Evaluation of Food Safety Information Provision in Meal-kit Recipes: A Pilot Study

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Introduction

Meal-kit subscription boxes enable consumers to receive pre-measured ingredients delivered straight to the front door[1,2]. The meal-kit includes a step-by-step recipe card for the consumer to prepare a specific meal within the domestic kitchen[1,2]. Research has highlighted that while the meal-kit industry has been steadily growing for several years, the COVID-19 pandemic has been a catalyst for increased popularity among consumers for meal-kit service use at home[3].

The trend of home cooking, and opting for meal-kit services, is expected to continue beyond the pandemic[4,5]. The appeal reported among consumers as being convenience, healthier options, more diverse and interesting recipes, less food waste, and reduced shopping trips[4].

Given the association of the domestic kitchen with the sporadic incidence of foodborne illness[6], this current consumer trend presents unique food-safety challenges, offering distinctive opportunities to inform and enable consumers to implement recommended food-safety practices to reduce the risk of foodborne illness associated with food prepared in the home.

Data suggests that the inclusion of food-safety information in recipes improves consumer food-safety practices[7]. Consequently, there is a need to review and evaluate recipe cards provided in meal-kit subscription boxes to determine the inclusion of food-safety information.

Purpose

The purpose of this study was to utilise citizen science methods to obtain examples of recipe cards from UK-based meal-kit delivery providers; and to review recipe cards to determine the inclusion of food-safety information.

Methods

- Members of the public, from the UK, were invited via social media platforms to share images of meal-kit recipe cards from the last 12 months via email and picture messaging.
- An online database was developed using the Partnership for Food Safety Educations (PFSE) 'Safe Recipe Style Guide'[8] to enable a content analysis of recipe cards according to the four predefined categories, *'Temperature', 'Cross-Contamination', 'Produce'* and *'Hand Washing'.*
- Ethical approval was obtained from the Health Care and Food Ethics Committee at Cardiff Metropolitan University (Ethics Approval Reference Number PGR-5421).

References

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Results

Citizen Science methods were used to obtain meal-kit recipe cards from members of the UK public. Images and physical copies of recipe cards (*n*=555) from ten meal-kit providers were obtained, these included carnivore, pescatarian, vegetarian, and vegan recipe cards (*n*=174). For this pilot study, recipe cards (*n*=18) were selected from eight providers.

Produce

Washing produce such as fruits, vegetables and herbs under cold running water during food preparation is important in reducing the microbial load on the raw produce lowering the risk of foodborne illness[9].

Of the recipe cards that involved an element of produce that was to be consumed raw (e.g., salad or herbs) (*n*=13):

- 84% referred to washing fruit and vegetables (see **Fig.1**) but only 53% of recipe cards referred to washing herbs.
- 30% of guidance for washing produce was cited on the front of the recipe card (opposite side of the recipe instructions).
- 53% of guidance for washing produce was in a separate section (adjacent to the recipe instructions) (see **Fig. 1**).
- One recipe referred to washing produce within the recipe instructions (see **Fig. 2**).

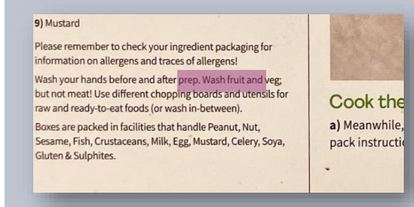

Figure 1. Highlighted advice relating to washing produce adjacent to the recipe instructions.

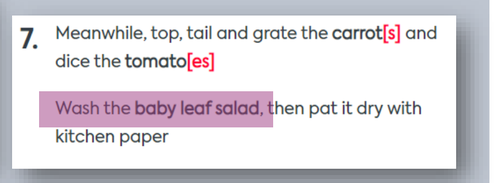

Figure 2. Highlighted advice relating to washing produce is included within the recipe instructions.

Hand Washing

Hand hygiene involves wetting, lathering, rinsing and drying hands before, during and after preparing food, after handling raw foods and after handling rubbish or touching the face can remove harmful bacteria and reduce the risk of cross-contamination[10].

In recipes that included raw meat, fish and poultry (*n*=14):

- 46% required further handling and preparation (e.g., cutting) by the consumer.
- 40% referred to handwashing during recipe preparation and stated to *"wash hands"* with no further advice regarding the process.
- When referred to, 40% of handwashing guidance was provided adjacent to the recipe instructions and 13% was provided within the recipe instructions (see **Fig. 3**).
- No recipe card mentioned the application of soap or hand drying.

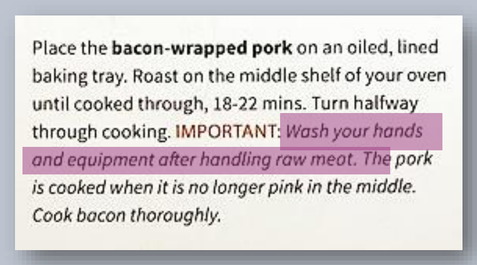

Figure 3. Highlighted handwashing advice that was found within recipe instructions

Temperature

Temperature probing of high-risk foods during food preparation is important to ensure that foods have reached the correct internal temperature in which harmful bacteria are eliminated[9].

Most recipes (*n*=14) contained high-risk ingredients (e.g., raw meat, poultry or fish) with:

- 93% of recipes refer to cooking duration in minutes.
- All cooking adequacy advice was provided within the recipe instructions (see **Fig. 4**).
- The advice on cooking adequacy primarily came from sensory characteristics including *"until no longer pink in the middle", "until golden/browned"* and *"until opaque".*
- Only one recipe card referred to using a temperature probe and gave a correct endpoint temperature (see **Fig. 4**).

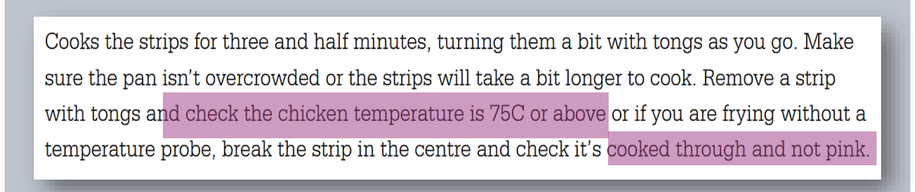

Figure 4. Highlighted cooking adequacy advice related to temperature and sensory characteristics ("not pink").

Cross-Contamination

Not washing poultry, not re-using marinades on RTE foods that were used on raw foods and using separate equipment after handling high-risk ingredients can all help reduce the spread of harmful bacteria[9].

Of the recipes that included raw meat, poultry or fish (*n*=14):

- 36% of recipes referred to not washing raw meat but none stated why it should not be washed.
- Although 43% of recipes referred to washing equipment in-between uses or using different chopping boards and utensils, only one recipe card specifically referred to washing equipment after handling raw meat (see **Fig. 3**).
- 57% of recipes that provided no cross-contamination advice after handling high-risk ingredients.
- When marinating was referred to (*n*=3), one referred to marinating in the refrigerator (see **Fig. 5**) none referred to disposal or avoiding reuse.

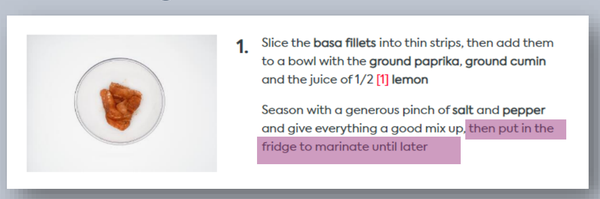

Figure 5. Highlighted marinating advice provided within the recipe instructions.

Post-pilot amendments to the data collection tool: Refrigeration

The PFSE 'Safe Recipe Style Guide'[8] was useful in establishing the key practices that should be included in a printed recipe to prompt safe food preparation and handling. However, one critical food-safety practice – refrigeration – was not referred to. The storage of ingredients in the refrigerator, below ≤5°C, is necessary to reduce the growth rate of bacteria. The database took this into consideration and was amended to include this important practice.

Of the meal-kit recipe cards that provided ingredients that required chilled storage:

- 50% of recipe cards referred to storing ingredients in the fridge.
- Only one recipe card referred to the recommended temperature (≤5°C).
- Of the recipe cards that referred to refrigeration, none of the recipe cards specified the location within the refrigerator. (i.e., On the bottom shelf).

Significance of study

- This pilot study has addressed a research gap detailing the inclusion of food-safety information in meal-kit recipe cards.
- Although all recipes provided some form of food-safety practice, none of the recipes expanded upon why this information was relevant or important for the consumer to reduce the risk of foodborne illness.
- Future observational research is required to establish if the inclusion of food-safety information in meal-kit subscription box recipe cards has an impact on the food-safety behaviours of consumers in the domestic kitchen.

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