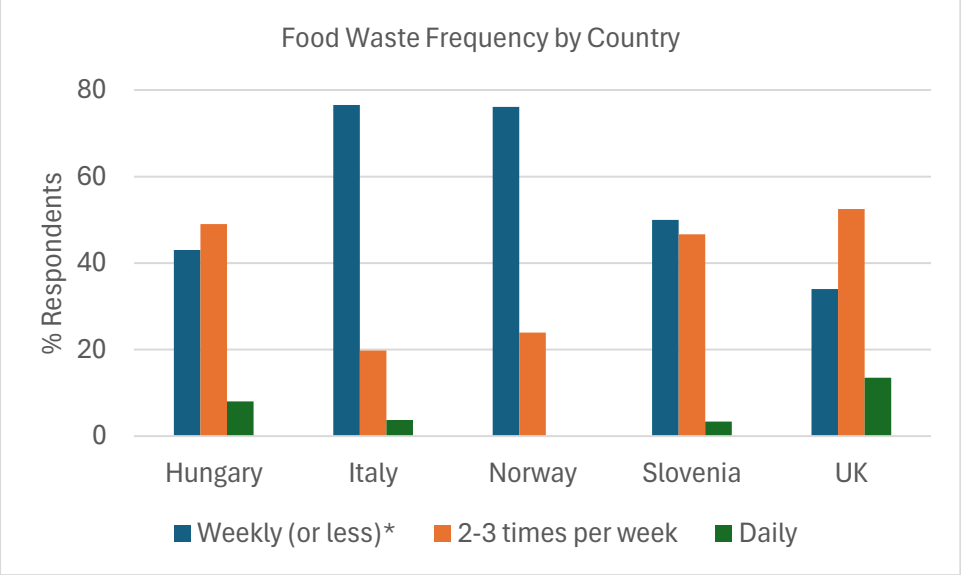

Figure 37: Responses to Food Waste Frequency by country, by percentage

These results demonstrate that of these countries, the UK has the highest frequency of food waste followed by Hungary and then Slovenia. Food waste is seen to typically occur 2-3 times a week for the UK and Hungary whereas in Italy and Norway food waste typically occurs weekly or less.

6.1.21 Question 21: Primary Reasons for Food Waste

Respondents were asked " What are the primary reasons for food waste at your end? You can select as many options as applies." They were given the following list:

i) Incorrect meal plan (shopping)
ii) Incorrect meal plan (portioning)
iii) Bulk shopping
iv) Spoiled/stale food
v) Improper Storage

Results

Table 54: Responses to Primary Reasons for Food Waste by country, by count

Country	Incorrect meal planning - shopping	Incorrect meal planning - cooking	Bulk shopping	Spoilt / stale food	Improper storage	Total Responses
Hungary	25	63	41	45	15	100
Italy	54	49	28	79	38	165
Norway	33	22	15	50	24	89
Slovenia	8	15	7	12	4	30
UK	163	219	145	241	89	503

Table 55: Responses to Primary Reasons for Food Waste by country, by percentage

Country	% Incorrect meal planning - shopping	% Incorrect meal planning - cooking	% Bulk shopping	% Spoilt / stale food	% Improper storage
Hungary	25	63	41	45	15
Italy	33	30	17	48	23
Norway	37	25	17	56	27
Slovenia	27	50	23	40	13
UK	32	44	29	48	18

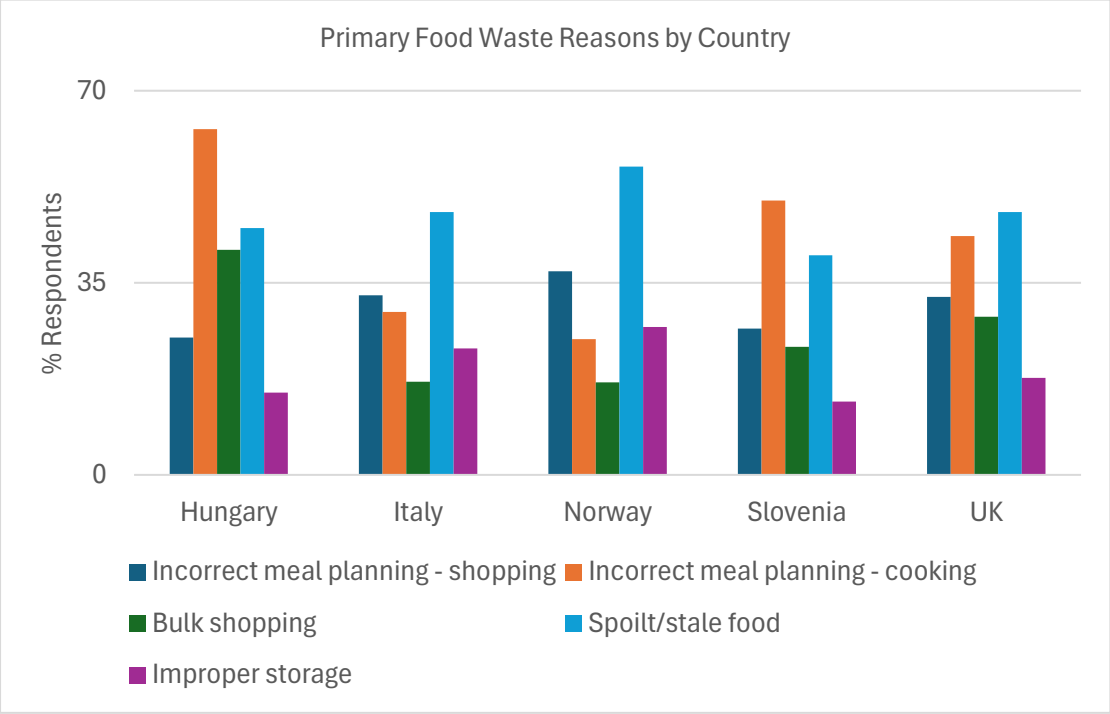

Figure 38: Responses to Primary Reasons for Food Waste by country, by percentage

We can see that in Norway, Italy and the UK spoilt/stale food was the main reason identified for causing food waste, and this was the second main reason for Hungary and Slovenia. Spoilt/stale food was also important for more than half of Hungary respondents. The main reason for food waste in both Hungary and Slovenia was incorrect meal planning during cooking, which was also the second most significant factor for the UK. Incorrect meal planning during cooking was also important for more than half of the Norway respondents. The other reasons were generally less significant, taking percentage values from 13% to 41%.

Most countries did not have a factor which was considered a primary reason for food waste by more than 50% of the population, so a mixed strategy may be required to help people reduce their food waste.

6.1.22 Question 22: Respondents who Repurpose Leftover Food vs Respondents who Do Not

Respondents were asked to tick “Yes” or “No” to the question: “Do you consume leftover food and repurpose the leftover ingredients to make a meal?”

Results

Table 56: Responses to Repurpose Leftover Food by country, by count

Country	No	Yes	Total
Hungary	46	44	90
Italy	26	139	165
Norway	2	92	94
Slovenia	2	28	30
UK	138	369	507

Table 57: Responses to Repurpose Leftover Food by country, by percentage

Country	% No	% Yes
	51	49
Italy	16	84
Norway	2	98
Slovenia	7	93
UK	27	73

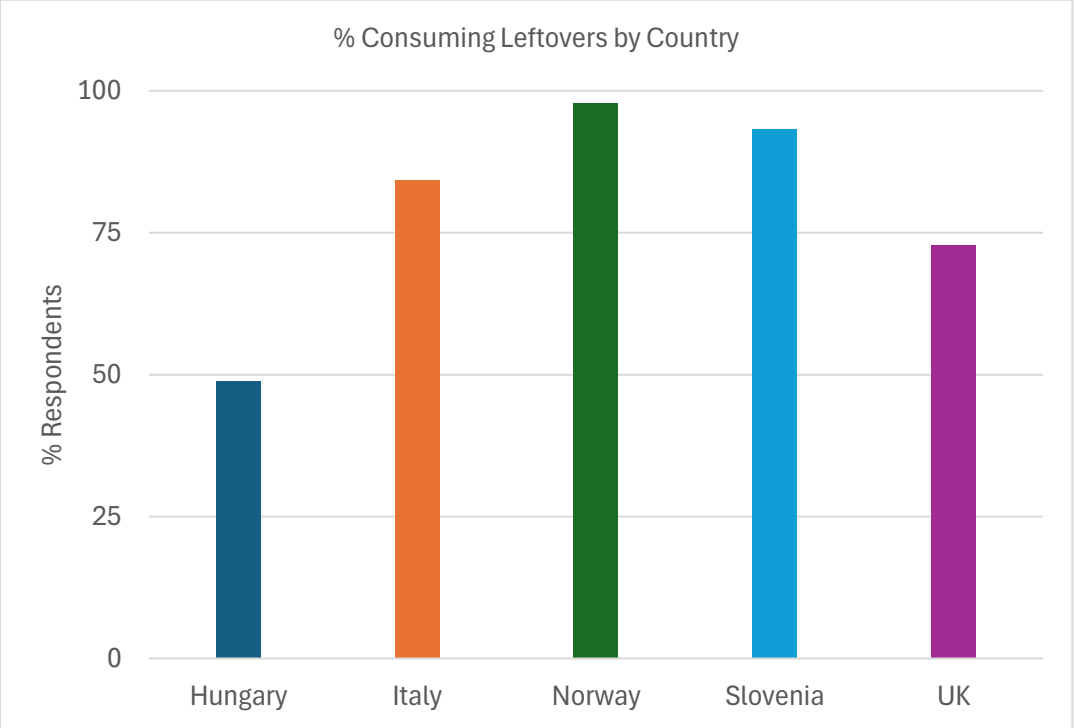

Figure 39: Responses to Repurpose Leftover Food by country, by percentage

We see that whilst in Norway and Slovenia only a small minority do not consume left-over food, more than a quarter of the UK respondents and more than half of the Hungary respondents do not consume left-over food. This implies a significant room for improvement in reducing food waste by consuming left-overs for both Hungary and the UK. There is also some room for improvement with Italy.

Note that as we only had 30 Slovenia responses, the actual proportion of Slovenians who consume left-overs may differ somewhat to our results.

6.1.23 Question 23: Reasons Respondents Do Not Consume Leftovers

Respondents were asked: "If your response in # 22 is No, please select from the options listed below why?

i) Not enough ingredient to prepare full meal
ii) Not good in taste as fresh alternative
iii) Safety concern
iv) No idea on how to use leftover
v) Any other, please specify……"

The last option required a written answer.

Table 58: Responses to Reasons Against Left-over Consumption by Country, by count

Country	Not Enough Ingredient to Prepare Full Meal	Not Good in Taste as Fresh Alternative	Safety Concern	No Idea of How to Use Leftovers	Others / comments	Total Responses
	11	17	22	28	4	50
Italy	5	6	8	11	5	27
Norway	1	0	1	0	1	2
Slovenia	0	0	1	1	1	3
UK	58	125	122	64	13	365

Table 59: Responses to Reasons Against Left-over Consumption by country, by proportion

Country	% Not Enough ingredient to prepare full meal	% Not good in taste as fresh alternative	% Safety concern	% No idea of how to use leftover	% Others / comments
	22	34	44	56	8
Italy	19	22	30	41	19
Norway	50	0	50	0	50
Slovenia	0	0	33	33	33
UK	16	34	33	18	4

It is important to note that Norway and Slovenia only have 2 or 3 respondents and so the results are not meaningful for these countries.

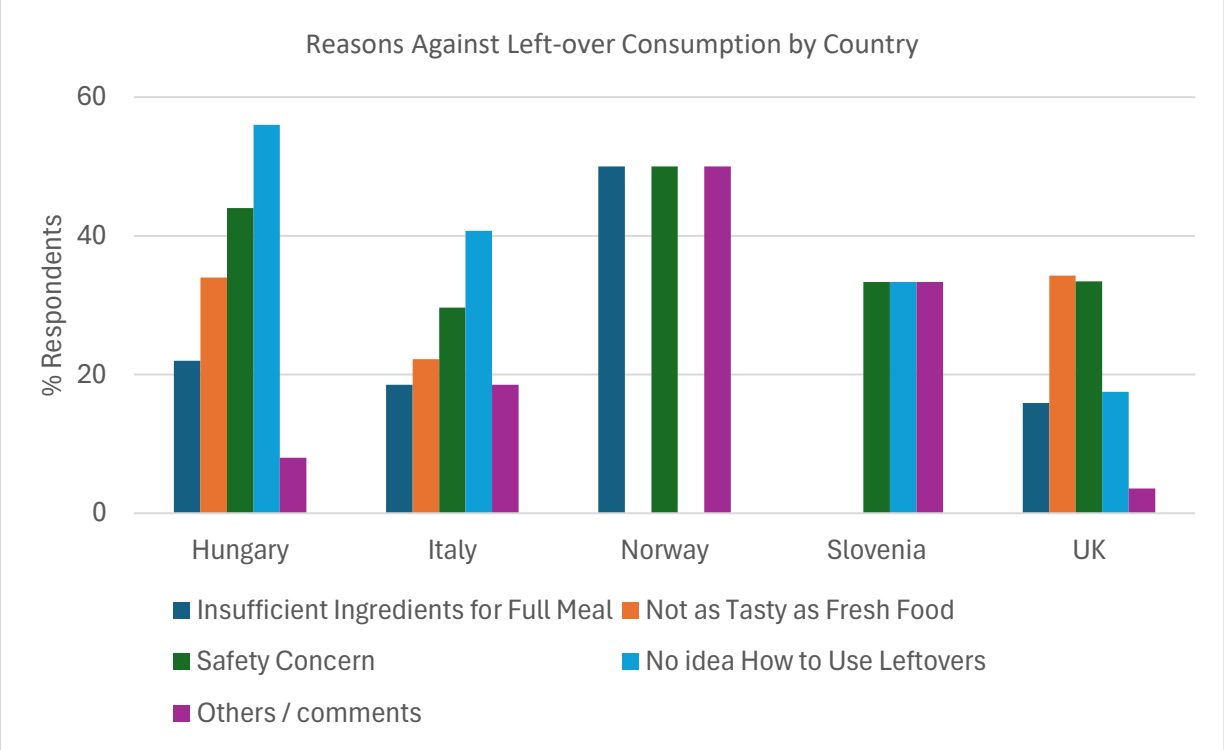

Figure 40: Reasons Against Left-over Consumption by Country

Only Hungary, Italy and the UK can be compared due to insufficient responses for Slovenia and Norway.

The order of responses for Hungary and Italy is the same. In particular, the most identified reason against consuming leftovers for Hungary and Italy respondents was that they did not know how to use leftovers, and the second most identified reason was a safety concern.

For the UK, taste and safety were most important.

"Insufficient ingredients" was identified least often as a reason the respondents do not consume leftovers. This was true for Hungary, Italy and the UK. Therefore, the respondents could in fact improve their level of sustainability if they find ways to reuse their leftovers.

6.1.24 Question 24: Respondents who Use Apps to Find Recipes to Use Leftovers

This question asked respondents to tick "Yes" or "No" to the question "Do you use any apps that help you filter and choose leftover recipes based on the ingredients you have at hand?"

Results

Table 60: Responses to Left-over App Users by country, by count

Country	Respondents Who Do and Do Not Use Apps to Find Recipes to Use Leftovers		
	No (Do Not Use)	Yes (Do Use)	Total Responses
Hungary	88	12	100
Italy	132	31	163
Norway	72	22	94
Slovenia	27	3	30
UK	223	284	507

Table 61: Responses to Left-over App Users by country, by percentage

Country	% No (Do Not Use)	% Yes (Do Use)
	88	12
Italy	81	19
Norway	77	23
Slovenia	90	10
UK	44	56

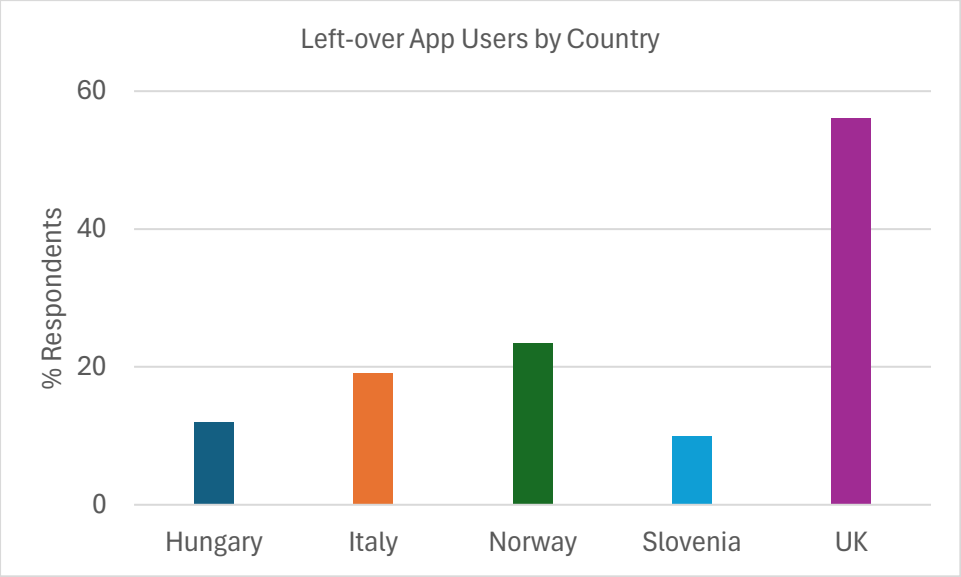

Figure 41: Responses to Left-over App Users by country

We can see that app usage for leftover recipes is much more common in the UK than in the other countries, which all have fewer than a quarter of respondents using such apps. Thus, there is much potential for leftover food app uptake in the other countries.

6.1.25 Question 25: Measures Taken to Prevent Food Waste

This question asks the respondents "What measures do you take to prevent food waste?" and gave the options

i) Meal planning
ii) Cooking with leftovers
iii) Donating to local food banks
iv) Community fridge sharing
v) Freezing food

This question allowed multiple answers for all the survey versions

Results

Table 62: Responses to Measures Taken to Prevent Food Waste by country, by count

Country	Measures Respondents Take to Prevent Food Waste	Cooking with left-over	Donation to local food bank	Community Fridge Sharing	Freezing Food	
Hungary	78	34	1	4	84	97
Italy	81	85	12	17	110	165
Norway	39	82	2	4	83	93
Slovenia	14	22	0	2	23	30
UK	227	241	174	120	170	506

Table 63: Responses to Measures Taken to Prevent Food Waste by country, by percentage

Country	% Meal Plan	% Cooking with left-over	% Donation to local food bank	% Community Fridge Sharing	% Freezing Food
Hungary	80	35	1	4	87
Italy	49	52	7	10	67
Norway	42	88	2	4	89
Slovenia	47	73	0	7	77
UK	45	48	34	24	34

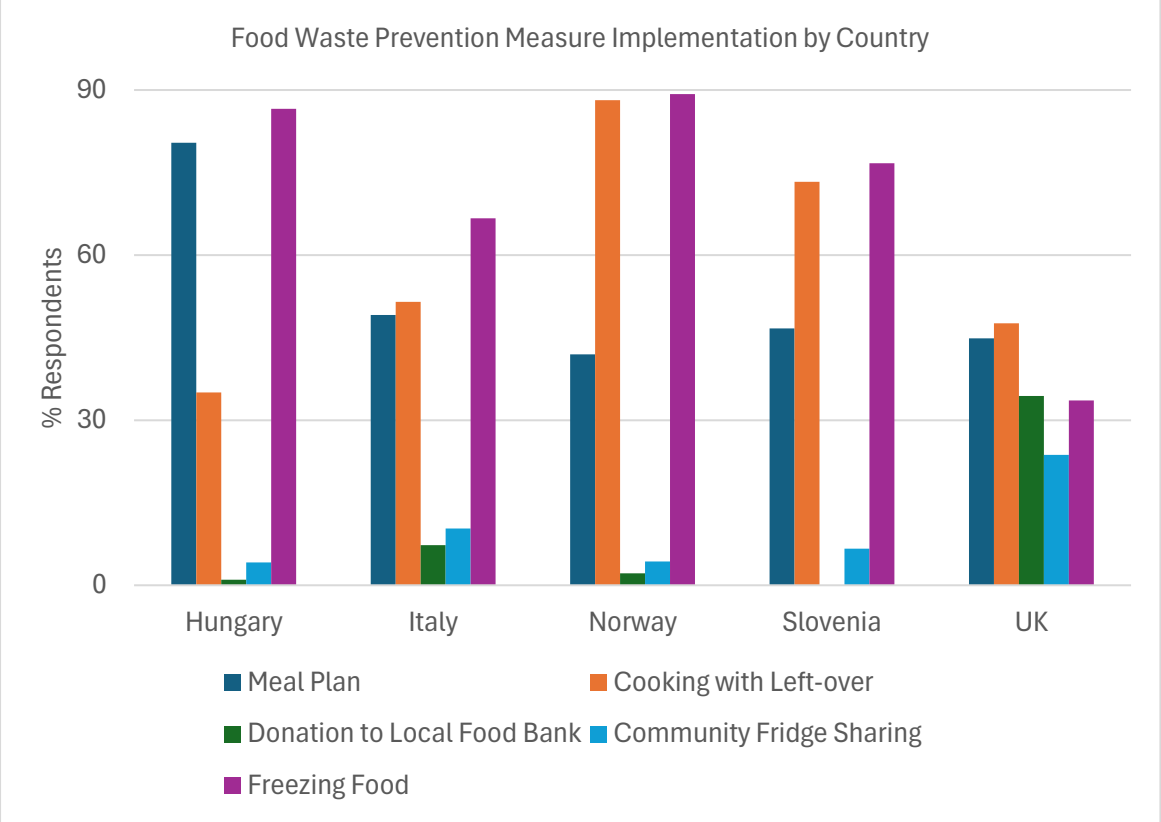

Figure 42: Food Waste Prevention Measure Implementation by Country

Freezing food was the dominant response for every country but cooking with leftovers and meal planning were also common food waste prevention measures among the respondents. Donating to local food banks and community fridge sharing were very uncommon food waste prevention measures except in the UK. This could highlight a difference in attitude, in giving ability or in the prevalence of food banks and community initiatives in the UK compared to other countries.

6.1.26 Question 26: Hypothetical Food Bank Acceptance

Question 26 asked the following: "Would you accept food for personal consumption from a local food bank if you qualify?"

The respondents could choose "Yes" or "No".

Results

Table 64: Responses to Hypothetical Food Bank Acceptance by country, by count

Country	No (Would Not Accept)	Yes (Would Accept)	Total
Hungary	44	56	100
Italy	52	111	163
Norway	17	75	92
Slovenia	13	17	30
UK	110	394	504

By proportion:

Table 65: Responses to Hypothetical Food Bank Acceptance by country, by percentage

Country	% No (Would Not Accept)	% Yes (Would Accept)
	44	56
Italy	32	68
Norway	18	82
Slovenia	43	57
UK	22	78

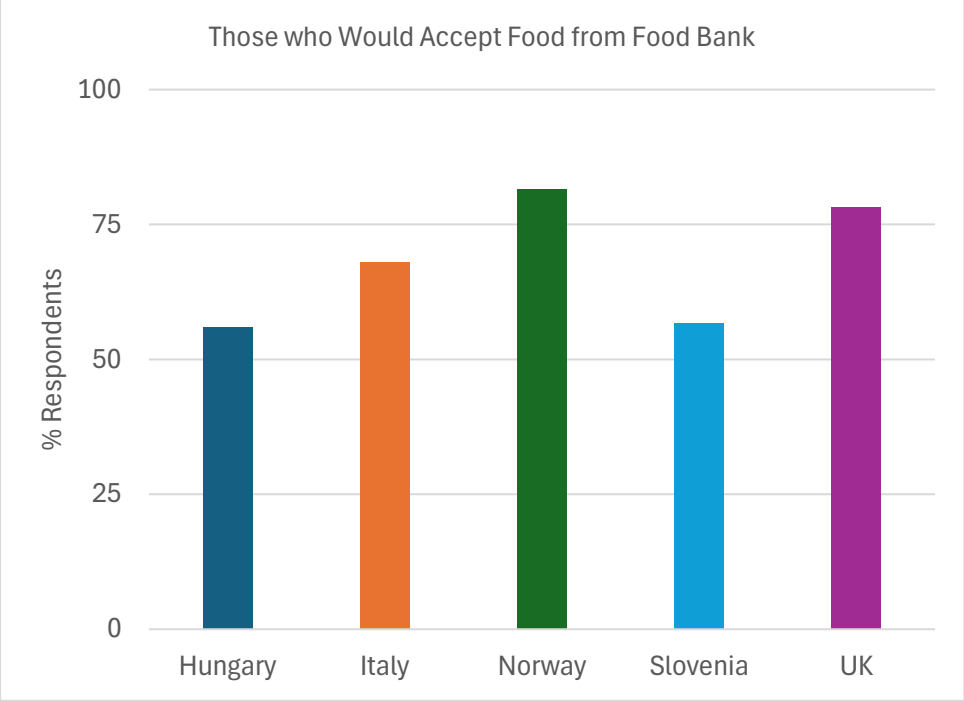

Figure 43: Responses to Hypothetical Food Bank Acceptance by country

We see that respondents from Norway most frequently would accept food from food banks, followed closely by respondents from the UK. Respondents from Hungary and Slovenia would accept food from food banks the least frequently. For respondents in any country, more than half would accept food from food banks.

6.1.27 Question 27: Reasons Whether Respondents Would Accept Food from Food Bank

This question asked, "What are your thoughts about accepting food from local food banks for yourself/family?" and was the follow-up question to question 26, allowing respondents to give justification to their answer.

The answers showed us that many respondents did not know enough about food banks, with several answers like "I don't know how this works" or "don't know about this concept", particularly in non-UK responses. This may be due to a lower number of food banks existing in the countries besides the UK

(we see in question 25 that there were very few respondents who give to food banks in the countries besides the UK).

Respondents with "Yes" answers to question 26 believed that food banks could efficiently decrease food loss and waste. Respondents who gave the answer "No" to question 26 gave concerns about food quality, lack of knowledge about ingredients, and not knowing how the food had been handled or where it came from.

Some respondents didn't seem to understand the hypothetical nature of question 26 and talked about how their decision would be affected by whether they needed to use it or not or that other people were more needy than them. Of course, it is possible that people who would be eligible for food banks may still feel too proud to acknowledge that they have a need to use them more than other people.

6.1.28 Question 28: Purchasers of Wonky Fruit and Vegetables

This question asked respondents to tick "Yes" or "No" to the question "Do you use or purchase wonky fruits and vegetables from supermarket or farmers' market or from online platforms (example of online market Oddbox)?"

Results

Table 66: Responses to purchasing Wonky Fruit and Vegetables by country, by count

Country	No (Do Not Purchase Wonky)	Yes (Do Purchase Wonky)	Total Responses
	36	64	100
Italy	102	62	164
Norway	60	32	92
Slovenia	22	8	30
UK	156	351	507

Table 67: Responses to purchasing Wonky Fruit and Vegetables by country, by percentage

Country	% No (Do Not Purchase Wonky)	% Yes (Do Purchase Wonky)
Hungary	36	64
Italy	62	38
Norway	65	35
Slovenia	73	27
UK	31	69

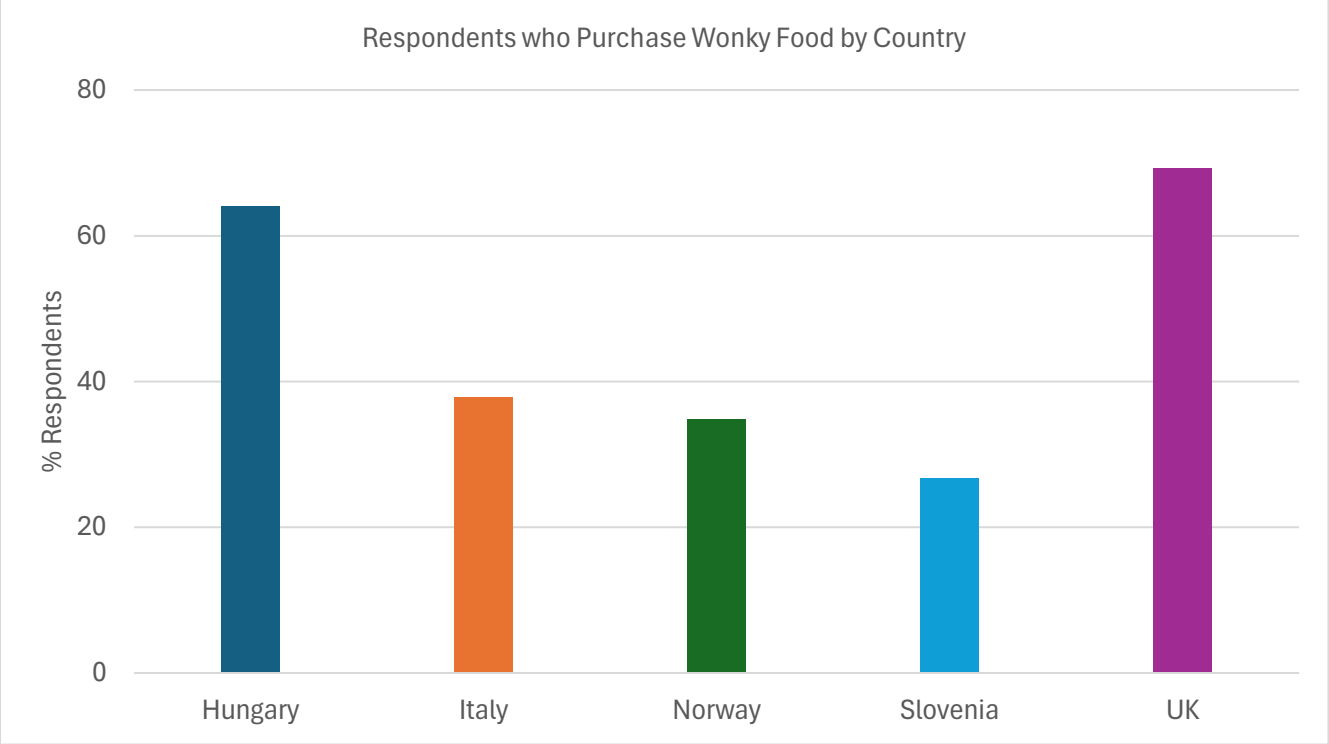

Figure 44: Respondents who Purchase Wonky Food by Country

We see that the majority of UK and Hungary respondents do purchase wonky food compared to a modicum of the respondents from Italy, Norway and Slovenia.

6.1.29 Question 29: Respondents who Purchase Locally

This question asks the respondents to tick "Yes" or "No" to answer the question: "Do you purchase locally produced fruits and vegetables, meat from local butchers, or milk from local farmers? (Examples for purchasing produce from other than supermarket chains are local farmers market, vendors who sell only locally produced food products)"

Results

Table 68: Respondents who Purchase Local Fruit / Veg by Country, by count

Country	No (Do Not Purchase)	Yes (Do Purchase)	Total
Hungary	25	75	100
Italy	42	122	164
Norway	64	24	88
Slovenia	11	19	30
UK	190	317	507

Table 69: Respondents who Purchase Local Fruit / Veg by Country, by percentage

Country	% No (Do Not Purchase)	% Yes (Do Purchase)
Hungary	25	75
Italy	26	74
Norway	73	27
Slovenia	37	63
UK	37	63

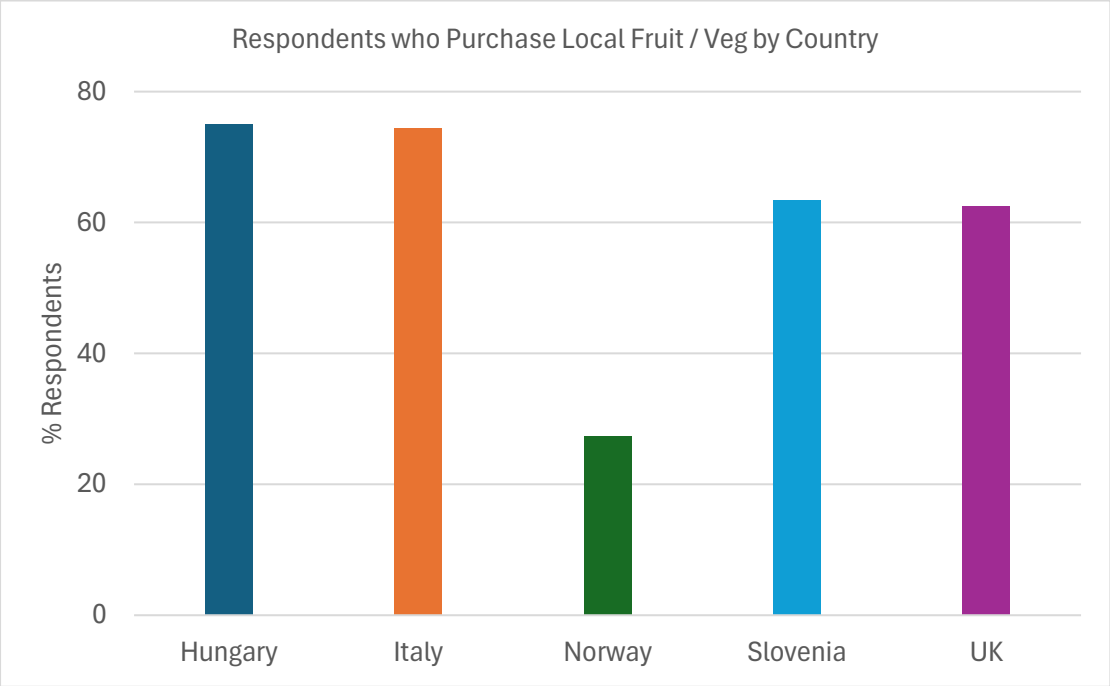

Figure 45: Respondents who Purchase Local Fruit / Veg by Country

The number of respondents from Norway who purchase local fruit and vegetables is dramatically lower than the other four countries. This may be due to low availability of local produced fruit and vegetables in Norway.

About three 75% of Hungary and Italy respondents purchase local fruit and veg, which is a 19% increase compared to the Slovenia and UK respondents (an additional 12% linearly).

6.1.30 Question 30: Reasons Respondents Do Not Purchase Locally

This question asked: "If your response to # 29 is No, then please elaborate on the reasons. " They could tick any number of the following options:

i) More expensive than supermarket
ii) Lack of varieties as only seasonal produce
iii) Other reasons

Please elaborate……

Results

Table 70: Respondents to the reason why do not Purchase Local Fruit / Veg by Country, by count

Country	More Expensive	Lack of Varieties and seasonal options	Any other
	13	2	14
Italy	26	9	16
Norway	57	4	25
Slovenia	7	2	4
UK	150	241	69

Table 71: Respondents to the reason why do not Purchase Local Fruit / Veg by Country, by percentages

Country	More Expensive	Lack of Varieties and seasonal options	Any other
	54	8	58
Italy	58	20	36
Norway	84	6	37
Slovenia	54	15	31
UK	34	54	15

*Note: some people may have answered this question and been included who said no to Q29 in the paper surveys. Furthermore, people have been included who put the other option without specifying.

The high price of local food is the main reason why consumers refuse to choose local fruit and vegetables. The lack of variety and seasonal choices as soon as possible was also mentioned by consumers, but it does not seem to be the main reason. The inability to locate markets selling local vegetables and fruits, along with inconvenient transportation, are also factors motioned by consumers limiting the purchase of local foods.

6.1.31 Question 31: Use of Online Apps to Purchase Food that would be Thrown Away

This question asked respondents to tick “Yes” or “No” to the following question:

“Do you use online apps to purchase leftover food from restaurants, bakeries, which otherwise would be thrown away (example- Too Good to Go, Karma); or apps that remind you to consume food that is close to expiration date; or use apps to share food that would otherwise go to waste with your neighbours, friends, local food banks (Food Cloud, Olio, Nowaste, any other examples)”.

They were also asked to elaborate on which app(s) which they use.

Table 72: Respondents who Use Apps to Purchase Food that would be Thrown Away by country, by count

Country	No (Do Not Use)	Yes (Do Use)	Total
	71	29	100
Italy	111	51	162
Norway	38	55	93
Slovenia	28	2	30
UK	245	260	505

Table 73: Respondents who Use Apps to Purchase Food that would be Thrown Away by country, by percentage

Country	% No (Do Not Use)	% Yes (Do Use)
Hungary	71	29
Italy	69	31
Norway	41	59
Slovenia	93	7
UK	49	51

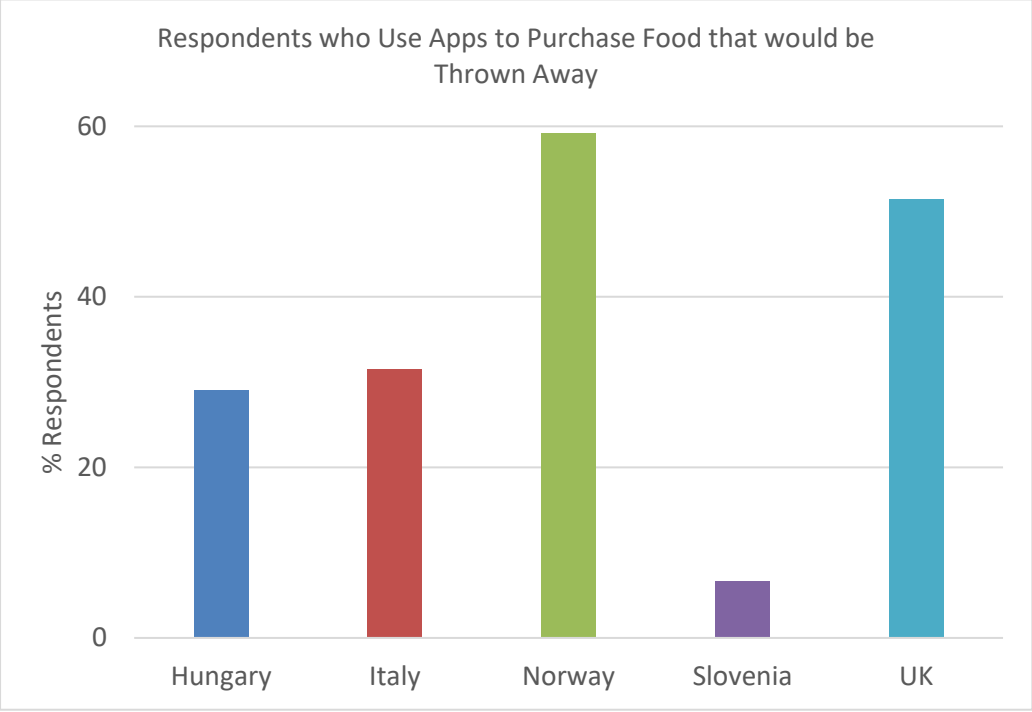

Figure 46: Respondents who Use Apps to Purchase Food that would be Thrown Away

We see that app use to purchase leftovers is greatest amongst the Norway and then the UK respondents (in both cases a majority said they used such apps). Slovenia has the lowest proportion of such app users, so perhaps there is potential for these apps to be implemented in Slovenia.

Some respondents gave which app they used. The number of each app given is shown below. However, many respondents did not give a valid app even if they responded yes. One respondent gave 2 apps. Responses for other countries are not included in the totals row in the table.

Table 74: Elaboration on responses to question 31, by country, by count

Country	Food Waste	Karma	OLIO	Too Good to Go	Throw No More
Hungary	0	0	0	0	0
Italy	1	0	0	17	0
Norway	0	0	0	49	1
Slovenia	0	0	0	0	0
UK	0	5	2	26	0
Totals	1	5	2	92	1

"Too Good to Go" was mentioned most frequently as an app that respondents use to purchase food that would be thrown away, with very small numbers of other apps mentioned.

6.1.32 Question 32: If your response to # 32 is No, then please elaborate on the challenges towards adoption of online platforms as shared in 32

This question asked respondents: "If your response to # 32 is **No**, then please elaborate on the challenges towards adoption of online platforms as shared in 32. (Kindly **rank** as applicable to you)."

Table 75: Responses to Challenges towards adoption of online platforms by country, by count for each rank

Country	Ranking	Challenges towards adoption of online platforms			
		Lack of information	Hesitant because I never used it before	Not convenient	Used but I do not like it
Italy	1	328	219	114	65
	2	160	204	165	68
	3	71	132	213	122
	4	70	72	94	283
Hungary	1	35	37	17	6
	2	14	9	7	4
	3	4	2	10	3
	4	1	1	2	7
UK	1	17	22	14	15
	2	20	20	17	6
	3	12	15	19	6
	4	12	9	3	24

Norway	1	237	135	56	38
	2	105	152	118	52
	3	46	91	156	109
	4	54	60	82	201
Slovenia	1	6	10	18	3
	2	4	3	5	1
	3	1	1	1	0
	4	0	0	0	0

Table 76: Responses to Challenges towards adoption of online platforms by country, by cumulative percentages of ranks

		Challenges towards adoption of online platforms			
Country	Ranking	Lack of information	Hesitant because I never used it before	Not convenient	Used but I do not like it
Italy	1	45	30	16	9
	2	67	58	38	18
	3	77	76	68	35
	4	87	86	81	74
Hungary	1	37	39	18	7
	2	51	48	25	11
	3	55	50	35	15
	4	56	51	37	22
UK	1	25	32	21	22
	2	54	62	46	31
	3	72	84	74	40
	4	90	97	78	75
Norway	1	51	29	12	8
	2	73	61	37	19
	3	83	81	71	43
	4	95	94	88	86
Slovenia	1	15	28	49	8
	2	25	36	61	11
	3	28	39	64	11
	4	28	39	64	11

UK and Norway have higher percentage of participants than other countries who ranked “lack of information” as the most important challenge towards adoption of online platforms. Slovenia has the highest percentage of respondents who ranked “not convenient” as the most significant challenge for adoption online platforms for food shopping. UK has the highest percentage of respondents who used but not liked the online platform for food shopping. Therefore, respondents from different countries

had very diverse challenges of online food shopping, which would affect the future food system logistics.

6.1.33 Question 33: How do you shop for your grocery?

This question asked respondents: “How do you shop for your grocery? Select all that applies.”

Results

Table 77: Responses to the ways shopping for grocery by country, by count

Country	In person from supermarket	In person from local vendor	In person at all*	Mix of both online and in-person	Online	Other**
	74	55	95	36	31	N/A
Italy	151	93	166	15	17	0
Norway	89	6	93	4	4	N/A
Slovenia	22	3	29	4	4	1
UK	198	113	455	169	216	2

*The "In-person at all" option was added after the survey was complete and ticked for anyone who ticked an in-person option or the mix option.

**Other was not an option for the paper surveys, which included all Hungary and Norway and most Italy responses.

Note that the online survey used by Slovenia and some of UK respondents only allowed one response out of "In person from supermarket", "In person from local vendor", "Mix of both online and in-person", "Online" and "Other". This means when respondents ticked "Mix of both" we don't know whether their in-person option was from a supermarket or a local vendor, therefore the countries with more online survey results (UK and Slovenia) may have less responses to these categories than they should do in reality.

These results are corrected slightly: people who ticked both an in-person option and the online option but not the mix option had the mix option included in their result. Similarly, people who ticked the mix option had both "Online" and "In person at all" included in their result even if they did not tick these.

Table 78: Responses to the ways shopping for grocery by country, by percentage

Country	In person from supermarket	In person from local vendor	In person at all	Mix of both online and in-person	Online
	25	19	33	12	11
Italy	34	21	38	3	4
Norway	45	3	47	2	2
Slovenia	35	5	47	6	6
UK	17	10	40	15	19

Figure 47: Responses to "how shops for grocery" by country

Majority of participants across all countries shop in-person rather than online. UK has a higher percentage of participants shopping online than the other countries.

6.1.34 Question 34: Primary Shopping Methods

This question asked respondents: "What is the primary method of grocery shopping for you?" and the options were "Online" or "In-person".

Results

Table 79: Responses to Primary Shopping Methods by country, by count

Country	In-person	Online	Total Responses
Hungary	96	4	100
Italy	165	3	168
Norway	93	1	94
Slovenia	30	0	30
UK	296	210	506

Table 80: Responses to Primary Shopping Methods by country, by percentage

Country	% In-person	% Online
Hungary	96	4
Italy	98	2
Norway	99	1
Slovenia	100	0
UK	58	42

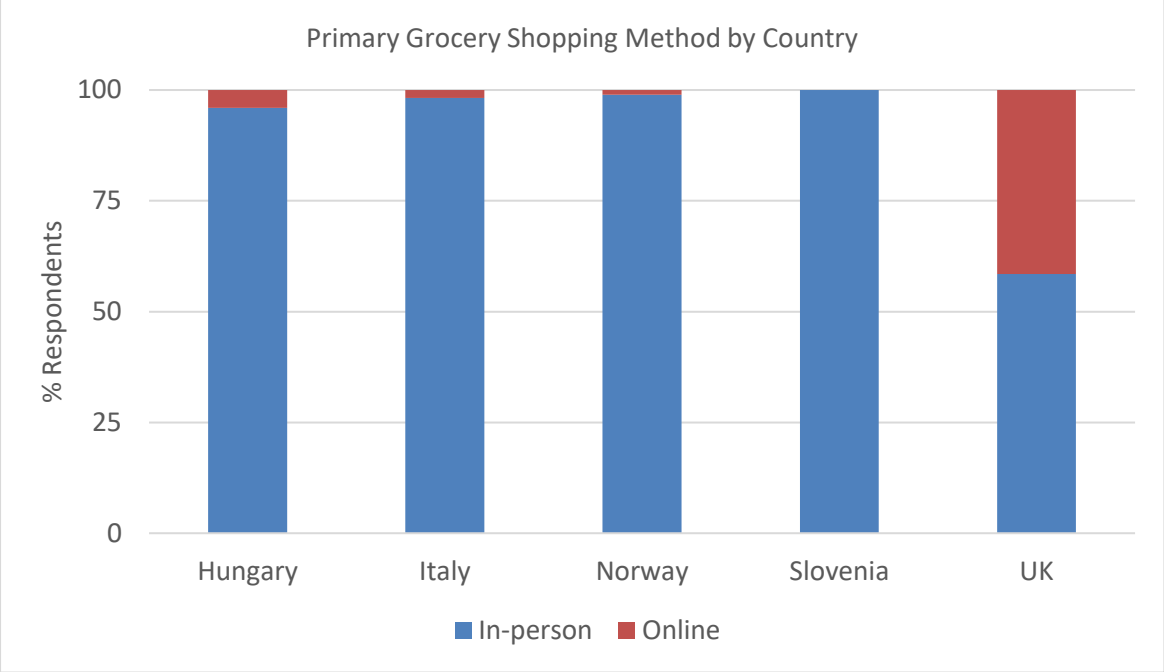

Figure 48: Primary Grocery Shopping Method by Country

The vast majority (96% to 100%) of respondents shop primarily online except for the UK, of which more than 40% of the respondents mainly shop online.

6.1.35 Question 35: Frequency of In-person Food Shopping

This question asked, "How often do you visit supermarkets or local vendors in a week?".

Results

Table 81: Responses to Frequency of In-person Food Shopping by country, by count

Country	Once Every 2 Weeks	Once Every Week	2-3 times a Week	More than 4 Times a Week	Total Responses
Hungary	9	32	51	8	100
Italy	9	68	78	12	167
Norway	1	14	49	26	90
Slovenia	4	13	10	3	30
UK	79	184	189	54	506

Table 82: Responses to Frequency of In-person Food Shopping by country, by percentage

Country	% Once Every 2 Weeks	% Once Every Week	% 2-3 times a Week	% More than 4 Times a Week
Hungary	9	32	51	8
Italy	5	41	47	7
Norway	1	16	54	29
Slovenia	13	43	33	10
UK	16	36	37	11

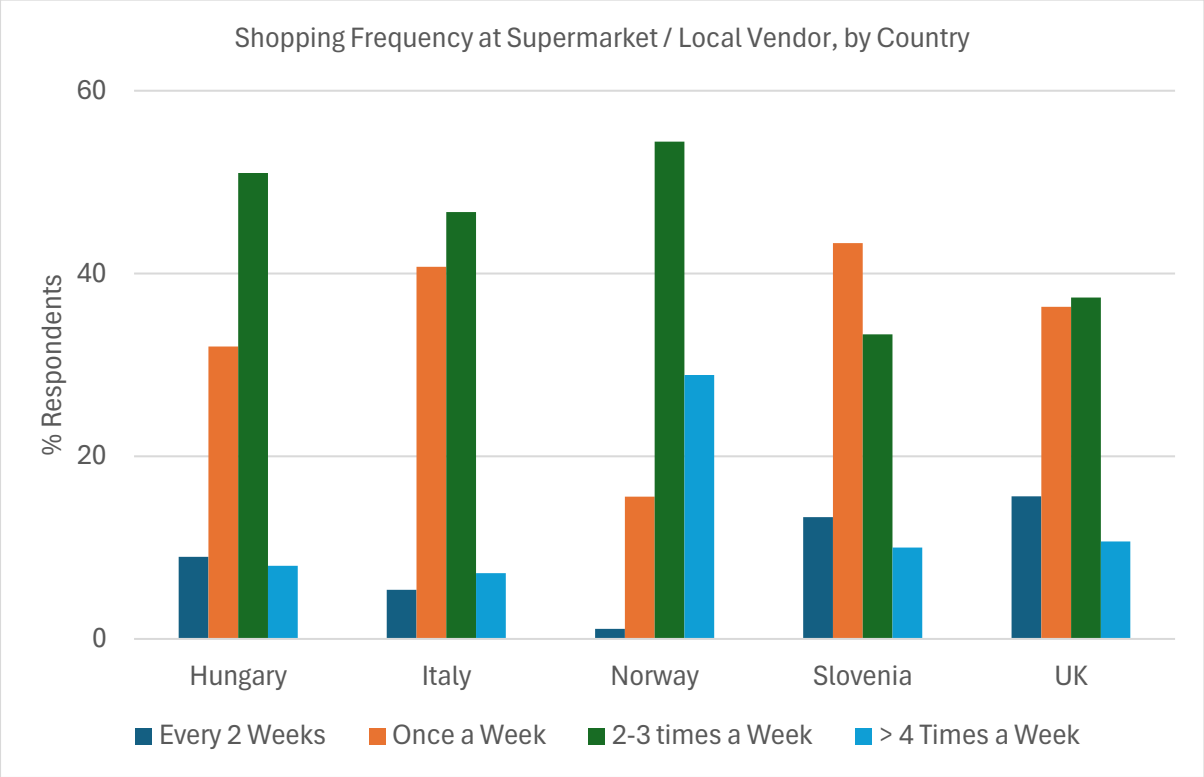

Figure 49: Shopping Frequency at Supermarket / Local Vendor, by Country

The median and mode choice for Hungary, Italy and Norway was 2-3 times a week. The UK also had a mode choice of 2-3 times a week. The Norwegian respondents generally gave the greatest shopping frequencies compared to the other countries.

The UK and Slovenia had a median choice of once a week, with Slovenia also having a mode choice of once a week. Slovenia respondents generally gave the lowest shopping frequencies out of all the countries.

6.1.36 Question 36: Typical Supermarket Distance

This question asked, "What is the average distance of travel to the supermarkets?" and had three distinct possible choices: "Within 1 mile", "1-2 miles" and "More than 2 miles".

Table 83: Responses to Typical Supermarket Distance by country, by count

Country	Within 1 Mile	1-2 Miles	More than 2 Miles	Total Responses
Hungary	38	46	16	100
Italy	92	46	26	164
Norway	86	6	2	94
Slovenia	15	5	10	30
UK	196	240	68	504

Table 84: Responses to Typical Supermarket Distance by country, by percentage

Country	Distance to Supermarkets		
	% Within 1 Mile	% 1-2 Miles	% More than 2 Miles
Hungary	38	46	16
Italy	56	28	16
Norway	91	6	2
Slovenia	50	17	33
UK	39	48	13

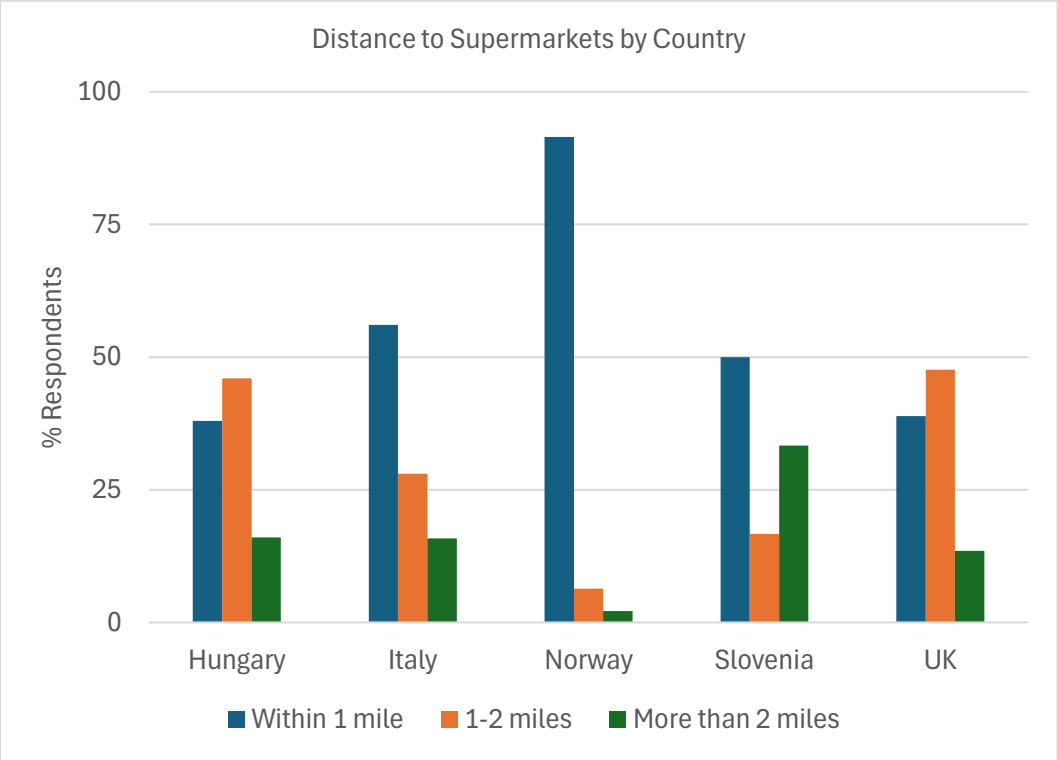

Figure 50: Distance to Supermarkets by Country

The vast majority of Norway respondents claimed to have to travel less than 1 mile to reach a supermarket. Italy and Slovenia also had a majority of respondents who made the same claim; but these and all the other countries also have a significant proportion (13-33%) of respondents travelling more than two miles to reach a supermarket.

The fact that 16% of Hungary and Italy respondents travel more than 2 miles to reach a supermarket is interesting, because the Hungary and Italy respondents both consist of a young population (see the age distributions in the demographics section) and so are less likely to be able to drive to the shops.

6.1.37 Question 37: Belief in Environmental Benefits of Online Shopping

This question asked "Do you think online shopping has more environmental benefits? Please give your reasons." It had a "Yes" or "No" choice and a place to give a reason.

Results

Table 85: Respondents who Believe Online Shopping Has Benefits by country, by count

Country	Whether Respondents Believe Online Shopping has Environmental Benefits		
	No (Do Not Believe has Benefits)	Yes (Do Believe has Benefits)	Total
Hungary	74	26	100
Italy	122	45	167
Norway	73	19	92
Slovenia	19	11	30
UK	194	306	500

Table 86: Respondents who Believe Online Shopping Has Benefits, by percentage

Country	Whether Respondents Believe Online Shopping has Environmental Benefits	
	% No (Do Not Believe has Benefits)	% Yes (Do Believe has Benefits)
Hungary	74	26
Italy	73	27
Norway	79	21
Slovenia	63	37
UK	39	61

Figure 51: Respondents who Believe Online Shopping Has Benefits by Country

Only in the UK did the majority of respondents believe that online shopping had more environmental benefits (than shopping in person).

The respondents who did not believe that online shopping offered enough advantages argued that the method would result in more traffic stress and modes of transport. Particularly if they choose to travel to the shop by walking, cycling or public transport, the additional delivery will result in more emissions. They also voiced concerns about over-packaging of products during the delivery process. Some respondents also stated that returned or non-fresh food still results in waste and additional transport logistics needs.

In contrast, respondents who considered online shopping to be uniquely advantageous highlighted the benefits of delivery in reducing emissions in bulk purchasing, which means that retailers could reduce additional travelling and thus achieve less energy consumption through better planning. They also pointed to the significant advantages of delivery versus travelling to the shop by car. At the same time, selling online can enable efficient stock management and thus reduce waste.

6.1.38 Question 38: Purchases and Perception of Meal Kits

This question asked “Do you use purchase meal-kits or food boxes with ingredients online? Please give your reasons.” It had a “Yes” or “No” choice and a place to give a reason.

Results

Table 87: Respondents whether people Purchase Meal kits by Country, by county

Country	No	Yes	Total
Hungary	79	21	100
Italy	156	10	166
Norway	89	4	93
Slovenia	28	1	29
UK	244	261	505

Table 88: Respondents whether people Purchase Meal kits by Country, by percentage

Country	% No	% Yes
Hungary	79	21
Italy	94	6
Norway	96	4
Slovenia	97	3
UK	48	52

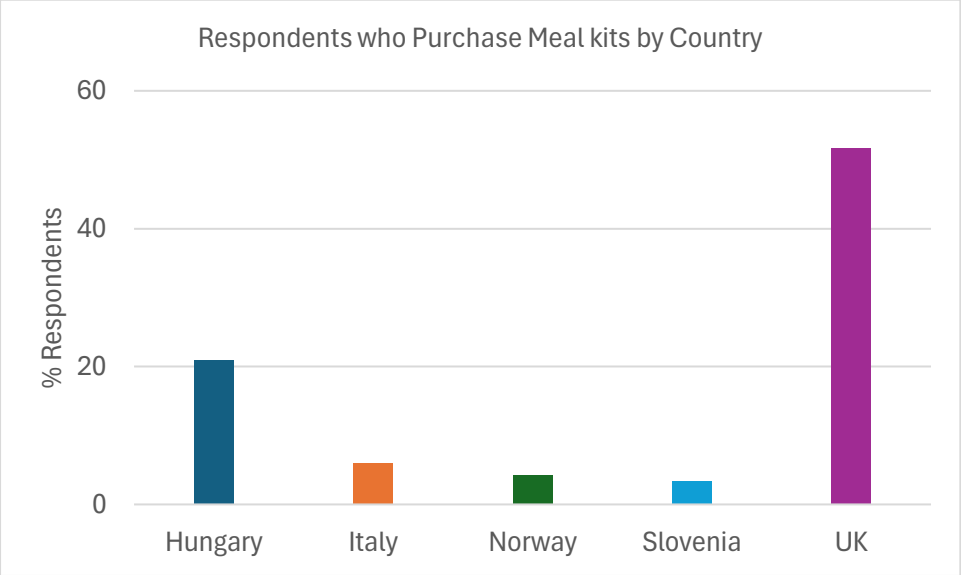

Figure 52: Respondents whether people Purchase Meal kits by Country

Purchasing meal kits appears to be very popular in the UK compared to the other four countries. The percentages of respondents who use meal kits is in single digits for Italy, Norway and Slovenia.

"Convenience" and "more choices" are the main reasons why respondents chose meal kits / boxes with foods online.

"Expensive price" and "unpopular flavour" were the main factors cited by respondents as influencing choice. And respondents also expressed concerns about the excessive plastic packaging of mealkits / boxes with foods.

6.1.39 Question 39: Willingness to Change Shopping Methods

This question asked: "Do you think you will stay with your preferred method in the future or are you willing to/looking for change? Please elaborate why..." and had options "Stay On" and "Try New Ways" alongside a place to write down a reason.

Results

Table 89: Responses to Willingness to Change Shopping Methods by country, by count

Country	Stay On (Don't Change)	Try New Ways (Change)	Total
Hungary	59	41	100
Italy	93	65	158
Norway	33	14	47
Slovenia	19	11	30
UK	262	211	473

Table 90: Responses to Willingness to Change Shopping Methods by country, by percentage

Country	% Stay On (Don't Change)	% Try New Ways (Change)
Hungary	59	41
Italy	59	41
Norway	70	30
Slovenia	63	37
UK	55	45

Figure 53: Whether Respondents Expect to Change their Shopping Method by Country

While some respondents indicated that they would maintain their current shopping methods, they expect positive changes in the future and indicated that shopping methods would be adapted to changing circumstances.

Similar to respondents who chose 'stay on', respondents who are eager to try new ways of shopping are also excited about positive changes in the way of shopping and are open to new things.

6.1.40 Question 40: Key Challenges Regarding Online Shopping

This question asked, "What are the key challenges of online shopping?" and had multiple possible answers. Any number of options could be chosen from those given. Additionally, there was another option for respondents to write down any challenges they came up with themselves.

Results

Table 91: Responses to Key Challenges Regarding Online Shopping by country, by count

Country	Limited Product Availability	Delivery Scheduling	Difficulty in changing old habit	Lack of social interaction	Dislike extra packaging that comes with online purchase	Difference in price of items	Other / Comments	Total Responses
Hungary	23	70	67	21	39	17	7	98
Italy	44	62	68	52	53	56	8	160
Norway	19	52	43	21	35	38	21	92
Slovenia	13	20	14	11	12	10	2	30
UK	174	218	248	123	146	133	34	506

Table 92: Responses to Key Challenges Regarding Online Shopping by country, by percentage

Country	Limited product availability	Delivery scheduling	Difficulty in changing old habit	Lack of social interaction	Dislike extra packaging that comes with online purchase	Difference in price of items	Other / Comments
Hungary	23	71	68	21	40	17	7
Italy	28	39	43	33	33	35	5
Norway	21	57	47	23	38	41	23
Slovenia	43	67	47	37	40	33	7
UK	34	43	49	24	29	26	7

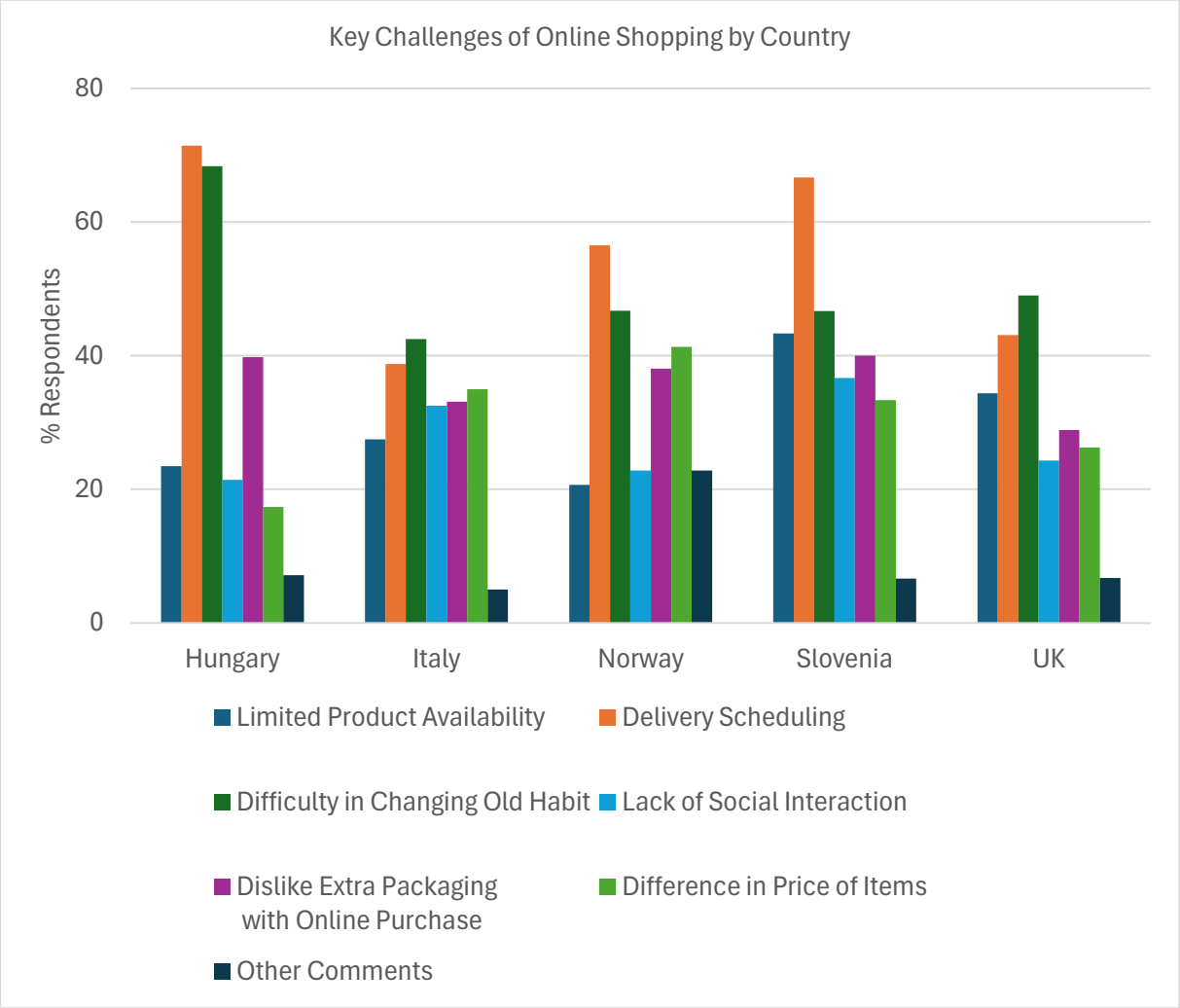

Figure 54: Key Challenges of Online Shopping by Country

Delivery scheduling was identified as a key challenge more often than any other choice in every country except Italy and the UK, where it was identified second most frequently. Difficulty in changing habit was the most identified key challenge for Italy and the UK, and the second most for the remaining countries. Disliking extra packaging was identified as a key challenge more frequently than either difference in prices or a lack of social interaction in every country except Italy.

These results suggest that the primary barrier to online shopping across these countries is the disruption to routine caused by delivery scheduling.

6.1.41 Question 41: Key Benefits Regarding Online Shopping

This question asked, "What are the key benefits of online shopping?" and any number of responses could be chosen. Additionally, there was another option for respondents to write down any benefits they came up with themselves.

Results

Table 93: Responses to Key Benefits Regarding Online Shopping by country, by count

Country	Convenience	Saves Time	Good for environment	Reduces food waste	Easier Meal Planning	Other comments	
Hungary	91	82	17	8	19	7	100
Italy	54	121	30	25	47	10	158
Norway	37	52	14	14	52	21	82
Slovenia	11	30	13	4	10	2	30
UK	245	272	250	141	118	34	505

Table 94: Responses to Key Benefits Regarding Online Shopping by country, by percentage

Country	% Convenience	% Saves Time	% Good for environment	% Reduces food waste	% Easier Meal Planning	% Other comments
Hungary	91	82	17	8	19	7
Italy	34	77	19	16	30	6
Norway	45	63	17	17	63	26
Slovenia	37	100	43	13	33	7
UK	49	54	50	28	23	7

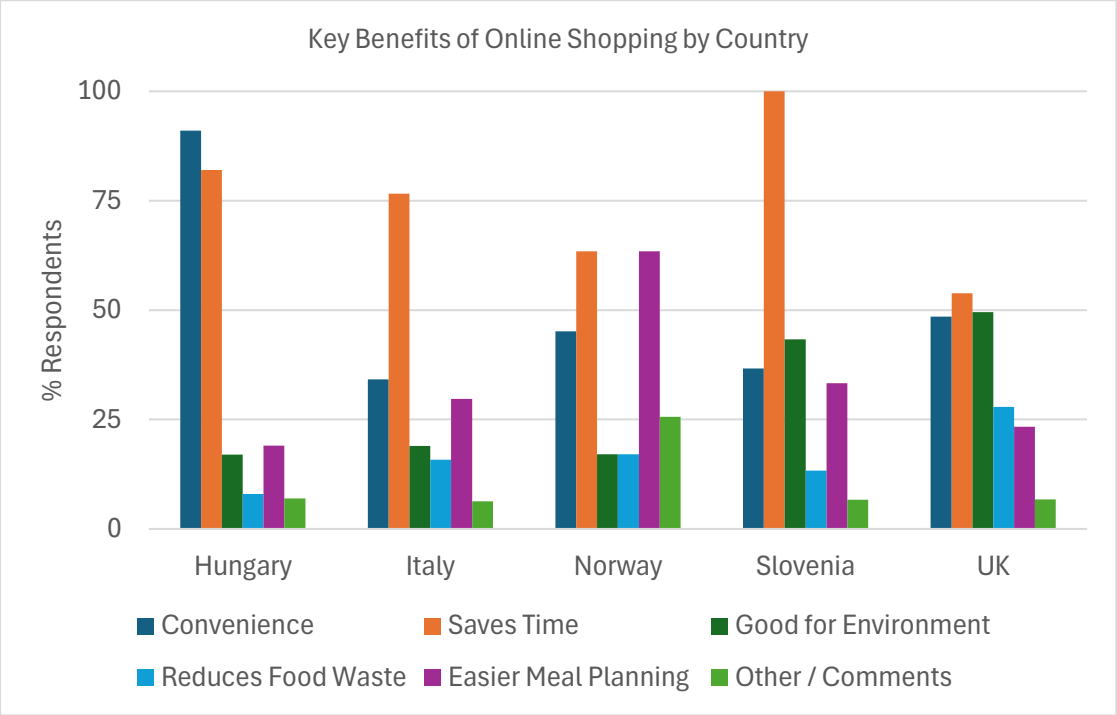

Figure 55: Key Benefits of Online Shopping by Country

The most identified benefit of online shopping was that it saves time. This was the most identified option for every country except Hungary by a small margin (and it was the joint most identified benefit for Norway). Furthermore, every single of the 30 Slovenia respondents identified this as a benefit and it is the only benefit identified by the majority of respondents for every single country.

The most identified benefit of online shopping for Norway was convenience. Easier meal planning was the other joint most identified benefit of online shopping in Norway.

A reduction in food waste was least commonly identified (besides the "other" option) in every country except the UK where it is second least identified. This could suggest that the respondents' experience of online shopping has not helped them to reduce food waste.

6.1.42 Impacts that food packaging brings

Question 42-1: Positive impacts of packaging.

Question 42-1 asked: "What are the Positive impacts of packaging?" It has been analysed as a text question, using the word cloud diagram to discuss the most popular opinions concerning packaging.

Positive impacts of packaging in Hungary

Positive impacts of packaging in Norway

Positive impacts of packaging in Italy

Positive impacts of packaging in UK

Figure 56: Positive impacts of packaging in all 5 countries

'Safety' is a word that was mentioned several times by the interviewees. In the view of the respondents, good packaging for food would be effective in protecting food safety, including reducing microorganisms and germs, extending shelf life and ensuring product quality. Unnecessary waste can also be avoided with good packaging. In addition to this, respondents also emphasised the important role of packaging in providing information provision. In addition, good packaging facilitates and improves the efficiency of transport.

Question 42-2: Negative impacts of packaging.

Question 42-2 asked: "What are the Negative impacts of packaging?" It has been analysed as a text question, using the word cloud diagram to discuss the most popular opinions concerning packaging.

Negative impacts of packaging in Hungary

Negative impacts of packaging in Norway

Negative impacts of packaging in Italy

Negative impacts of packaging in UK

* The limited number of responses from Slovenia respondents to this question did not allow for the completion of a word cloud map. Therefore, the Slovenia data will be analysed as part of a common data set for all countries.

Figure 57: Negative impacts of packaging in all 5 countries

Pollution and environmental damage caused by plastic packaging was the impact factor considered to be of most concern to respondents, as it was mentioned several times. Respondents expressed concern about the lack of reliable and standardised recycling processes for existing plastic packaging. In addition to this, some respondents were also concerned about the quality of plastic packaging and their potential impact on food quality. Potentially unnecessary packaging was also highlighted as a concern.

6.1.43 Question 43: Influence of Food Packaging on Purchases

This question asked the following: “Do food packaging materials affect your food purchase choice? Meaning, do you actively look for labels to identify recycled materials and biodegradable materials used for packaging.” The respondents had to choose “Yes” or “No”.

Table 95: Responses to Influence of Food Packaging on Purchases by country, by count

Country	No	Yes	
Hungary	38	61	99
Italy	63	103	166
Norway	58	31	89
Slovenia	17	13	30
UK	145	357	502

Table 96: Responses to Influence of Food Packaging on Purchases by percentage, by count

	Do food packaging materials influence your food purchase choice?	
Country	% No	% Yes
Hungary	38	62
Italy	38	62
Norway	65	35
Slovenia	57	43
UK	29	71

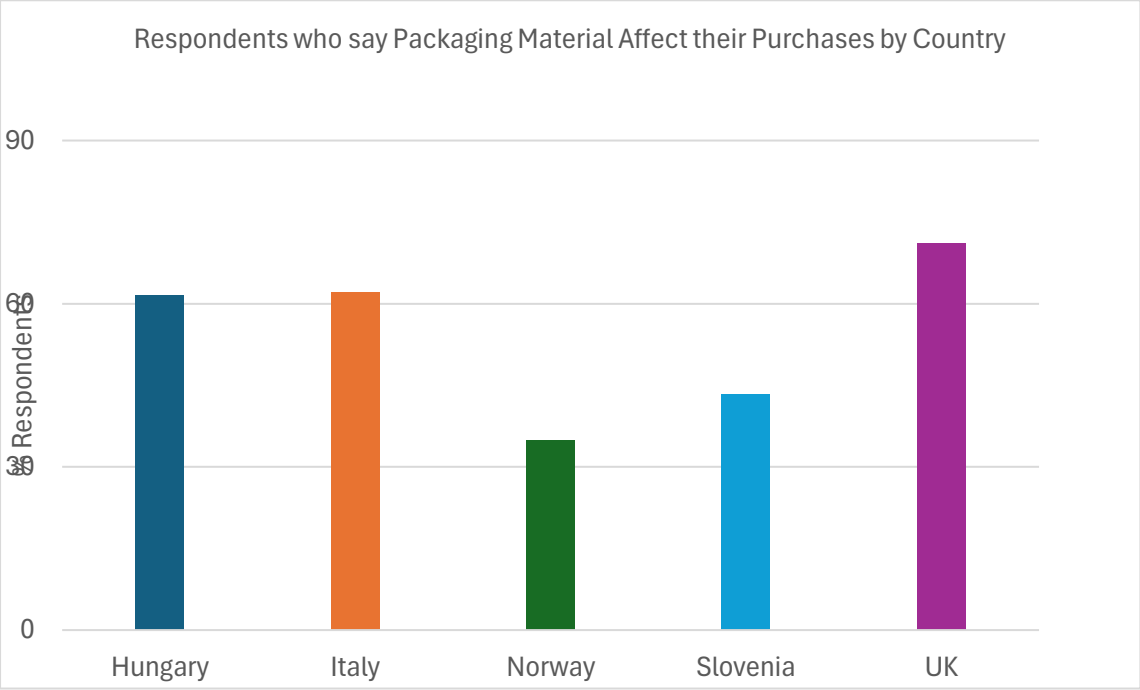

Figure 58: Respondents who say Packaging Material Affect their Purchases by Country

Norwegian and Slovenian consumers believe that the material of food packaging influences their purchasing decisions. In contrast, the majority of consumers from Hungary, Italy, and the UK indicated that packaging material does not affect their shopping choices.

6.1.44 Question 44: Packaging Features which Influence Food Purchases

This question asked the following: "If your response to #44 is **Yes**, please elaborate on what features are important to you when choosing a packaging material?"

The respondents could choose any number of the given options. Additionally, there was an "other" option for respondents to write down any features important to them which they came up with themselves.

Results

Table 97: Responses to Packaging Features which Influence Food Purchases by country, by count

Country	Biodegradable and compostable	Recyclable	Packaging volume	Packaging which increases shelf life	Reusability	Ease of storage	Use-by labelling	Other / Comments	Total Responses
Hungary	35	49	33	13	37	38	25	1	61
Italy	79	82	37	19	46	26	16	1	103
Norway	15	20	23	3	9	6	15	4	34
Slovenia	4	4	4	1	2	0	0	0	15
UK	80	129	73	88	85	67	42	11	440

Table 98: Responses to Packaging Features which Influence Food Purchases by country, by percentage

Country	Biodegradable and compostable	Recyclable	Packaging volume	Packaging which increases shelf life	Reusability	Ease of storage	Use-by labelling	Any other comment
Hungary	57	80	54	21	61	62	41	2
Italy	77	80	36	18	45	25	16	1
Norway	44	59	68	9	26	18	44	12
Slovenia	27	27	27	7	13	0	0	0
UK	18	29	17	20	19	15	10	3

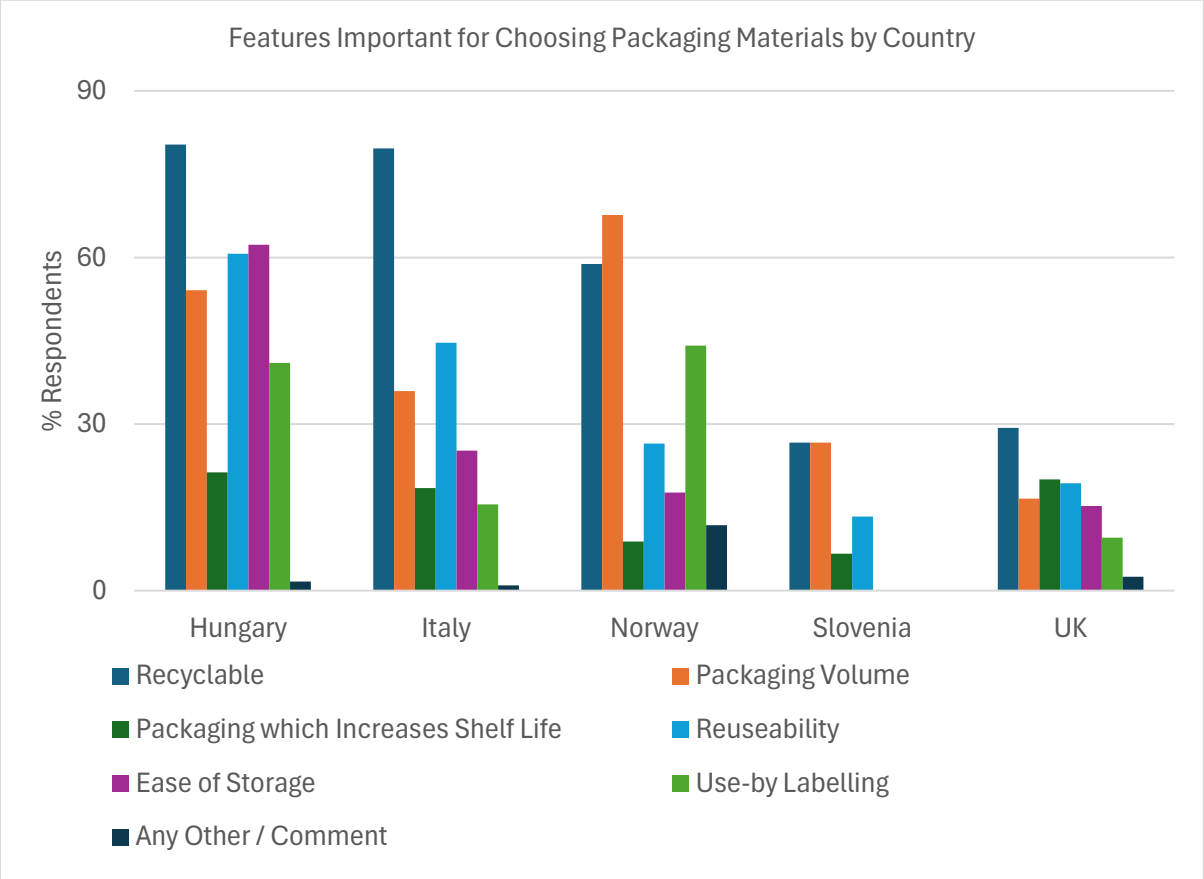

Figure 59: Features Important for Choosing Packaging Materials by Country

The most identified packaging feature important for choosing food products for Hungary, Italy, the UK and (with a tie) Slovenia respondents was recyclability. This was also the second most frequently identified packaging feature for Norway respondents, where packaging volume was most identified. Packaging volume was also the tied most identified feature for Slovenia respondents.

The least important feature in Hungary, Norway and Slovenia was packaging which increases shelf life. However, we must bear in mind the respondents who answered this question already said that sustainability affected their purchase choice and perhaps this is not seen as a sustainable choice by them compared to the other options.

6.1.45 Question 45: Reasons Sustainable Packaging Does Not Influence Food Purchases

This question asked the following: "If your response to #44 is No, please elaborate on why you not choose sustainable packaging materials while purchasing food."

Table 99: Reasons Respondents Do Not Choose Sustainable Packaging by Country, by county

Country	Time consuming	Unclear / inadequate labelling	Lack of knowledge or information	Compromise product quality	Compostable packaging increase cost of product	Do not compose or recycle at home	Any other reason / comment	Total Responses
Hungary	23	18	14	12	13	12	2	38
Italy	18	16	25	13	23	2	6	58
Norway	30	22	35	6	15	2	10	56
Slovenia	8	7	3	1	1	0	1	21
UK	92	84	122	87	60	32	29	419

Table 100: Reasons Respondents Do Not Choose Sustainable Packaging by Country, by count

Country	Time consuming	Unclear / inadequate labelling	Lack of knowledge or information	Compromise product quality	Compostible packaging increase cost of product	Do not compose or recycle at home	Any other reason / comment
Hungary	61	47	37	32	34	32	5
Italy	31	28	43	22	40	3	10
Norway	54	39	63	11	27	4	18
Slovenia	38	33	14	5	5	0	5
UK	22	20	29	21	14	8	7

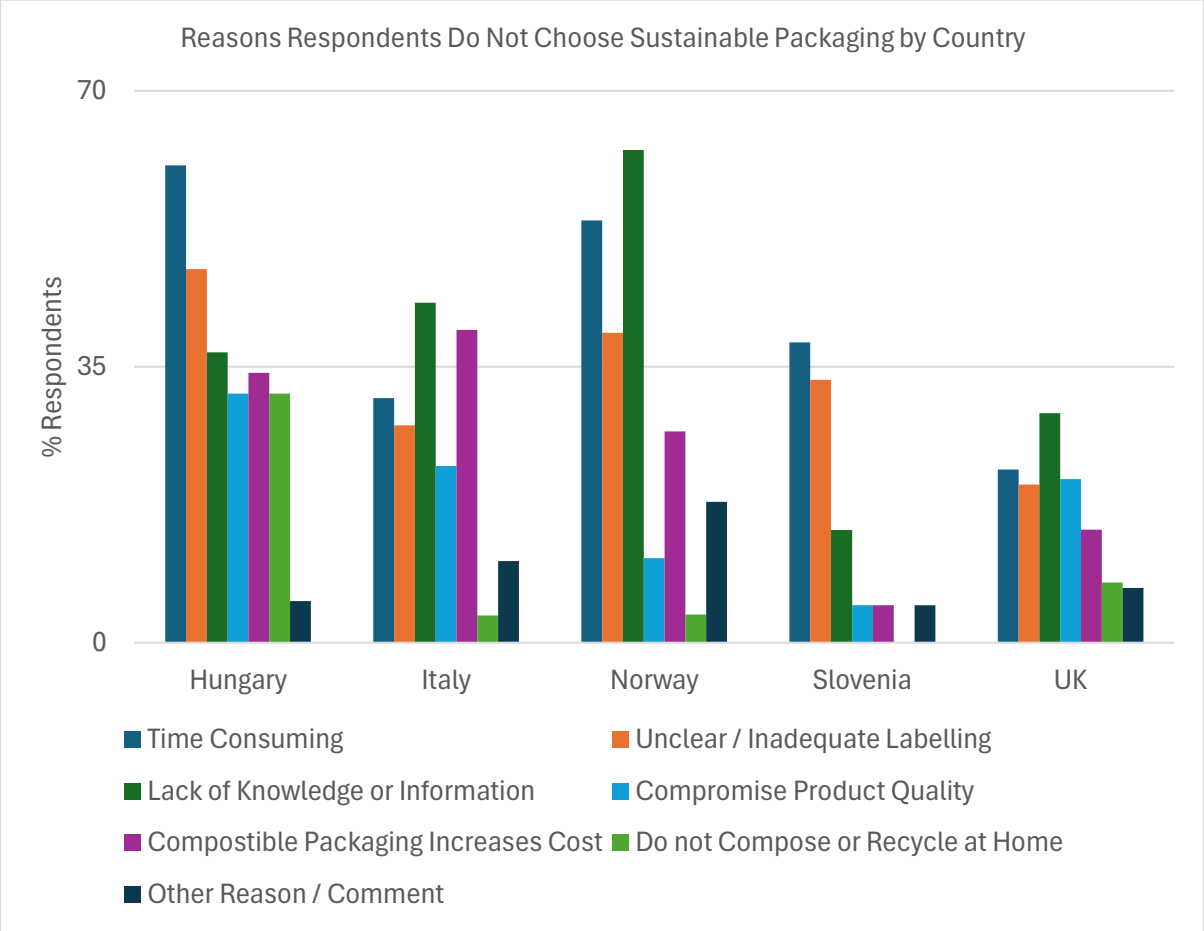

Figure 60: Reasons Respondents Do Not Choose Sustainable Packaging by Country

The main reason respondents don't choose sustainable packaging is that it is time consuming for Hungary and Slovenia and a lack of knowledge or information for Italy, Norway and the UK. Not composting or recycling at home appears to be a non-issue for Italy, Norway, Slovenia and the UK but had a few responses for Hungary implying that home composting is not as well practiced in Hungary. However, since the online version only accepted one response it could just be that people in the UK and Slovenia who do not compost at home also had other more important reasons for not choosing sustainable packaging and so could not tick this option.

6.1.46 Question 46: Recycling Instructions Adherence Level

This question asked, "How often do you follow the recycling instructions on the packaging materials?" and had a range of distinct options for the respondents could choose.

Table 101: Responses to Recycling Instructions Adherence Level by country, by county

Country	Always	Never	Not Sure*	Often	Sometimes	Total Responses
Hungary	15	8	3	48	26	100
Italy	91	5	2	49	17	164
Norway	31	3	0	44	12	90
Slovenia	8	2	1	8	11	30
UK	123	43	11	178	148	503

Table 102: Responses to Recycling Instructions Adherence Level by country, by percentage

Country	% Never	% Sometimes	% Often	% Always
Hungary	8	27	49	15
Italy	3	10	30	56
Norway	3	13	49	34
Slovenia	7	38	28	28
UK	9	30	36	25

*"Not Sure" was not an option in all surveys, so we compare percentages over the respondents who were sure.

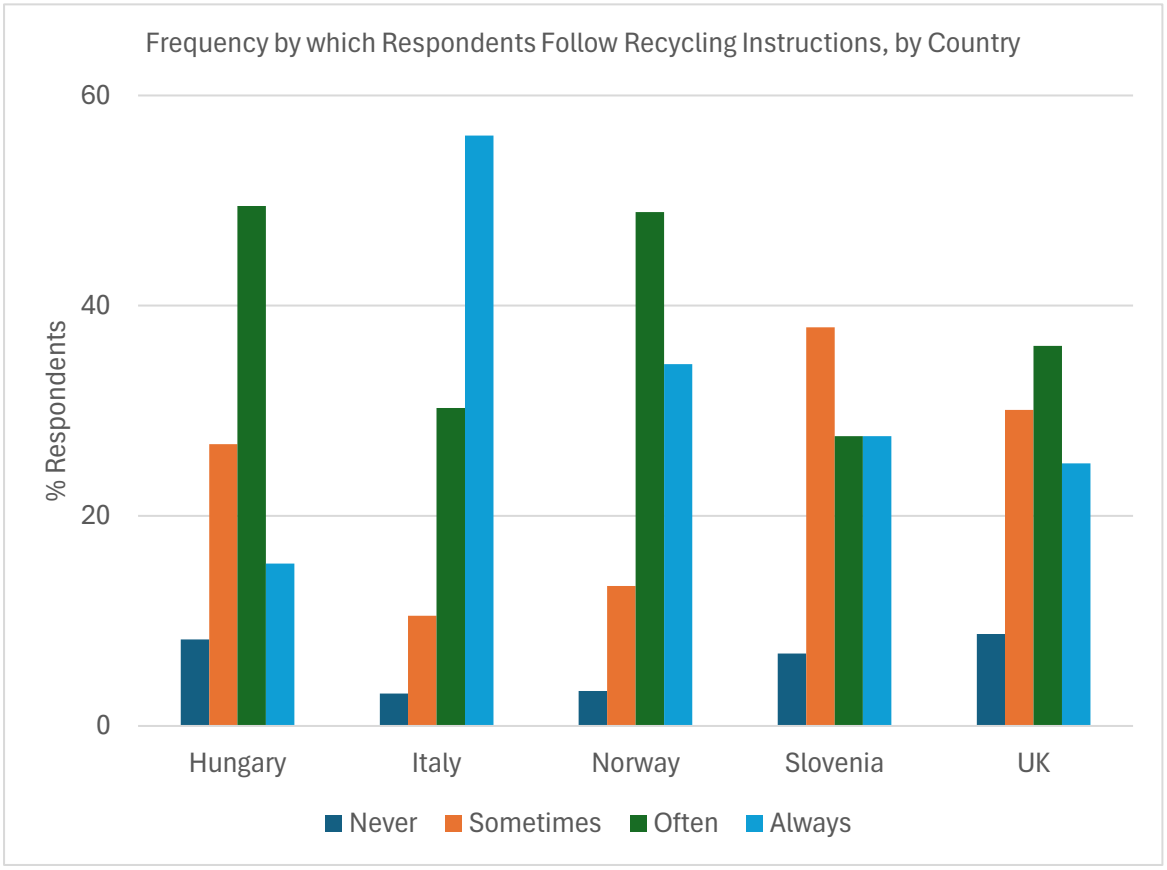

Figure 61: Frequency by which Respondents Follow Recycling Instructions, by Country

The Italy respondents are revealed to be the best at following recycling instructions, and Italy is the only country for which the majority of respondents claim they always follow recycling instructions. The Norway respondents were the second best at following recycling instruction. A concerning 7-9% of respondents for the remaining countries admit to never following recycling instructions.

7 REGRESSION ANALYSIS

7.1 Modelling

Ordered logistic regression models are appropriate for situations where the dependent variable is internally ordered but not median, such as distance to the supermarket (DS) in this study, which includes three categories: up to 1 mile, 1-2 miles, and more than 2 miles. We assume that there exists a potentially continuous variable y* that determines the value of the observed discrete dependent variable y. The model takes the form:

$y^* = x'\beta + e$

where y* is the unobservable latent variable, x is the vector of independent variables, β is the vector of parameters to be estimated, and e is the error term. The latent variable y* is categorized into y classes by setting different cut-off points ri.

The rules for taking values of y:

$y = 0$ if $y^* \leq r0$

$y = 1$ if $r0 < y^* \leq r1$

$y = 2$ if $r1 < y^* \leq r2$

…

$y = N$ if $rN-1 < y^* \leq rN$

Here, r0, r1, ..., rN are the thresholds or cut-off points to be estimated. The dependent variable y can be an integer value from 0 to N, corresponding to different categories. Like we mentioned earlier, this model is particularly suitable for cases where the dependent variables have a clear order but not necessarily a fixed interval.

The binary choice models (Logit and Probit models) are applicable when there are only two possible values of the dependent variable. We also assume that there is a potential continuous variable y* that determines the value of the binary dependent variable y. The Logit model assumes that the error term e obeys a standard logistic distribution, while the Probit model assumes that the error term e obeys a standard normal distribution. The model form is similar to ordered logistic regression:

$y^* = x'\beta + e$

The rule for the value of y:

$y = 1$ if $y^* > 0$
$y = 0$ if $y^* \leq 0$

The dependent variable y has only two possible values, usually expressed as 0 and 1, and is suitable for indicating the occurrence or non-occurrence of an event. The model is particularly suitable for situations where the dependent variable is binary categorical, e.g., whether to consume alternative proteins (CAP) is a binary variable coded Yes = 1 and No = 0.

We used the maximum likelihood estimation (MLE) method to estimate the model parameters β and the cut-point parameter ri. For the ordered logistic regression model, the model was fitted using the `polr` function in the R language. For binary choice models, the Logit and Probit models were fitted using the `glm` function in R, respectively.

The goal of both models is to estimate the probability of taking the value of the dependent variable y. The probability of taking the value of the dependent variable y is estimated. For each observation x, the ordered logistic model estimates the probability P (y = j | x) that y takes on a different category j, which is calculated using equation [1] below:

$$P(y = j \mid x) = \Phi(rj - x'\beta) - \Phi(rj-1 - x'\beta) \quad [1]$$

where Φ (-) is the cumulative distribution function of the standard normal distribution (for the Probit model), or the logistic distribution function (for the Logit model).

For the Binary Choice model, the estimate is the probability that y takes the value 1:

$P(y = 1 \mid x) = 1 / (1 + \exp(-x'\beta))$ (Logit model),

$P(y = 1 \mid x) = \Phi(x'\beta)$ (Probit model).

With these estimation methods, we can calculate the probability that the dependent variable y will take on a different value given the independent variable x.

In the analyses of this study, sex (Gender) and age (Age) were modelled separately as the main independent variables for multiple response variables. We output the coefficients of each model and their significance levels and assessed the goodness of fit of the models using the AIC values. In addition, to gain a deeper understanding of the specific impact of the independent variables on the dependent variable, we calculated marginal effects.

Marginal effects analysis reveals how the probability of the dependent variable changes when the independent variable changes. Using the R package `margins`, we computed marginal effects for the model and showed the average marginal effects (AME) for different independent variables (e.g., gender and age), as well as statistics such as standard errors (SE), z-values, p-values, etc., for these effects. This part of the results demonstrates the magnitude and significance of the effect on the predicted probability of the dependent variable when the independent variables change.

7.2 Description of Variables

Since the data collected in our questionnaire is not purely numerical but contains many textual descriptions, we processed and cleaned the collected data and replaced the textual descriptions with numerical ones, making the answers we collected from the questionnaire a numerical matrix for further analysis. The specific results are shown in the table below.

Table 103: Descriptions of variables

Variable	Observations	Mean	Variance	Std. Dev	Min	Max	Description
Gender	921	0.526602	0.249563	0.499563	0	1	Gender: Female = 0, Male = 1
Age	809	1.475896	0.564084	0.751055	1	4	Age: 21-30 = 1, 31-40 = 2, 41-50 = 3, More than 50 = 4
CAP	905	0.746961	0.189219	0.434993	0	1	Whether to consume alternative proteins: Yes=1, No=0
FAPC	722	1.682825	0.399954	0.632419	1	3	How often do you consume alternative proteins: 1-2 Meals = 1, 2-5 Meals = 2, More than 5 Meals = 3
CTNNAP	606	0.943894	0.446434	0.668157	0	2	Would you consider trying alternative proteins that you haven't tried before? Yes=1, No=0, Maybe=2
CFF	904	0.932522	0.062994	0.250987	0	1	Whether to consume frozen foods: Yes=1, No=0
FFFC	873	1.610538	0.405485	0.636777	1	3	How often do you eat frozen foods? 1-2 Meals = 1, 2-5 Meals = 2, More than 5 Meals = 3

FFVSFN	759	1.840558	0.527321	0.726169	1	3	Comparison of the nutritional quality between frozen and fresh foods: Worse=1, Equal=2, Better=3
SMIFC	895	2.403352	0.851667	0.922858	1	4	The impact of social media on food choices: Never=1, Sometimes=2, Often=3, Most often=4
FFW	890	1.634831	0.423308	0.650621	1	3	Frequency of food waste: Once or less=1, 2-3 times=2, Daily=3
CRLO	887	0.751973	0.186720	0.432111	0	1	Do you consume/reuse leftover food? Yes=1, No=0
APPULOM	895	0.398883	0.240043	0.489942	0	1	Do you use apps to manage leftover food? Yes=1, No=0
AFF	891	0.732884	0.195985	0.442702	0	1	Do you accept food from food banks? Yes=1, No=0
PWF	894	0.579418	0.243966	0.493929	0	1	Do you purchase imperfect food? Yes=1, No=0
PLF/V	892	0.624439	0.234778	0.484539	0	1	Do you buy locally produced fruits and vegetables? Yes=1, No=0
UALF	892	0.443946	0.247135	0.497127	0	1	Do you use online apps to handle leftover food? Yes=1, No=0

PMGS	899	1.746385	0.189505	0.435322	1	2	Primary shopping method: Online=1, In-person=2
FWS	895	2.538547	0.714116	0.845054	1	4	Weekly shopping frequency: Once Every 2 Weeks=1, Once Every Week=2, 2-3 times a Week=3, More than 4 Times a Week=4
DS	895	1.668156	0.492665	0.701901	1	3	Distance to the supermarket: Within 1 mile=1, 1-2 miles=2, More than 2 miles=3
OSB	891	0.466891	0.249184	0.499183	0	1	Does online shopping have advantages? Yes=1, No=0
PMBO	894	1	0.000000	0	0	1	Do you purchase meal kits online? Yes=1, No=0
CPMF	818	1.427873	0.245097	0.495073	1	2	Will it change the future of shopping: Stay On=1, Try New=2
FRIF	888	2.85473	0.967599	0.983666			How often do you follow recycling instructions? Always=4, Often=3, Sometimes=2, Never=1, Not Sure=0

In this study, we considered several independent and response variables that influence consumer behaviour. Gender was a binary variable coded as Female = 0 and Male = 1. Age was categorized into four groups coded as 1 for 21-30 years, 2 for 31-40 years, 3 for 41-50 years, and 4 for 50+ years.

Multiple response variables were also included in the study to capture different behaviours and attitudes of consumers. For example, whether to consume an alternative protein (CAP) was a binary variable coded Yes = 1 and No = 0. How often to consume an alternative protein (FAPC) was categorized into three categories coded as 1 for 1-2 meals, 2 for 2-5 meals, and 3 for more than 5 meals.

Additionally, we examined whether consumers considered trying an alternative protein that they had not yet tried (CTNNAP), a variable coded as Yes = 1, No = 0, and Maybe = 2. For whether they consumed

frozen foods (CFF), it was coded as Yes = 1, No = 0. Similarly, how often they consumed frozen foods (FFFC) was coded as 1 for 1-2 meals, 2 indicating 2-5 meals, and 3 indicating more than 5 meals.

We also examined consumer perceptions of the nutritional quality of frozen versus fresh foods (FFVSFN), which were coded as 1 for worse, 2 for equal, and 3 for better. The influence of social media on food choices (SMIFC) was categorized into four levels coded as 1 for never, 2 for sometimes, 3 for often, and 4 for most often.

For frequency of food waste (FFW), variables were coded as 1 for once or less, 2 for 2-3 times, and 3 for daily. Whether or not surplus food was consumed or reused (CRLO) was coded as Yes = 1, No = 0. Whether or not an app was used to manage surplus food (APPULOM) was similarly coded as Yes = 1, No = 0.

We also examined whether to accept food from food banks (AFF), coded as Yes = 1, No = 0, and whether to purchase defective food (PWF), coded as Yes = 1, No = 0. Whether or not to purchase locally produced fruits and vegetables (PLF/V) was also a dichotomous variable, coded as Yes = 1, No = 0.

When examining whether an online application was used to dispose of leftovers (UALF), it was coded as Yes = 1 and No = 0. Primary mode of shopping (PMGS) was categorized into two categories Online = 1 and In-person = 2. Frequency of weekly shopping (FWS), on the other hand, was categorized into four categories coded as 1 indicating once every two weeks, 2 indicating once a week, 3 indicating 2 - 3 times per week, and 4 indicating more than 4 times per week.

For distance to supermarket (DS), variables were coded as 1 for within 1 mile, 2 for 1-2 miles, and 3 for more than 2 miles. We also examined whether consumers perceived an advantage to shopping online (OSB), which was coded as Yes = 1, No = 0. Finally, whether to buy food packages online (PMBO) was coded as Yes = 1, No = 0, and for whether it would change the way they shop in the future (CPMF), the variables were coded as Stay On = 1, Try New = 2.

7.3 Factors Impacting Social Media's Influence on Food Choices

Here we analysed the effects of gender (Gender) and age (Age) on multiple response variables (FAPC, FFFC, FFVSFN, SMIFC, FFW, DS, FRIF), and extracted the coefficients (Coef) and P-values (P-Value) of each variable from the Logit and Probit models to compute the AIC values of the model. The AIC (Akaike Information Criterion) is used to measure the goodness of fit of the model, with smaller values indicating a better model fit. The specific results are shown in the table below.

Table 104: Ordered Logit/Probit Model Results

Variable	Logit Coef (Gender)	Logit Coef (Age)	Logit P-Value (Gender)	Logit P-Value (Age)	Logit AIC	Probit Coef (Gender)	Probit Coef (Age)	Probit P-Value (Gender)	Probit P-Value (Age)	Probit AIC
FAPC	-0.14192	-0.08222	>0.05	>0.05	1230.859	-0.08992	-0.05479	>0.05	>0.05	1230.608
FFFC	-0.04367	0.09221	>0.05	>0.05	920.636	-0.02561	0.07484	>0.05	>0.05	919.9795
FFVSFN	0.04863	0.20414	>0.05	≈0.05	1298.033	0.002043	0.128904	>0.05	≈0.05	1297.206
SMIFC	-0.04968	-0.31376	<0.05	<0.05	1328.796	-0.03991	-0.19320	<0.05	<0.05	1327.439
FFW	0.1926	-0.0347	>0.05	>0.05	1014.355	0.11485	-0.02291	>0.05	>0.05	1014.271
DS	0.05509	0.12156	>0.05	>0.05	1033.865	0.04619	0.08135	>0.05	>0.05	1033.395
FRIF	0.02337	-0.08958	>0.05	>0.05	1397.723	0.01331	-0.07066	>0.05	>0.05	1397.053

Among all the variables, only in the analysis of Social Media Influence on Food Choice (SMIFC), the results of both Logit model and Probit model show that gender and age have significant negative impact on SMIFC.

First, in the Logit model, the coefficient of gender is -0.04968, with a p-value of less than 0.05, indicating that gender has a significant negative effect on social media influence on food choice (SMIFC). Specifically, a change in gender from male to female decreases the impact of social media on food choice. The coefficient of age is -0.31376 and the p-value is also less than 0.05, indicating that the effect of social media on food choice significantly decreases with increasing age. The AIC value of the Logit model is 1328.796, indicating that the model is better in fitting this variable.

In the Probit model, the coefficient of gender was -0.03991 with the same p-value of less than 0.05, reconfirming the significant negative effect of gender on the influence of social media on food choice.

The coefficient of age was -0.19320 with a p-value also less than 0.05, indicating that the effect of age on the impact of social media on food choice was likewise significantly weakened. The AIC value of the Probit model was 1327.439, which was slightly lower than the Logit model, indicating that the Probit model was slightly more effective in fitting this variable.

In summary, both gender and age showed significant negative effects on the influence of social media on food choice. The negative effect of gender may stem from the fact that females have different attitudes or preferences than males when it comes to accepting or responding to social media influences, resulting in females being less influenced by social media. The negative correlation between age and this effect, on the other hand, may indicate that individuals are less receptive or responsive to social media influences as they get older, possibly due to changing preferences or a greater focus on health considerations.

For the other variables (FAPC, FFFC, FFVSFN, FFW, DS, and FRIF), the p-values for both gender and age were greater than 0.05, implying that the effects of these variables on these response variables were not statistically significant. Although the coefficients of these models may provide some directional information, due to the non-significant p-values, we are unable to determine the effect of these independent variables on the response variables.

7.4 Marginal effect analysis

After analysing the effects of demographic characteristics and age-gender on consumer perceptions of social media-influenced food choices (SMIFC), we also explored how respondents' evaluations change when the independent variable changes from one category to another. Figure 62 and Figure 63 illustrate the marginal effects of attitudinal variables on social media-influenced food choices (SMIFC) to help us gain a deeper understanding of the extent to which social media influences different demographic groups in terms of food choices.

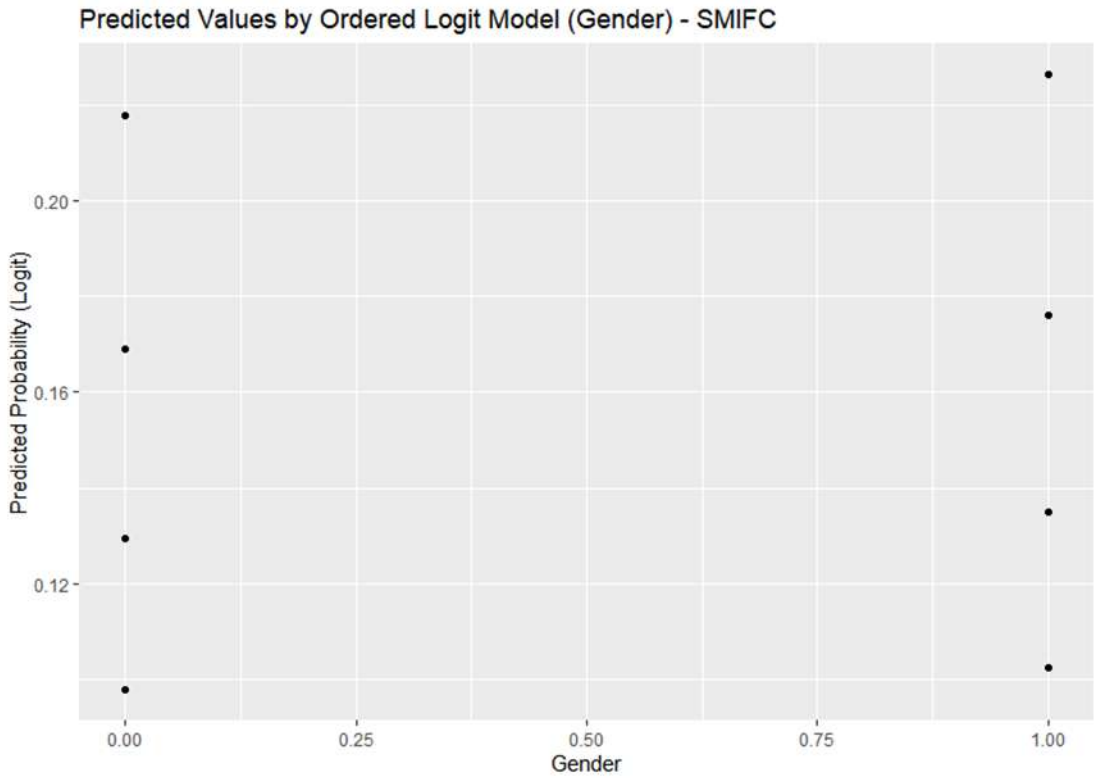

Figure 62: Predicted values by ordered Logit model (gender)

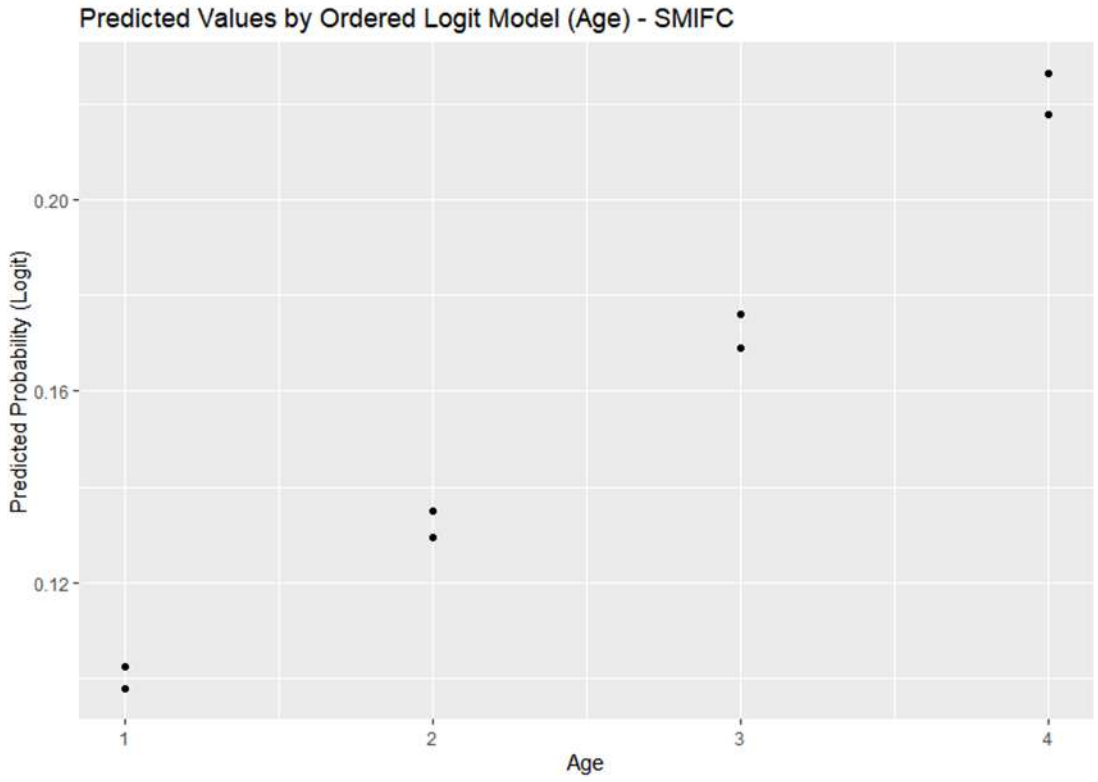

Figure 63: Predicted vales by ordered Logit model (age)

Figure 62 and Figure 63 show that the predicted probability of the influence of social media on food choices increases significantly with age, a trend that is particularly evident in the 50+ age group. This suggests that older age groups are more susceptible to the influence of social media, possibly due to their increased focus on healthy eating information.

In contrast, the 21-30 age group had the lowest predicted probability, implying that this younger group is relatively insensitive to the influence of social media. Gender, on the other hand, did not have a significant effect on the predicted probability, with males and females having almost the same predicted values, suggesting that there is no significant difference in the influence of social media on food choices when it comes to gender.

Taken together, the effect of age on SMIFC in the Logit model is significant, with the effect of social media on food choice being more pronounced as age increases, while the effect of gender is insignificant, suggesting that there is little difference in the effect of social media on food choice for either males or females.

7.5 Factors Influencing Alternative Protein Consumption

In this study, for further in-depth analysis, we used Logit and Probit models specifically for a range of binary choice variables. These binary choice variables included whether or not to consume alternative proteins (CAP), whether or not to consume frozen food (CFF), whether or not to consume/reuse leftover food (CRLO), whether or not to use an app to manage leftovers (APPULOM), whether or not to accept food from a food bank (AFF), whether or not to purchase defective food (PWF), whether or not to purchase locally produced fruits and vegetables (PLF/V), and whether they use an online application to handle surplus food (UALF). Through Logit and Probit model analysis of these variables, we extracted the coefficients, p-values, and AIC values of each model to assess the effects of gender and age on these binary choice behaviours. The specific results are shown in the table below.

Table 105: Binary Choices Model Results

Model Type	Coefficient (Intercept)	Std. Error (Intercept)	P-Value (Intercept)	Coefficient (Gender)	Std. Error (Gender)	P-Value (Gender)	Coefficient (Age)	Std. Error (Age)	P-Value (Age)	AIC	Residual Deviance
Logit	0.3498	0.2645	0.1861	0.2229	0.2013	0.2681	0.3133	0.1374	0.0226*	603.12	597.12
Probit	0.23403	0.15736	0.1370	0.13676	0.12037	0.2559	0.18038	0.07946	0.0232*	603.21	597.21

In this study, we used Logit and Probit models to analyse the effects of multiple binary categorical response variables on gender (Gender) and age (Age). However, due to issues such as data limitations that may have existed during the modelling run, the results of the analysis were ultimately obtained only for the variable on whether to consume alternative proteins (CAP). Therefore, the following description is detailed only for the CAP variable.

The AIC value of 603.12 for the Logit model and 603.21 for the Probit model are very close to each other, indicating that the goodness of fit of the two models is comparable. Among these two models, we prioritize the results of Logit model in this study because it is more intuitive and easier to interpret.

Specifically, the P-Value for gender (Gender) in both the Logit and Probit models is greater than 0.05, indicating that the effect of gender on whether to consume alternative proteins is statistically insignificant. This implies that the difference between males and females in alternative protein consumption is not significant in this sample. In contrast, age (Age) had a P-Value of less than 0.05 in both models, indicating that the effect of age on whether to consume alternative proteins was statistically significant. In the Logit model, the coefficient for Age was 0.3133, indicating that as age increases, consumers are more likely to choose to consume alternative proteins. This can be explained in two ways: first, according to the findings of Question 8, many consumers lack sufficient information about alternative proteins (AP), such as raw materials, production processes, and purchasing channels, which can affect their willingness to try AP. Older consumers may be more experienced in these areas or more willing to be proactive in obtaining information, thus removing these cognitive barriers and consequently choosing alternative proteins. Secondly, question 5 identified flavour as an important factor in consumers' motivation to choose alternative proteins. As consumers age, they may become more concerned with dietary modification for health and environmental reasons and tend to look for healthy or sustainable protein alternatives. Such consumers are more likely to accept alternative proteins, especially if their flavour and nutritional value meet their needs.

8 DISCUSSION AND CONCLUSION

8.1 Perspectives and Consumption of Alternative Protein

Taste was revealed to be a particularly important factor regarding alternative protein perception and consumption in every country except the UK.

The survey showed taste was considered a significant factor in changing consumption habits of APs, and taste was also a significant reason why respondents said they did not consume APs. In particular, except for the UK between 50% and 56% of the respondents gave taste as a reason they did not consume APs (see question 8). Between 44% and 64% of respondents for each country except the UK gave taste as a factor which would help change their perception and consumption of APs (see question 12). The UK did have lower responses of 19% and 36%. Thus, it would appear that the notion alternative proteins are not tasty is inhibiting people from consuming APs.

Whether the respondents believe that APs are less tasty than meat from experience or whether it is just their perception of APs that leads them to believe they are less tasty is unknown.

8.2 Perspectives and Consumption of Frozen Foods

We can see some notable trends concerning consumers' attitudes towards frozen food consumption in the five countries. Most respondents indicated that they do consume frozen food, but more than 5% of respondents in Italy and the UK refuse to consume frozen food. Norwegian respondents are the

highest consumers of frozen food, which may be related to Norway's cooler climate for preserving food. Respondents in Norway and the UK consume frozen foods on average 2-5 times per week, compared to 1-2 times per week for respondents in other countries, suggesting that frozen foods are consumed most frequently in Norway and the UK.

Frozen baked goods and ready-to-eat foods were most popular in Norway and least popular in Italy. Frozen fruit & vegetables and frozen meat were common choices for at least half of the respondents in each country, with frozen fruit and vegetables being the most popular category in Hungary and Norway.

Regarding the reasons for choosing frozen food, convenience is believed as the top reason by respondents in Italy, the UK and Hungary. However, reducing waste is also an important consideration from consumers in Hungary. In Norway and Slovenia, price advantage is an important driver, especially when respondents' choice is at the top of the list showing a clear preference, but convenience also plays a part.

Considering the reasons for not choosing frozen food, the least important factor is consistent across countries, namely the unavailability of fresh options. In addition, for respondents in Italy and the UK, flavour was a relatively unimportant factor, while in the UK nutritional quality was a very important consideration, ranking much higher than other factors.

There are significant differences in attitudes towards frozen food consumption across countries, with higher frequency of consumption in Norway and the UK, where convenience, price and waste reduction are the main reasons for choosing frozen food, while flavour and freshness are generally not major concerns across countries.

8.3 Perspectives on Food Waste Reduction

Except for Slovenia, fruit and vegetables were the most commonly wasted food types, especially in Italy, Hungary, Norway and the UK. In Slovenia, on the other hand, the main food waste category was bread and baked goods. Overall, the highest frequency of food waste was witnessed in the UK, followed by Hungary and Slovenia. Food waste in the UK and Hungary usually occurred 2-3 times per week, while in Italy and Norway it was relatively less frequent, weekly or less.

The main causes of food waste included spoilt or stale food, which was the most common cause in Norway, Italy and the UK, and the second most cause in Hungary and Slovenia. The main cause of waste in Hungary and Slovenia was incorrect meal planning when cooking, which was also the second most common cause of waste in the UK.

Regarding the consumption of leftovers, most respondents in Norway and Slovenia consume leftovers, while more than a quarter of respondents in the UK and more than half of respondents in Hungary do not consume leftovers. There is similar room for improvement in Italy.

Recipe apps that use leftovers are more common in the UK than in other countries, with less than a quarter of respondents in other countries using such apps, showing the potential for these countries to promote such apps.

In addition, freezing was the most common waste prevention measure, and cooking leftovers and meal planning were also common prevention methods. But donating food or engaging in community food sharing was less common, particularly in countries outside the UK. While many respondents indicated a willingness to accept food from food banks, respondents from Hungary and Slovenia were showing their refuse of food from food banks. In some text question, we find that many respondents expressed a lack of knowledge about food banks, which may reflect the reality that there are fewer food banks.

8.4 Perspectives on Shopping Online versus In-person

Majority of participants across all countries shop in-person rather than online. UK has a higher percentage of participants shopping online than the other countries. Consumers from Norway, Hungary, Italy and Norway has the highest frequency of shopping, with typically shopping 2-3 times per week.

In terms of distance, most Norwegian respondents were less than a mile from a supermarket, with the majority of respondents in Italy and Slovenia also reporting closer proximity. However, 16 per cent of respondents in Hungary and Italy had to travel more than two miles to reach a supermarket, which can be challenging for younger groups of respondents who may not be able to shop by car.

About environmental impact, only consumers from the UK believe that online shopping is more environmentally friendly. Opponents were mainly concerned that online shopping would increase traffic stress and over-packaging, especially for respondents who walk, cycle or use public transport to shop, and that emissions from deliveries could be greater. Waste and additional logistical demands associated with returned or un-fresh food are other concerns.

Respondents who support online shopping believe that buying in bulk and reducing personal shopping trips can reduce energy consumption, while online sales can improve efficiency in stock management and reduce waste. They see more positive changes in the future for online shopping and are willing to adapt to new ways of shopping.

The main shopping obstacle in each country was delivery arrangements, especially in Norway and Hungary. Respondents in Italy and the UK, on the other hand, had more difficulty changing their shopping habits.

Respondents in all countries agree that the biggest benefit of online shopping is saving time, which is the only advantage recognised by all respondents in Slovenia and shared by a majority in each country. In addition, respondents in Norway pointed to convenience and easier meal planning as the main benefits of online shopping.

Reducing food waste was not recognised by most respondents as the main advantage of shopping online, and except for the UK, it was one of the least mentioned benefits in every country.

8.5 Perspectives on Food Packaging

'Safety' was mentioned most by respondents, who believed that good packaging can effectively protect food safety, reduce the risk of microbial and bacterial attack, extend shelf life and ensure product quality. And good packaging could avoid unnecessary waste, provides consumers with essential information and improves transport efficiency.

However, pollution and damage to the environment from plastic packaging was a major concern for respondents, especially the lack of reliable recycling standards and processes for existing plastic packaging. Some respondents were also concerned about the quality of plastic packaging and its potential impact on food quality.

Consumers in Norway and Slovenia believe that packaging materials influence their purchasing decisions, whereas most consumers in Hungary, Italy and the UK say that packaging materials have no influence on their shopping choices.

Recyclability is the packaging feature most valued by Hungarian, Italian, UK and Slovenian consumers when choosing food products, and is also the second most important consideration for Norwegian consumers. Slovenian consumers will value packaging volume.

The main barriers to choosing sustainable packaging vary by country. Consumers in Hungary and Slovenia perceive sustainable packaging as time-consuming, while consumers in Italy, Norway and the UK lack knowledge and information.

8.6 Future implications

Although gender was not significant in this study, age was a significant influencing factor, and it is recommended that age-related consumption habits and behavioural patterns be further explored to develop targeted marketing strategies or product promotion plans. This could be aided by taking narrower ranges for the ages to allow for continuous modelling.

The results from the behaviour and public perception survey will be used to develop scenarios of food supply chain in the future, to predict the potential energy consumption and resulting GHG emissions of the food supply chain.

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