

Label Perception of Frozen Ready-to-Eat Products and Frozen Not-Ready-to-Eat Product

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“The views expressed in this paper are those of the author and do not necessarily reflect the official policy, position or views of BCIT, the Environmental Health Program or its faculty.”

Abstract

Background: Frozen meals are popularized in recent years due to their ease of preparation. This convenience factor greatly benefits busy workers who simply lack the time to cook a full meal. However, the risk of misidentifying these frozen products as cooked when they are in fact, raw, can lead to devastating consequences. This is important especially when the products are improperly prepared and undercooked. Some significant examples in recent years includes the *Salmonella* cases associated with frozen raw breaded chicken. These cases are partly due to the inadequate cooking of the product, as a result of misidentifying them as cooked even though they are raw. The purpose of this project is to determine how well the public can determine if a frozen product is cooked or raw based on the front side of the packaging, which is the first visuals that will be presented to the consumers in store.

Methods: An electronic survey was conducted for Canadian residents to determine whether they can accurately interpret if a product is cooked or raw based on the front packaging. The survey also determines if the respondent's age, gender, average number of supermarket visits in a week, and level of education will affect the accuracy of their interpretations. The survey was created and hosted online with SurveyMonkey, and distributed out in Reddit. The results are analyzed using the statistical software, NCSS 12.

Results: Chi-square tests indicated no significant difference between the demographics groups and the accuracy of the label interpretations by the respondents. Five different products; chicken pot pie, fish fillets, breaded chicken wings, poutine bites, and tourtiere pie, were chosen for identification, each with their own label statements, respectively; "cook thoroughly", "uncooked", "fully cooked", "heat thoroughly" and one with no label statement. The fish fillets, poutine bites and the tourtiere pie had the most varied answers from the respondents. The poutine bites and tourtiere pie had the majority of the respondents selecting the wrong answer or being unsure. The fish fillets had the majority choosing the correct answer, but given the simplicity of the label "uncooked", it was surprising that only 45% of the respondents chose "require additional cooking".

Additionally, a few of the open ended comments from respondents indicate some desire for labels clarity in regards to fonts and color on the packaging, as well as having clear, standardized statements that clearly identifies the products as cooked or raw. However, there are some comments that indicate the current labels are adequate, and some comments mentioning about labelling on the back of the box.

Conclusion: Based on the results of the study, it would appear that the demographic groups selected have no effect on the accuracy of label identifications of frozen products. The study also indicates that there is preference from the public to favours clear and straightforward labelling statements. The study identifies potential problems with some ambiguity in the label statements (or lack of label statements), and some potential issues with the noticeability of the statements to the consumers.

Keywords: Frozen Ready-to-Eat Products, Frozen Products, Labelling, Survey, Frozen Meals, Labels

Introduction

The biggest advantage of frozen food products is the convenience that it offers to its consumer. However, contrary to what most may believe, partly due to the visual representation of such products in the packaging and in the way they are presented, frozen food products are not always precooked. The result of this misperception and misinterpretation of packaging labels on frozen food products is what leads to inadequate cooking and improper food handling. The front of the packaging is the first visual representation of the product that a consumer will see when they are shopping. It is important that information of the product is available promptly to the consumers before they make the purchase, this is the “first line of defense” in regards to the consumers properly preparing the product. The wide spread availability of these products in supermarkets magnifies this problem, causing a widespread health problem. It is essential that consumers are able to identify if the frozen product is cooked or not in order to prevent foodborne illness from improper food handling. The objective of the study is to assess the ability of consumers to accurately interpret the product’s labels in regards to it being cooked or not, based on the front of the package.

Literature Review

Health Impact of Frozen Meals

Ready-to-eat meals is at a rising trend in terms of sales (Ready Meals in Canada, 2015), and in terms of being consumed for Canadians (Levesque, 2017), composing a significant portion of the population’s diet. However, it is important to note that frozen meals are not always precooked, this causes them to lack a final processing step that reduces foodborne pathogens to a safe level before being consumed (Tang et al., 2018). This lack of a final cooking step causes the potential for foodborne pathogens to persist on the food, some common ones are *Bacillus cereus*, *Clostridium botulinum*, *Clostridium perfringens*, *Escherichia coli O157:H7*, *Listeria monocytogenes*, *Salmonella* sp., *Staphylococcus aureus*, Hepatitis A, Norovirus, and Calicivirus (Tang et al., 2018). These foodborne pathogens can cause a variety of diseases such as gastroenteritis, salmonellosis, listeriosis, and botulism. These diseases also bring about symptoms such as bloody diarrhea, fever, vomiting and potentially hospitalization and death (Kalyoussef & Feja, 2014).

Misconceptions & Outbreaks

Multiple outbreaks occurred in Canada in recent years due to frozen food products (Canadian Food Inspection Agency, 2018; Associated Press 2018), including frozen raw breaded chicken (Canadian Food Inspection Agency, 2018). Despite changes in regulations to have the products labelled

when they are visually represented as being ready-to-eat, there's still numerous recalls occurring due to the misinterpretation of these products as being precooked (Canadian Food Inspection Agency, 2018). In a study by Smith et al. (2008), four outbreaks in the U.S. for frozen, microwavable breaded chicken from 1998 through 2006, demonstrated that inadequate labeling, consumer's response to the labeling, and microwaving cooking are all essential factors. Although raw frozen breaded chicken is a more well-known example of such a product to be causing outbreaks, other frozen not-ready-to-eat product, such as pot pies in the U.S., have also shown to have outbreaks occurring in the past (Meyer et al., 2009). Proper food safety practices is crucial when preparing the frozen not-ready-to-eat products and cooking thoroughly by following the cooking instructions (Public Health Agency of Canada, 2018a). The labeling for cooking instructions and the state of the food as shown on the front packaging, serves as a defence mechanism to foodborne illness from inadequate food preparation, so it is critical that both are accurately and clearly depicted on the packaging.

Consumers' Reading Behaviours on Labels & Ease of Reading

In regards to the tendency of reading labels, a study conducted by Petrescu et al. (2014), indicates that students in Cluj-Napoca, a city

in Romania, which represents a young and educated demographic, have a lower tendency to read labels as compared to expectations. A gap in the focus of consumers can be seen by most of the student's interest being directed to labels on expiration date, brand, quantity and price, whereas, information in processing method and preparation time, allergens and other information is less focused on. In addition, the study also shows that there is a significant difference in regards to the reading frequency of "other information" for consumers below and above 25 years old. This represents a potential difference in label reading behaviour of people in different age groups.

A study prepared for the U.S. Department of Agriculture's Food Safety and Inspection Service by Cates et al., (2001), revealed that a standardized labelling system was preferred for the consumers, as some of them were confused over whether a product needs to be further cooked completely due to the inconsistency in the labelling. For standardization, it was suggested and preferred by most consumers, that a logo for not ready-to-eat products or a color-coding scheme with a standardized phase should be created for both ready-to-eat and not-ready-to-eat products. It was also mentioned that the printed text should be large enough to be visually seen by the consumer and standardized so it is consistently placed in

the same location on the front of the packaging. It was recommended at the end of the study, for the U.S. Department of Agriculture's Food Safety and Inspection Service to evaluate the costs and benefit of implementing a regulation or policy to standardized labelling of not-ready-to-eat meat and poultry products, so consumers would know that the product requires cooking before consumption.

In the study done by Mackey and Metz (2009), it was discovered that the way the printed information on the label is presented can influence the ease of reading for the consumers in Canada. It was found that colour contrast in the prints, optimal typography, the size of the fonts, the amount of spacing between lines and the layout/length of text lines can all influence the ease of reading for consumers. When these factors are not optimally implemented in the labels, it can influence the ease of finding relevant information on the package and cause consumers to have to read multiple times to find the information they need, thereby, increasing their uncertainty in the products (Mackey & Metz, 2009).

Factors such as the kind of visual presentation of the product on the package, small sized fonts of the uncooked statement in comparison to the other texts on the package, package being discarded for storage in the freezer and the fact that the item was marketed as a quick meal option

can mislead consumers into thinking that no cooking would be required (Hobbs et al., 2017). There are concerns in Canada for consumer's reading behaviour on labels that indicate if the product is ready-to-eat or not-ready-to-eat. The clarity of such printed text and the presentation of it can have a direct influence on how well the consumers can read and understand the labels.

Materials and Methods

Materials Used

The materials used was a laptop/desktop with internet access, along with Microsoft Word and Microsoft Excel. NCSS 12 was used for inferential statistical analysis of the data. SurveyMonkey Canada was used to create and host the survey. A smartphone and email was used for contacting the manufacturers. As well, the smartphone was used to take photos of the product in the store.

Description of Standard Methods

The standard method used was an online survey. The survey was distributed online through Reddit and includes 3 main sections alongside a consent form and cover letter on the internet posts, which entails what the scope and purpose of the study is, the personnel involved, the format of the survey, contact information, confidentiality issues, inclusion and exclusion criteria and any risk or benefit to participation.

The first part of the survey composed of demographic questions to categorize respondents into groups of interest. The second part of the survey were identifications of the status of the product, ready-to-eat or not-ready-to-eat via product pictures and label statements, presented visually in the form of photos, as well as consumers' interpretation of specific label statements. The last section of the survey was an open-ended comment section to obtain respondents' opinions on how to improve clarity on labels.

The data collected through the survey was input into Microsoft Excel spreadsheet and transferred over to NCSS 12, a statistical tool software that can analyze and compare proportions via chi-square tests (NCSS 12 Statistical Software, 2019), in which Chi-square tests were conducted to analyze the data.

Emails or telephone calls were made to the manufacturers of the product that are included in the photos in the survey questions, to determine if the product is ready-to-eat or not-ready-to-eat.

Inclusion and Exclusion Criteria

All respondents of the online survey should be Canadian residents and have consented to the study after reading and understanding the consent form and cover letter. All non-Canadian residents are excluded from the study.

Ethical Considerations

Ethical considerations are in place throughout the course of the study, due to the study itself involving human beings. A cover letter was included in the internet postings to introduce the survey, and then the consent form was shown to participants at the start of the survey to inform them of any confidentiality issues and the goal of the research. The participants are also informed in the consent form that they are free to withdraw from the study at any time, and contact information to the investigator was given to them if they have any questions. The survey itself was reviewed by the BCIT Research Ethics Board, an elected group of faculty and staff in the institution that are in charge of reviewing and approving research studies in BCIT that involves human beings or human biological materials (BCIT, 2018). The board follows the Research Ethics for Human Participant Policy, which is based on the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (BCIT, 2018).

Results

Data Description

The data collected was multichotomous ordinal and nominal data, in addition to that, an open-ended question, in the form of a comment box, was included at the end.

Statistical Package Used

Responses data was exported from SurveyMonkey to spreadsheet format in

Microsoft Excel, SurveyMonkey and Microsoft Excel organizes the data into spreadsheets and into various graphs and charts. The data organized in Microsoft Excel was then transferred to NCSS 12 to conduct Chi-square tests on.

Descriptive Statistics

A total of 139 respondents participated in the survey, however, only 112 respondents completed the entire survey (with the exclusion of open-ended questions, which were left as optional to complete). Out of the 139 respondents, 137 respondents completed the demographic section of the survey.

For demographics, gender, 38.69% of the respondents were male, 60.58% were female and 0.73% identified themselves as “other”. For age, 1.46% were under 20 years old, 51.82% were between the ages of 20 to 39,

35.04% were between the age of 40 to 59 and 10.95% were 60 or over 60 years old and 0.73% of the respondents preferred not to answer about age. For level of education, 36.50% completed undergraduate degree, 35.77% completed graduate degree, 16.06% completed some post-secondary, and 22.63% were in high school, completed high school or completed some post-secondary.

As well, 3.65% have “other” as education and 1.46% prefer not to answer. For the

average number of times respondents visit the supermarket in a week, 62.77% visit 1 to 2 times a week, 19.71% visit less than once per week, and 16.06% visited between 3 to 7 times per week. 1.46% identified themselves as “other”, indicating they visited more than 7 times per week. Aside from those demographic groups, 90.51% of the respondents had English as their native language and 9.49% had “other” as their native language.

The following charts summarizes the descriptive statistics for the product identification portion of the survey.

Figure 1. Responses to label interpretation of food products based on front of packaging photos taken.

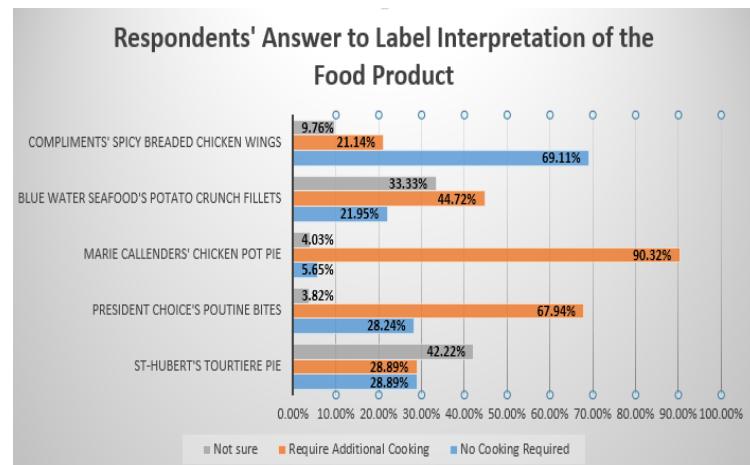


Table 1. Descriptive analysis of label interpretations with no products shown

	Product requires no cooking prior to being ready-to-eat with option to warm up to taste preference	The food product requires additional cooking prior to being ready-to-eat	Can be either ready-to-eat or not-ready-to-eat depending on the type of product	Not sure	Total
Product presented as a cooked product in the front of package and is not labelled with any specific statement. I interpret this to indicate...	41.23% (47 respondents)	8.77% (10 respondents)	44.74% (51 respondents)	5.26% (6 respondents)	114 respondents
The product is labelled as heat thoroughly. I interpret this to indicate...	26.32% (30 respondents)	55.26% (63 respondents)	14.04% (16 respondents)	4.39% (5 respondents)	114 respondents
The product is labelled as cook thoroughly. I interpret this to indicate...	1.72% (2 respondents)	95.69% (111 respondents)	1.72% (2 respondents)	0.86% (1 respondents)	116 respondents
The product is labelled as uncooked. I interpret this to indicate...	1.74% (2 respondents)	96.65% (110 respondents)	2.61% (3 respondents)	0% (0 respondents)	115 respondents
The product is labelled as fully cooked. I interpret this to indicate...	78.45% (91 respondents)	5.17% (6 respondents)	15.52% (18 respondents)	0.86% (1 respondents)	116 respondents

In their replies, the St-Huberts' Tourtiere Pie and Marie Callenders' Chicken Pot Pie were identified as not precooked (St-Hubert, personal communication, Jan 16, 2019). For the chicken pot pie specifically, the dough was not cooked but the meat was cooked inside (Conagra Brand, personal communication, Jan 30, 2019). For the Blue Water Seafood Potato Crunch fillet and Compliment's Breaded Chicken Wings it was clearly stated on the label that it was uncooked and fully cooked, respectively. For the President Choice's Poutine Bites the product was identified as being precooked (President Choice, personal communication, Jan 17, 2019).

Out of the 57 comments, 9 respondents left comments mentioning the back of the box, 9 mentioned something related to the font/color clarity on the package, 7

mentioned detailed or clear cooking instructions should be required, and 26 responses mentioned something with the statements itself. Out of the 26 responses some mentioned having standardization, clear labels, or specific wordings for uncooked products. A few of the responses identified the current labels as adequate/clear enough for identification.

Inferential Statistics

Chi-Square tests were conducted comparing demographic groups and the accuracy of the respondent's interpretation of labels. The accuracy of respondents was determined based on how many (out of 5 questions) of the label interpretation questions, provided with the photo of the product, they can accurately identify. Chi-square tests were selected due to the data being nominal, and for determining if there's an association between multiple groups (Duignan, 2016).

Table 2. Chi-Square Tests Conducted for Survey of Frozen Products vs. Label Interpretation

Null Hypothesis	Test Used	P-value	Conclusion
H0: There is no association between consumers' interpretation of frozen food products labels and age Ha: There is an association between consumers' interpretation of frozen food products labels and age	Chi-Square Test	0.23241	The p-value is greater than 0.05, therefore do not reject null hypothesis and conclude that there's no association between consumers' interpretation of frozen food products labels and age

H0: There is no association between consumers' interpretation of frozen food products labels and level of education Ha: There is an association between consumers' interpretation of frozen food products labels and level of education	Chi-Square Test	0.39832	The p-value is greater than 0.05, therefore do not reject null hypothesis and conclude that there's no association between consumers' interpretation of frozen food products labels and level of education
H0: There is no association between consumers' interpretation of frozen food products labels and the average number of times they visit the supermarket in a week Ha: There is an association between consumers' interpretation of frozen food products labels and the average number of times they visit the supermarket in a week	Chi-Square Test	0.99141	The p-value is greater than 0.05, therefore do not reject null hypothesis and conclude that there's no association between consumers' interpretation of frozen food products labels and the average number of times they visit the supermarket in a week
H0: There is no association between consumers' interpretation of frozen food products labels and their gender Ha: There is an association between consumers' interpretation of frozen food products labels and their gender	Chi-Square Test	0.40879	The p-value is greater than 0.05, therefore do not reject null hypothesis and conclude that there's no association between consumers' interpretation of frozen food products labels and their gender

Discussion

Purpose

The purpose of the study “Label Perception of Frozen Ready-to-Eat Products and Frozen Not-Ready-to-Eat Product” was to examine the demographics of Canadian residents and assess their ability to determine the state of frozen food products as precooked or raw. In addition, the residents’ knowledge of general statements that are found on frozen products such as “cooked”, “uncooked”, or “cook thoroughly” are assessed as well.

Demographics

The demographics can be used to target specific age or level of education groups when designing clear and suitable labelling statements. Health campaigns or announcements to promote more awareness for frozen product consumption can also be directed towards this specific demographics. This demographics data can also be utilized towards cooking instructions stated at the back of the box. According to the report by Agriculture and Agri-Food Canada (2012), global consumer trends indicate that consumers in the age of 18 to 34 in countries like the U.S. or U.K., along with consumers in the age group of 35 to 64 are more likely to purchase or favour frozen foods. A news article by Chris Powell (2015), also indicate that Canadian dads are a significant portion of frozen meal consumptions. From the results of the survey, the majority of the

demographic audience is young adult to middle age group, with adequate English proficiency and high level of education, the language used in the instructions can be more technical or specific if necessary. However, it is important to keep in mind that the survey was only available online, so certain age groups such as seniors or children might not be able to access it as readily as others. The platform this was posted on, Reddit, and the sub-Reddit that was posted on, might influence the type of respondents surveyed. The formality of the post, along with the academic nature of the survey, might had driven away participants of lower education.

Product Identification

For the first photo, a Tourtière pie product with no statement was given. Since there was a lack of statement, it was expected that the “not sure” option would be chosen the most, and the results of an even split of the other two options beside “not sure” indicate uncertainty about the product’s status. Since the pie itself is not fully precooked, this can lead to potential consumption of undercooked pie when it is being prepared by consumers.

The second photo was a poutine bite product, with the statement “heat thoroughly” on the package. Most of the respondents perceives “heat thoroughly” as require cooking. However, the product itself is actually precooked. This indicate a

potential misinterpretation when statements that suggests “heating” or cautious statement that say “thoroughly” is involved. Since the product itself is precooked, additional cooking won’t cause a problem in regards to health concerns, but it indicate that consumers’ ability to interpret label statements are lacking.

The third photo is a chicken pot pie, with the statement “cook thoroughly” on the package. Majority of the respondent chose the correct answer of the product being “require additional cooking”, which indicate that the statement “cook thoroughly” was accurately identified by respondent as a product that require additional cooking. This indicate that common label statements such as “cook thoroughly” that appears a lot on packaging is well understood by consumers.

The fourth photo is potato crunch fish fillets, with the statement “uncooked” on the package. A clear statement “uncooked” was identified as raw or partially cooked by less than half the respondents. It was expected that a higher percentage of the respondent would choose “additional cooking” since “uncooked” should be relatively clear to indicate the product is raw. However, potentially due to the small font size and lack of color contrast of the statement on the package, a lower percentage was shown for the option “require additional cooking”. For the fish fillet, the statement was relatively

small in size and placed in the corner area. The statement is significantly smaller in comparison to the text “Breaded Alaska Pollock Fillet” directly below it. This might had cause the respondent to be distracted by the “Breaded Alaska Pollock Fillet” text and missed the “uncooked” label above. For frozen breaded products, they can give off a similar appearance to a ready-to-eat product when it is actually still raw (Newstex, 2015). For public health significance, this can potentially cause consumers to undercook the product, thinking it was precooked.

The last photo is spicy breaded chicken wings, with the statement “fully cooked” on the package. Since the statement is clear and straightforward, it was expected that the majority of the respondents would choose “require no cooking” as their choice. However, only 69% of the respondents chose this option. This might had been due to the statement itself being put together along with the terms “seasoned” and “15% meat protein”, so consumers might had missed it when they were reading the package. Since the product itself is already fully cooked, there’s no significant health concerns in consuming the product even if it’s undercooked.

The respondents were asked to identify label statements such as “cook thoroughly” separately without photos of the product. The trends of the answers follow similarly to

the product photo identification question. However, the option “uncooked” and “fully cooked” was more accurately determined by respondents to be “require additional cooking” and “require no cooking”, respectively, in comparison to the lower percentage indicated in earlier questions with the product photo presented. This might be due to issues with the visual appearance, having a smaller font size or color contrast, rather than the statement itself being misinterpreted. Which is why when a clear statement was presented to be identified, a larger percentage of respondents chose the correct answer.

NCSS 12 (2018) was used to conduct the analysis for the four hypothesis comparing demographic groups to the accuracy of the respondents’ interpretation of the products based on its labelling descriptions. No association was found between any of the demographic groups to the product labelling interpretations. This indicate that neither age, gender, level of education, or average number of supermarket visits per week affected the accuracy of the respondents’ label interpretations of the frozen products.

For the open ended comments, several responses indicate that a clear standardized label would be beneficial to have. Clear, large statements or cooking instructions along with specific temperature were suggested by some. It would appear that

having simple and clear statements such as “fully cooked” or “raw/uncooked” would be the most favourable option for some respondents. A lot of the comments mentioned the back of the box or referring to cooking instructions. This can potentially indicate a heavier reliance on the cooking instructions on back of the box to determine if a product is precooked. A clear standardized label can serve to enhance the ability for consumers to accurately interpret a product as being cooked or raw.

Knowledge Translation

As more outbreaks or recalls occurs due to frozen food products, the clarity of labelling on the package is critical to ensure that the product is prepared adequately by consumers. The front of the package is the first line of defense, and the first thing consumers will look at before purchasing a product. If consumers can accurately determine if the product is precooked or not at this stage, it can influence their decision in purchasing the product and their method of preparation before consumption. This study can be used to identify if the current labelling system is adequate to ensure that consumers fully understand if the product they purchase is precooked or not. It can assist guidelines and legislations in assessing the effectiveness of the current labelling system. It can also provide assistance towards formulating a standardized labelling

statements by identifying which of the current statements are the most confusing for the consumers. The open ended response in the study can also assist in identifying what the public are looking for in clear labelling and what their opinions are for improving the labelling.

Limitations

The study was heavily influenced by time. The number of responses gathered could have been higher if more time was allowed. This would allow a higher proportion of respondent to have different demographic categories to be included in the study, potentially changing the result of the data analysis of the four hypothesis. In addition, since the survey was distributed online, the demographic group could have been affected. This would be limited to populations with English proficiency and ability to access the internet. Since the distributing platform was Reddit, there's potentially bias of respondents for the sub-Reddit that was posted. The sub-Reddit selected would indicate that the respondent are already self-interested in the topic, and can cause a selection bias (Shatz, 2017). For example, in posting at /r/Samplesize, the respondent of that sub-Reddit was biased towards people who actively want to participate in surveys. Finally, wordings and understanding of the question's context was a significant factor in the survey. There was

several comments expressing confusion towards the questions. As well, some of the products are sold in stores and respondents might have previous knowledge regarding the product, which would affect how accurately they can identify the products.

For recommendations, more time can be allotted to complete the study, which would allow a larger sample size. In addition, other types of surveying such as in person interviews can be considered in contrast to online surveys. The questions can be worded simpler and the questions can be reduced to avoid fatigue of the respondents.

Future Research

Future Research can include

- A survey of consumer's reliance on front of package to identify frozen products as being precooked or raw in comparison to back of package
- A survey of the visual presentation of labels on packaging – The effect of size of the font or color of the font in contrast to the background versus the noticeability by consumers.
- An observation trial examining how consumers prepare precooked or raw frozen food products with the cooking instructions given.

- A survey of dry storage products and if consumers know its raw or not- e.g. raw flour

Conclusion

Clear labels on packaging is the first line of defense towards consuming undercooked foods by assisting consumers towards determining if a frozen product is precooked or not. This help prevent the products from being undercooked, thus preventing foodborne illness from the consumption of raw/undercooked food. This study assesses the clarity of labelling statements on the current market along with the accuracy of consumers' interpretation of those labels. The study found that neither age, gender, level of education, or number of weekly supermarket visits have an effect on how consumers' interpretation of labels on frozen food products. Although cooking statements that clearly state "uncooked" or "fully cooked" are generally understood by consumers. Other more ambiguous statements such as "heat thoroughly" or a lack of statement on the package completely, indicate some degree of uncertainty amongst consumers in determining if the product is cooked or raw. It would appear that the public favours clear and straightforward labelling statements, as identified in some open responses from the participants. The study identifies potential problems with the ambiguity of some (or lack of) label

statements and potential issues with how the statement is presented to be visually noticeable to consumers. However, further research is required to better understand this issue and assess consumers' opinion on how to improve those labels.

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Competing Interest

The author declares that they have no competing interest

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