

Misconceptions about Food Date Labels and their Effect on Food Waste in Lebanon

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Introduction

For over a century, food waste has been acknowledged as an economic concern and is earning immense attention on the academic level as well as on the public policy level.¹ Recent research suggests that food date labels may be one of the leading reasons behind food waste.² Consumers' confusion in interpreting the meaning of date labels causes food waste on the domestic level, also the choices of food retailers, who usually remove food products from shelves several days before the expiry date.³ In the literature, only a few published studies used both scientific methods and social science methods to understand the relationship between food waste and food date labels. By looking into previous research on the global trends in the field of food waste due to food date labeling, it was found that 60% were survey-based, 33.6% were experimental studies, and 6.3% were review-based studies.⁴ To the best of our knowledge, no work has been reported to make such an investigation in Lebanon.

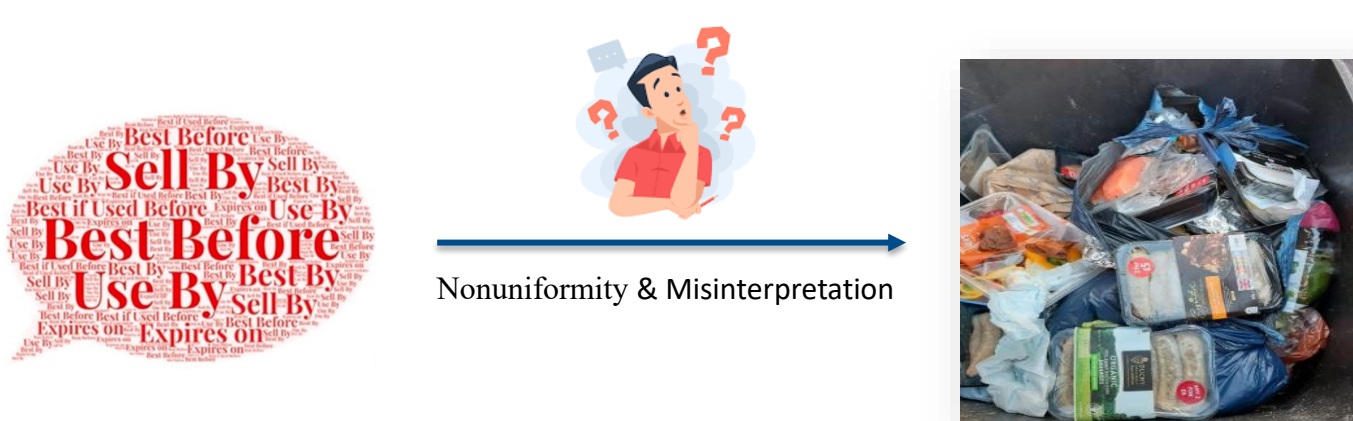


Figure 1: Consumers' confusion and food waste

Aim

The aim of this study was to evaluate the Lebanese consumers' level of understanding of the different date labels and to explore their behavior toward food products that are expired or close to expiry through a questionnaire-based survey. The study also aimed to test the quality and safety of some expired perishable and semi-perishable Lebanese food products by measuring some of their physico-chemical properties as well as their microbiological conformity according to LIBNOR standards.

Methods

Stage one: An online survey (n = 457) was conducted among residents in Lebanon aged 18 years and above that responded to the questionnaire between January and early April 2022. The data was cleaned and analyzed using SPSS 21 (SPSS Inc., Chicago, IL, USA). The statistical analysis included the measure of frequency, percentages of responses, and Chi-Square independence test. The questionnaire consisted of 4 sections (26 questions) as shown in Figure 2.

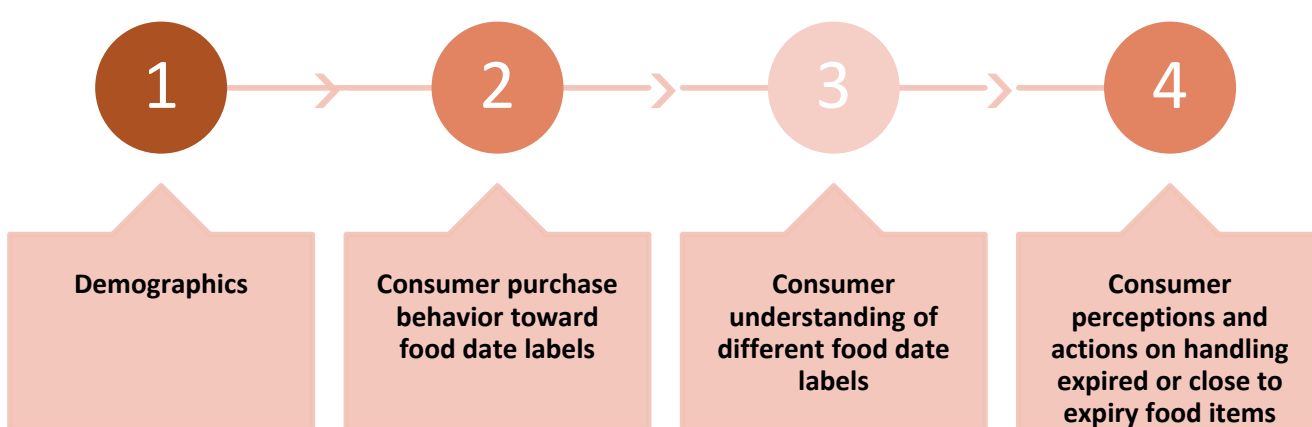


Figure 2: Questionnaire sections

Stage Two: Physico-Chemical (quality) and Microbiological (safety) testing of Lebanese prepackaged food products (n=40) purchased from different local shops and supermarkets (Table 1 & Table 2). Testing started on the labeled expiry date (t₀) and repeated at 15 days time interval until nonconformity was identified.

Table 1: Product Characteristics and Physico-Chemical tests applied

Commodity	Product	Date label	Physico-Chemical Tests
Dairy	Pasteurized Milk (n=10) (Fresh)	Best Before	pH-value Water Activity Total titratable acidity
Beverage	Pasteurized Orange Juice (n=6) (Fresh)	Expires on	pH-value Water Activity
Pre-Packaged Bakery	Brioche (n=10)	Best Before	pH-value Water Activity
RTE	Hummus Dip (n=14)	Expires on	pH-value Water Activity Potassium Sorbate

References

- [1] Bovay, J., & Zhang, W. (2020). A Century of Profligacy? The Measurement and Evolution of Food Waste. *Agricultural and Resource Economics Review*, 49(3), 375–409.
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- [3] Collart, A. J., & Interis, M. G. (2018). Consumer imperfect information in the market for expired and nearly expired foods and implications for reducing food waste. *Sustainability*, 10(11).
- [4] Patra, D., Leishnam, P. T., Tanui, C. K., & Pradhan, A. K. (2020). Evaluation of global research trends in the area of food waste due to date labeling using a scientometrics approach. *Food Control*, 115.

Table 2: Microbiological tests investigated and the relative identification techniques

Product	Microbiological tests	Identification techniques
Hummus Dip (LIBNOR RTE guidelines)	Total Aerobic Count <i>Salmonella</i> spp <i>Listeria monocytogenes</i> <i>Staphylococcus aureus</i> <i>Escherichia coli</i> <i>Clostridium perfringens</i> Enterobacteriaceae	ISO 4833-2:2013 ISO 6579-1:2017 ISO 11290-1:2017-05 ISO 6888-1:2021 ISO 16649-2:2001 ISO 7937-2004 ISO 21528-6:2017:06
Milk (LIBNOR NL 510)	Total Aerobic Count <i>Salmonella</i> spp <i>Listeria monocytogenes</i> <i>Staphylococcus aureus</i> Enterobacteriaceae	ISO 4833-1:2013 ISO 6579-1:2017 ISO 11290-1:2017-05 ISO 6888-1:2021 ISO 21528-6:2017:06
Brioche (LIBNOR NL 240)	Total Aerobic Count <i>Salmonella</i> spp Total Coliforms <i>Staphylococcus aureus</i> Mold and Yeast	ISO 4833-2:2013 ISO 6579-1:2017 ISO 4832:2006 ISO 6888-1:2021 ISO 21527-1:2008
Orange Juice (LIBNOR NL 234)	Total Aerobic Count <i>Salmonella</i> spp Total Coliforms Mold and Yeast	ISO 4833-1:2013 ISO 6579-1:2017 ISO 4832:2006 ISO 21527-1:2008

All the food samples were tested for microbiological conformity according to LIBNOR standards at the Lebanese Agricultural Research Institute (LARI)

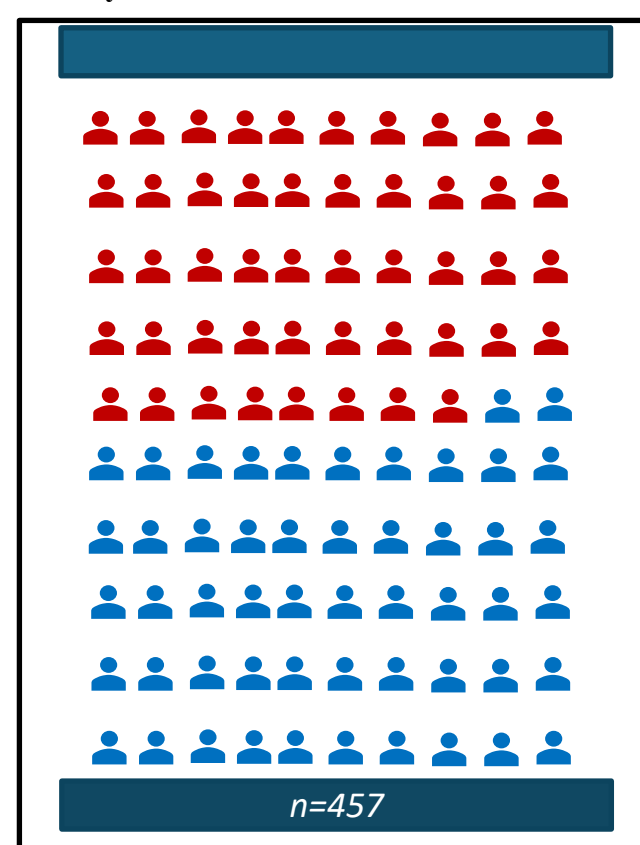
Results

Consumer purchase behavior towards food date labels

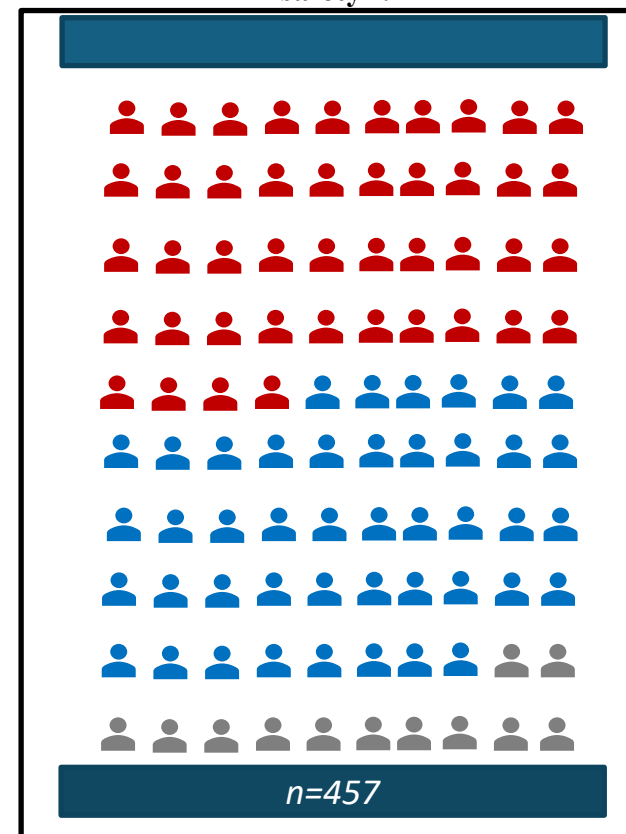
- Almost two-thirds of participants (66%) reported that they always check the date label when they examine a food item label.
- When participants were asked to choose between the different date labels, they are familiar with, the majority of 87% said "Expiry date", 52% "best before" and 50% "Expire on".
- Almost all participants responded that they "Always" check the date label for perishable foods with 44% for raw eggs, 61% for fresh meats, 78% for fresh dairy products, 51% for prepackaged bakery products, 53% for fresh beverages, and 64% RTE food items.

Consumer understanding of different food date labels

The information on the food item labeled as "use by" and "best before" means the same?

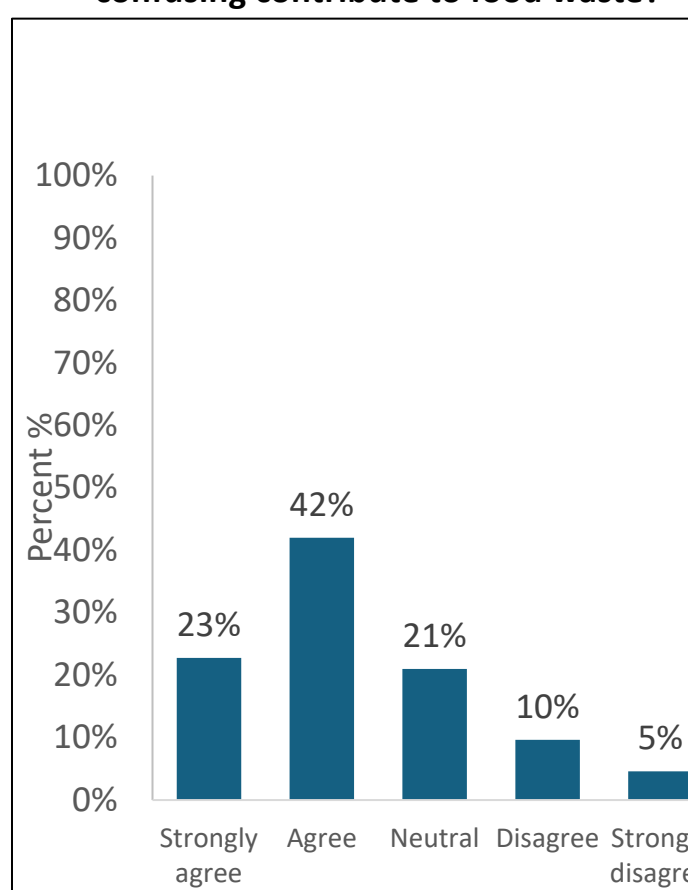


Which term do you think is more related to food "safety"?



Consumer perception and actions on handling expired or close to expiry food items

Do you believe that date labels that are confusing contribute to food waste?



How frequently do you discard the following based only on date label?

Food	%
Raw eggs	59
Fresh meat	65
Fresh dairy	61
Prepackaged bakery	44
Beverages	53
RTE foods	62
Canned food	53

Significance of information among demographics

Which term do you think is more related to the "safety" of food?			
Demographics	Item	Response (%)	P-value
Age group 18-25	Use by	15	0.000*
Education level Postgraduate	Use by	22	0.024*
The idea of having different food date labels is very confusing?			
Demographics	Item	Response (%)	P-value
Age group 26-35	Strongly Agree	11	0.030*
Occupation Employed	Strongly Agree	17	0.036*

* Significant at p<0.05, ** significant at p<0.005, *** significant at p<0.001

Physico-chemical properties and Microbiological analysis

Hummus dip

The hummus dip retained its microbiological conformity for 90 days post its expiry date. This can be due to the use of Potassium Sorbate as a preservative to extend shelf-life. Also, the low value of pH had a crucial impact on controlling microbial growth (Table 3).

Table 3: Physico-chemical and microbiological testing of hummus dip

Time	Conformity	Limits exceeded
t ₀ -t ₆	Conform	-
Time	Water Activity (25°C)	pH* (22°C)
t ₀ -t ₆	0.71-0.78	4.50±0.01-4.73±0.01
Potassium Sorbate Content		
1.3g/Kg		

* Indicates significance at p <0.01

Fresh Milk

Milk retained its microbiological conformity for 45 days post its expiry date. A significant decrease in pH and increase of Lactic Acid was noticed due to break down of Lactose (Table 4).

Table 4: Physico-chemical and microbiological testing of Milk

Time	Conformity	Limits exceeded	
t ₀ -t ₃	Conform	-	
t ₄	Not conform	Total Aerobic Count 1.0 x 10 ⁶ cfu/ml (Limit: 1.0 x 10 ⁵ cfu/ml)	
Time	Water Activity (25°C)	pH* (22°C)	Titrateable Acidity*(%LA)
t ₀ -t ₄	0.81-0.90	6.71±0.01 - 5.84±0.01	0.18±0.05 - 0.44±0.05

* Indicates significance at p <0.01

Brioche

Brioche retained its microbiological conformity for 45 days post its expiry date. An increase in water activity and a significant increase in pH was noticed (Table 5).

Table 5: Physico-chemical and microbiological testing of Brioche

Time	Conformity	Limits exceeded
t ₀ -t ₃	Conform	-
t ₄	Not conform	Total Aerobic Count 1.0 x 10 ⁵ cfu/g (Limit: 1.0 x 10 ³ cfu/g) Mold and Yeast 8.0 x 10 ⁴ cfu/g (Limit: 1.0 x 10 ³ cfu/g)
Time	Water Activity (25°C)	pH* (22°C)
t ₀ -t ₄	0.68 - 0.80	5.41±0.01-5.74±0.01

* Indicates significance at p <0.01

Orange Juice

The orange juice exhibited nonconformity on day of expiry due to exceeding the limits of Total Aerobic Count with 2.0x10⁵ cfu/ml and Mold and Yeast with 1.0x10⁵ cfu/ml.

Conclusion

The participants' confusion about different date labels, along with their agreement that this ambiguity significantly contributes to food waste, highlights the need for clearer, standardized date labeling. Equally important is educating consumers on the meaning of various date labels, enabling them to make informed decisions and reduce unnecessary food waste. Moreover, the microbiological conformity of the tested products (hummus dip, milk, and brioche) past their expiry date urges the support of more exhaustive shelf-life studies on food items produced and marketed in Lebanon to further control food safety, assure quality, and reduce waste.



United Kingdom Association for Food Protection

