Food Industry Centre Cardiff Metropolitan University



# Thinking Outside of the Box: Food Safety and Nutritional Information in UK and US Meal-Kit Recipe Boxes Naomi Melville<sup>1</sup>\*, Alicyn Dickman<sup>2</sup>, Joseph Baldwin<sup>1</sup>, Elizabeth C. Redmond<sup>1</sup>, Sanja Ilic<sup>2</sup> & Ellen W. Evans<sup>1</sup>, (1) ZERO2FIVE Food Industry Centre, Cardiff Metropolitan University, Cardiff, United Kingdom (2) The Ohio State University, Columbus, OH \*Corresponding author: nmelville@cardiffmet.ac.uk

# Introduction

Meal-kits are subscription boxes that deliver fresh ingredients and recipe instructions directly to consumers' homes (1). Both in the UK and US markets, meal-kits have gained popularity in recent years due to the convenience they offer, with the COVID-19 pandemic further contributing to the increased demand, as more people have started cooking at home and prioritizing healthier options (2-4). Meal-kits provide pre-measured ingredients, diverse recipe options, reduce food waste, and offer healthier meal choices (5). In both the US and UK, limited research has been conducted on the food safety (6-8) and nutrition (9) aspects of meal-kits.

The recipe cards included in meal-kits have the potential to educate consumers on safe food handling practices and nutrition, which is crucial considering the rising prevalence of obesity and nutrition-related chronic diseases (10-12). Research suggests that the inclusion of food safety messaging in a recipe has a positive impact of food handling behaviour (13). Similarly, the inclusion of nutritional information can lead to healthier food choices (14).

It is essential to evaluate the food safety and nutrition information provided in meal-kits to ensure that they effectively promote safe food preparation and communicate nutritional information. The rationale for the comparison of recipe cards from the US and UK include: a common language, similar diets, a crossover of meal-kit providers in both markets, and an increasing popularity in both countries.

# Purpose

The aim of the research was to determine the provision of food-safety and nutritional information in UK and US meal-kit recipes cards.

# Methods

**Data collection tool:** An online database tool was developed to enable content analysis of meal-kit recipe cards. Frameworks were used:

- The Partnership for Food Safety Education 'Safe Recipe Style Guide,' (15) to identify key food safety information.
- 'MyPlate' (US), Dietary Guidelines for Americans and the 'Eatwell Guide' (UK) were used to identify nutritional information (16-18).

A pilot study using 18 recipe cards was undertaken to evaluate recipe cards from eight meal-kit providers to assess the reliability of the electronic database tool

Data collection and analysis: Images and physical copies of recipe cards were collected using Citizen Science methods. Recipes included in data collection analysis:

- *n*=126 (US)
- *n*=359 (UK)

### **Ethical Approval:**

- Approval was obtained from the Health Care and Food, Ethics Committee at Cardiff Metropolitan University (Reference number: PGR-5421).
- The Ohio State University did not require an IRB for this project.

As indicated in **Table 1**., more US recipe cards (66%) provided guidance for internal temperatures than UK recipe cards (<1%). Subjective indicators were included in (99%) of UK recipe cards (Fig. 1) and (80%) of US recipe cards (Fig. 2). However, such methods are not always a reliable way of ensuring that food has reached a safe core temperature (19). Best practice involves using a food thermometer to kill harmful bacteria (Fig. 3) by cooking to the recommended internal temperatures (Fig. 4) (20).

Table 1. Inclusion of temperature information in UK (*n*=346) and US (*n*=126) meal-kit recipe cards.

Temperature information	ик	US
Subjective Indicators	•Statements on the recipe cards regarding the cooking adequacy of high-risk foods ( <i>n=1306</i> ).	•Staten regardin adequa ( <i>n=236)</i>
	<ul> <li>35% relating to the visual assessment of colour.</li> </ul>	•25% re assessn
	•26% referring to cooking duration.	<ul><li>40% reducatio</li><li>28% reducatio</li></ul>
<b>Best Practice</b>	<ul> <li>&lt; 1% recommended a meat thermometer and an internal temperature of 75°C.</li> </ul>	•66% o recipes temper on the o



Ensuring that high-risk ingredients, such as animal proteins, remain at chilled temperatures (≤5°C/41°F) (**Fig. 11**) during storage, and in the case of meal-kits, during transportation, can help slow the growth of harmful bacteria (1, 23). Results showed UK recipe cards (50%) were more likely to recommend refrigeration, in contrast to US recipe cards (12%) (Table 4.). In both countries, when refrigeration was to referred to on the recipe cards, most recipe cards did not mention temperature (Fig. 12, Fig. 13 and Fig. 14).

Table 4. UK (*n*=332) and US (*n*=126) recipe card results of refrigeration

Refrigeration Information	UK	US
Refrigeration Advice	• Of the applicable recipes ( <i>n</i> =332), 50% referred to storing ingredients in the fridge.	• 0 (n = stor in t
Best Practice	<ul> <li>Only one recipe (&lt;1%) referred to recommended temperatures (≤5°C).</li> </ul>	• 0 reco stor
Location of advice	• 47% of storage instructions were found on the back of the recipe card, adjacent to the recipe instructions.	• 93 inst the care

# Results

### Temperature

### b) IMPORTANT: The chicken is cooked when no longer pink in the middle. Figure 1. Subjective Indicator of cooking advice as viewed on the UK recipe cards Meanwhile, pat **chicken** dry with paper towels; season all over with half the paprika (all for 4 servings), salt, and pepper. leat a drizzle of oil in panused for bacon over medium-high heat. Add chicken and cook until browned and cooked through, 5-6 minutes per side. In the last 1-2 minutes of cooking, evenly nents on all recipe card top chicken with **bacon** and **cheese**; cover pan to melt cheese. ng the cooking Figure 2. Subjective Indicator of cooking advice as cy of high-risk foods viewed on the US recipe cards elating to the visual ment of colour. FSA recommend cooking burgers thoroughly to well done. Burgers served under may contain harmful bacteria that could cause food poisoning. eferring to cooking **Figure 3.** Example of Food Safety advice regarding the risk of undercooking burgers as seen on one UK eferring to doneness. recipe card f meat-containing include internal \*Barramundi is fully cooked when nternal temperature reaches 145°. ature recommendation Figure 4. Example of internal temperature guidance regarding cooking fish on a US recipe card

## Refrigeration



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Handwashing

Handwashing, including the use of soap and water, is an essential food safety prac (21). In the UK, all handwashing advice at the start of preparation (Fig. 5) was adja recipe cards, during preparation, had a highlighted disclaimer for handwashing with indicated that written communication of food safety advice within instructions, ha (13). US recipe cards (6%) were found to be lacking in handwashing advice (Table (Fig. 7).

Table 2. UK (*n*=359) and US (*n*=126) recipe card results for the safe practice of

handwashing			Wash your hands before and after prep. Wash fruit and veg;
Handwashing Information	ИК	US	but not meat! Use different chopping boards and utensils for raw and ready-to-eat foods (or wash in-between). Boxes are packed in facilities that handle Peanut, Nut, Sesame, Fish, Crustaceans, Milk, Egg, Mustard, Celery, Soya, Gluten & Sulphites.
At the start of recipe preparation	•46% of recipe cards stated 'wash hands'.	•0% of recipe cards stated 'wash hands'.	<b>Figure 5.</b> Handwashing advice located adjacent to the recipe instructions. Refers to before and after preparation.
During recipe preparation	•48% of recipe cards.	•6% of recipe cards.	<b>pieces</b> to the bowl and toss to coat completely in the cornflour. <b>IMPORTANT</b> : Wash your hands after handling raw chicken.
Location of advice	<ul> <li>Within cooking instructions (n=109) or in a separate section adjacent to the recipe (n=162).</li> <li>When located within the recipe instructions (n=104), it was highlighted with an 'important' disclaimer.</li> </ul>	<ul> <li>In a separate section on the front of the recipe card</li> <li>(n=7).</li> </ul>	Figure 6. Handwashing advice located within the recipe instructions. Highlighted by an <i>'important' disclaimer</i> *Barramundi is fully cooked when internal temperature reaches 145°. Wash and dry fresh produce. Wash hands and surfaces after handling raw fish
Hand Hygiene	•No further advice such as the use of soap or drying.	•No further advice such as the use of soap or drying.	<b>Figure 7.</b> Handwashing advice located in US recipe card, separately from the recipe instructions. Refers to after preparation.

Produce

Washing produce is important to reduce any potential microbial load, particularly if there is no cooking process, to remove any harmful bacteria (24). Advice for washing fruit and vegetables (Fig. 15 & Fig. 16) was the most communicated practice in both the UK (88%) and the US (82%) (Table 5). While advice was less frequent for herbs (Fig. 17), there could also be improvements regarding extra detail in the communications used (e.g., scrubbing firm produce).

Table 5. UK (*n*=358) and US (*n*=126) recipe card results for the correct handling of

Washing Produce Information	UK	US
Washing Produce	<ul> <li>88% referred to washing fruit and vegetables.</li> <li>Less often for herbs (51%).</li> </ul>	<ul> <li>82% referred to washing produce.</li> <li>Less often for herbs specifically (19%).</li> </ul>
Recipes including raw ingredients such as a salad, herb or produce garnish	• Of the applicable 248 recipes, 11% made no reference to washing produce.	• Of the applicable recipes 18% made no reference to washing produce.

ice to reduce the spread of harmful bacteria
cent to the recipe instructions (Table 2). UK
recipe steps (Fig. 6). Previous research has
a positive impact on food safety behaviour
2) with only references to after preparation
Please remember to check your ingredient packaging for



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## **Cross-contamination**

Prevention advice for avoiding cross-contamination, through recommended food safety practices, can help reduce the spread of harmful bacteria from raw and uncooked to ready-to-eat (RTE) foods (22). In the UK, recommended practices included the correct separation of foods and equipment (47%) (Fig. 8) and avoiding washing meat (36%) (Fig. 9). In the US, there were instances (n=49) where the risk for cross-contamination was increased through improper food handling practices (Fig. 10).

Table 3. UK ( <i>n</i> =346) and US ( <i>n</i> =126) recipe card results indicating the difference and prevalence in cross-contamination prevention advice			Use separate equivalent of wash between u as any recipe ste possible via ema
<b>Cross-Contamination</b>	ик	US	<b>Figure 8.</b> Ad or to clean i cooked food
Prevention Advice	<ul> <li>Prevention advice was present in 51% of recipes.</li> <li>Most frequently included advice (47%) was 'wash equipment in-between uses'.</li> </ul>	<ul> <li>Prevention advice was present in 12% of recipes.</li> <li>Most frequently included advice (73%) was 'clean surfaces'.</li> </ul>	Please remember information on all <u>Wash your hands</u> but not meat! Use raw and ready-to- Boxes are packed Sesame, Fish, Cru Gluten & Sulphite
'Do not wash meat'	<ul> <li>Preventive statement found in 36% of recipe cards.</li> <li>Located in a separate section adjacent to the recipe instructions.</li> <li>No further advice on 'why' this practice is important.</li> </ul>	<ul> <li>•0% of recipes included instruction to not wash meat.</li> <li>•3% of recipes included instruction to rinse raw protein.</li> <li>•39% of all cards included instructions to pat raw meat with paper towels.</li> </ul>	Figure 9. Gu located next a UK recipe of Meanwhile, and season Figure 10. Gu recipe card w contaminatio



## Nutritional information

Given the increase in obesity, and both countries having similar diets (10-12), it was necessary to evaluate how nutritional information was provided to consumers through the meal-kit recipe cards. Both countries were similar in communicating nutritional information and health claims (Fig. 18 & 19). However, the US added further details related to Micronutrients (Fig. 20).

### Table 6. Inclusion of nutritional information by UK (*n*=8) and US (*n*=11) meal-kit providers on recipe cards

Nutritional Information	ик	US	for uncooked ingredient Energy (kJ/kcal) Fat (g)
Macronutrients (Carbohydrates, Protein, Fat & Kcal)	<ul> <li>Macronutrient information was given by six meal-kit providers.</li> <li>One provider omitted details regarding saturated fats, salt, and sugar.</li> <li>One provider exclusively offered calorie information without any additional nutritional details (i.e. Macronutrients).</li> </ul>	<ul> <li>Macronutrient information was given by seven meal-kit providers.</li> <li>Including one provider that displayed inconsistency in delivering nutritional information.</li> <li>One provider exclusively offered calorie information without any additional nutritional details (i.e. Macronutrients).</li> </ul>	Fat (g)         Sat. Fat (g)         Carbohydrate (g)         Sugars (g)         Protein (g)         Salt (g)    Figure 18. UK recipe cards including Mac Nutritional information          Image: Salt (g)         Image: Salt (g)
Micronutrients (Vitamins & Minerals)	<ul> <li>No meal-kit providers gave information on Micronutrients.</li> </ul>	<ul> <li>3 meal-kit providers gave information on Micronutrients.</li> </ul>	claim for '2 of your 5-a-day'          Serving: 8oz       Sodium: 2mg       Calcium: 22         Vitamin C: 50mg       Vitamin A: 100IU       Sugar: 2g
Health Claims	<ul> <li>'2 of your 5-a-day', 'energy enhancing', and 'gluten-free' were made by 4 meal-kit providers.</li> </ul>	<ul> <li>Meal-kit providers (n=5) offered claims such as 'healthy', 'gluten-free', and 'high protein'.</li> </ul>	Fiber: 11g       Potassium: 6mg       Cholesterol         Calories: 450kcal       Saturated Fat: 15g       Fat: 15g         Protein: 22g       Carbohydrates: 12g       Iron: 14mg         Figure 20. US recipe card including





## The Ohio State University



Cardiff Metropolitan University

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# Significance of study

### ipment to handle raw and cooked meat (or s). Missing or replaced ingredients, as well changes, will be communicated where

ice to use separate equipment -between uses for raw and on a UK recipe card



dance to 'not wash meat' to the recipe instructions on



idance to 'pat dry' meat on a US th no further crossn advice provided



Micronutrient Nutritional information

### • While recipes cards in the UK (*n*=359), were found to contain more instances of food safety information in contrast to the US recipe cards (n=126); overall, the information was often inadequate and there were missed opportunities to communicate recommended domestic food-safety practices.

- This study has identified differences in food-safety information communication by US and UK meal-kit providers.
- Although food-safety information was more frequently included in UK recipes, there is a need to understand if, and how, consumers engage with such information when following meal-kit recipes.
- Further research will need to be conducted to determine the optimum positioning of key food safety messages on recipe cards.
- While nutritional related information was observed at varying degrees of detail in both countries, there is a need to examine what role meal-kits play as an educational tool for nutrition or for teaching health-promoting behaviors.

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