



Behaviour of Belgian consumers, related to the consumption, storage and preparation of cooked chilled foods



Jeff Daelman^{a,*}, Liesbeth Jacxsens^a, Jeanne-Marie Membré^{b,c}, Benedikt Sas^a, Frank Devlieghere^a, Mieke Uyttendaele^a

^a Laboratory of Food Microbiology and Food Preservation, Department of Food Safety and Food Quality, Part of Food2know, Faculty of Bioscience Engineering, Ghent University, Coupure links 653, B-9000 Ghent, Belgium

^b INRA, UMR1014 Secalim, 44322 Nantes Cédex 3, France

^c LUNAM Université, Oniris, Nantes, France

ARTICLE INFO

Article history:

Received 6 February 2013

Received in revised form

30 May 2013

Accepted 4 June 2013

Keywords:

Cooked chilled foods

REPFEDs

Consumer practices

Time-to-onsumption

ABSTRACT

Cooked chilled foods or Refrigerated and Processed Foods of Extended Durability (REPFEDs) are a heterogeneous group of food products designed for consumer convenience. The consumer exposure to pathogenic microorganisms due to the consumption of REPFEDs is influenced by the industrial production process and by consumer behaviour. A consumer survey was organised and conducted to assess the consumption frequency, storage time, reheating practices and perception of and respect for the product's 'use by' date. The survey was conducted at a local food fair in Belgium with 874 respondents correctly completing the questionnaire. Over three quarters (77.5%, $n = 677$) had consumed at least one REPFED over the last year. Consumption frequency was the highest between the ages of 18 and 30. Nine out of ten consumers were able to give an acceptable estimate of the shelf life of REPFEDs (e.g. less than four weeks). By contrast, only half of the consumers (53.3%) fully respected the 'use by' date as indicated on the packaging. The majority of the remaining consumers (39.6%) would consume the product until three days past the 'use by' date; 2.5% of the consumers would still consume the product after more than three days past the 'use by' date and 4.6% did not consider the 'use by' date. In addition, only half of the consumers fully complied with the reheating instructions on the label, 36.5% only partially followed these instructions and 13.4% did not follow them at all. Data analysis showed that consumers, who did not respect the 'use by' date, were also less likely to follow the reheating instructions. To determine the distribution of the time a REPFED spends in a consumer fridge, the consumers were asked how frequently they bought REPFEDs and how they stored them. Using this information an attempt was made to construct a time-to-consumption (TTC) distribution. This TTC demonstrated that approx. 20% of REPFEDs was consumed on the day of purchase; about half (52.9%) were consumed within two days of purchase, 75.5% within four days and over 90% during the first week. These short storage times are likely to reduce the exposure to psychrotrophic microorganisms present in REPFEDs.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

Cooked chilled foods, ready meals, Refrigerated Processed Foods of Extended Durability (REPFED) are all names for a broad group of food products, which are designed to meet the consumer desire for convenient meals. The food industry primarily controls the microbial safety of REPFEDs using heat treatment, cold storage and modified atmosphere packaging in combination with appropriate product formulation and shelf life

limitation. The combined EU–US market for these products has steadily grown from \$29.2 billion in 2005 to \$32.6 billion in 2009. A growth that is likely driven by the increased consumer demand for convenience and lack of time (Business Insights, 2006).

The three main microbial hazards in REPFEDs are non-proteolytic *Clostridium botulinum*, *Bacillus cereus* and *Listeria monocytogenes*. The latter can be controlled using pasteurisation (70 °C for 2 min) and preventing recontamination if applicable (ICMSF, 2002; Reij, Den Aantrekker, & ILSI Europe Risk Analysis in Microbiology Task Force, 2004). Spores of psychrotrophic *C. botulinum* are inactivated (6D reduction) by heating 10 min at 90 °C. This has led to the general performance standard used in

* Corresponding author. Tel.: +32 9 264 99 02; fax: +32 9 255 55 10.
E-mail address: jeff.daelman@ugent.be (J. Daelman).

REPFEDs of 10 min at 90 °C (or equivalent) combined with storage at chilled temperatures to prevent outbreaks of botulism (ACMSF, 1992). However, *B. cereus* spores are generally more heat resistant and able to survive the pasteurization process (ACMSF, 1992; Carlin, Brousolle, Perelle, Litman, & Fach, 2004; Del Torre, Della Corte, & Stecchini, 2001). The growth of mesophilic *B. cereus* is limited at storage temperatures below 8 °C, but some psychrotrophic strains of *B. cereus* may still be able to (slowly) grow at 5–7 °C (Samapundo, Heyndrickx, Xhaferi, & Devlieghere, 2011), although the toxigenic potential of these latter strains is debated (Ceuppens et al., 2011).

Several studies have pointed out that the microbial contamination of these microorganisms in REPFEDs is characterised by low prevalence and low concentrations and that the microbial risk of these products is small when stored at the correct temperature and within proper time periods (Carlin, Girardin, et al., 2000; Daelman, Jacxsens, Devlieghere, & Uyttendaele, 2013; Daelman, Jacxsens, Lahou, Devlieghere, & Uyttendaele, 2013; Nissen, Rosnes, Brendehaug, & Kleiberg, 2002). But it has been established that consumers do not always respect indicated instructions on time and temperature of storage or preparation of refrigerated foods (Nauta, Litman, Barker, & Carlin, 2003; Sampers et al., 2012). For example the temperature of 20–35% of domestic refrigerators temperatures in Europe has been reported to exceed 8 °C (EFSA, 2007). This type of temperature abuse or neglecting the use by date as indicated on the package may render a product microbially unsafe for human consumption. It is therefore necessary to include consumer behaviour in any microbial exposure assessment about REPFEDs (Nauta et al., 2003; Sampers et al., 2012).

The notice of including consumer behaviour in assessing the safety of foods is also included in the EU regulation on microbiological criteria for foodstuffs (Commission regulation, 2005). Under this regulation food business operators must ensure that the food safety criteria applicable throughout the shelf life can be met under reasonably foreseeable conditions of storage and use. For *L. monocytogenes* some recommendations on this approach to simulate transport, retail and consumer storage are included in the technical guidance document on the challenge test protocol used by the EU community reference laboratory (EU CRL for *Listeria monocytogenes*, 2008) or in the AFNOR for shelf life testing (AFNOR, 2010). For temperature abuse at the consumer phase it is suggested to use either a temperature justified by detailed information (75th percentile of the observations of home refrigeration temperatures for the proper country), or if no such data is available, to use 8 °C or 12 °C. For storage time it is supposed that products are kept at consumer phase for 1/3 or 2/3 of their indicated shelf life. However, it is to be expected that not all food products are stored for their entire shelf life and consumed on the last day of their shelf life. Storage-times for various products (e.g. smoked fish, ready-to-eat foods, cold sliced ham) in consumer fridges have been reported. These were either based on expert opinion (Nauta et al., 2003) or on consumer surveys (Garrido, Garcia-Jalon, Vitas, & Sanaa, 2010; Pouillot, Lubran, Cates, & Dennis, 2010).

The first objective of this study was to gain actual data about consumer attitudes towards REPFEDs by organizing a survey at a food fair in Ghent, Belgium inquiring on the following items: frequency of purchase, home storage time, respect for 'use by' date and implementation of the reheating guidelines on the label. The second objective was to quantitatively analyse the survey data to enable in a next step to determine the impact of the consumers' behaviour with REPFEDs on their exposure to psychrotrophic pathogens (i.e. *C. botulinum*, *B. cereus* and *L. monocytogenes*) via scenario analysis.

2. Materials and methods

2.1. Questionnaire

To gain insight the behaviour of Belgian REPFED consumers a questionnaire was developed. During the development of a Quantitative Microbiological Exposure Assessment (QMEA) for *B. cereus* in REPFEDs the primary sources of uncertainty at consumer level were listed. Three items were selected: storage time at consumer level, respect for the shelf life (i.e. how many products are consumed after the 'use by' date) and compliance to reheating guidelines. Since the frequency of consumption determines the weight of an answer in the analysis, this was also included in the questionnaire. To prevent ambiguity in the questions and to be as comprehensive as possible, several preliminary versions of the questionnaire were drafted and subsequently tested by the personnel of the Laboratory of Food Microbiology and Food Preservation at Ghent University. The final questionnaire was presented to visitors of a food fair in Ghent (17–20 May 2012). Participants were offered an incentive (drink, chocolate) for filling out the questionnaire. To enable more people to take part in the same time period and to prevent errors in data processing, participants completed a questionnaire using a laptop and a web-based application (survey monkey). The questionnaire was completed under supervision, which allowed a more correct data gathering (e.g. no young children or groups) and gave the participants the possibility to ask clarification if needed. The full questionnaire, translated from Dutch, including possible answers is listed in Table 1. Text between brackets in italic was not visible on the questionnaire (e.g. skipping questions).

2.2. Data processing

Incomplete questionnaires, irrespective of the number and the nature of the question(s) left unanswered, were removed from the database. The answers to question two, five and six were recoded to acceptable/unacceptable to facilitate the discussion (Table 1). Correlations were evaluated using the non-parametric Kendall tau-c rank correlation coefficient (SPSS 20.0, IBM) and are listed in Table 2a,b.

2.3. Construction of 'time-to-consumption' distribution

The time a product is stored in a consumer fridge is of significant importance to assess the exposure to psychrotrophic pathogens. To this end, a time-to-consumption (TTC) curve was constructed. The TTC curve is determined based on a combination of three probabilities: the frequency of purchase, the storage time in the consumer fridge and the respect for the 'use by' date. The Kendall tau-c statistic was used to determine if the probabilities were correlated (Table 2a,b). Since this was the case conditional probabilities were used. A schematic representation of these probabilities is given in Fig. 1, equations, variables and examples are given in Table 3. All the necessary data to reproduce the calculations is given in Table 4.

1. The probability that a product is consumed by someone with a given frequency of purchase: $P(\text{frequency})$. This depends on the frequency of purchase (question 3). Daily consumers will consume more products than consumers who buy one product per year.
2. The probability that this consumer respects or disrespects the shelf life (question 5) given the frequency of purchase: $P(\text{respect} | \text{frequency})$. This probability will determine if a product that exceeds the 'use by' date is still consumed.
3. The probability that a consumer has answered a certain time in response to question 4, given the respect for the 'use by' date

Download English Version:

<https://daneshyari.com/en/article/6392417>

Download Persian Version:

<https://daneshyari.com/article/6392417>

[Daneshyari.com](https://daneshyari.com)