Food Quality and Preference 66 (2018) 13–18

Contents lists available at ScienceDirect

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

Short Communication

Discard intentions are lower for milk presented in containers without date labels

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ARTICLE INFO

Keywords:
Milk
Discard intention
Food waste
Date label
Sell-by date
Sensory assessment of quality
Sustainability

ABSTRACT

Eighty-eight regular milk drinkers were presented whole fat pasteurized cow's milk stored at 4 degrees Celsius in plastic containers for 15, 25, 30 and 40 days after commercial bottling. Subjects opened and smelled individual half-gallon containers presented in two flights of four that were identical except one flight featured a sell-by label with a date set to 18 days post-bottling, while the other flight lacked label dates and related language. 48.9% of respondents indicated they would discard milk featuring a date label if it were in their home refrigerator while 38.1% indicated the same for milk lacking date labels, which equates to a 28% increase in discard intention attributable to the presence of a date label. Among containers with milk 25, 30 and 40 days post bottling, 64.0% of respondents intended to discard milk in containers with date labels while 45.8% intended to discard milk in containers without such labels, which is a 40% increase in discard intentions for milk that is putatively 'past date' among commercial bottlers. Multivariate analysis reveals that discard intentions are lower among participants with higher incomes and fewer household members, but revealed no other significant correlations with personal or household characteristics. Given that the date labeling on pasteurized milk is not designed to address safety concerns, and given the high level of consumer milk waste in many developed countries, these results suggest further innovation in milk labeling may support improved sustainability by reducing the discard rate of milk attributable to sell-by date labels.

1. Introduction

In September 2015 the US government announced a goal to cut domestic food loss and waste in half by 2030 (U.S. Department of Agriculture, 2015). This was complemented by the May 2016 issuance of a national strategic food waste reduction plan by the private-public group Rethink Food Waste through Economics and Data (Rethink Food Waste Through Economics and Data, 2016). Rethink Food Waste Through Economics and Data (2016) estimates the impact of 27 categories of food waste interventions. Innovative food packaging and reduction of confusion about food label dates rank high among all categories in terms of potential contributions to sustainability. While provocative, the Rethink Food Waste Through Economics and Data (2016) analysis is silent on what packaging and labeling interventions can deliver societal benefits and which food items should be prioritized in these efforts. Further, the estimates represent a general analysis based upon projected features of and behavioral responses to such interventions rather than on firm evidence from lab or field studies.

Pasteurized cow's milk (hereafter, milk) is the fifth most consumed beverage in the United States (LaComb, Sebastian, Enns, & Goldman, 2011), and the only top five beverage rife with bacterial populations that cause spoilage. Milk represents about 12% of US consumer-level food waste by weight (Buzby & H. Farah-Wells, 2014). The waste of food in homes (versus earlier in the supply chain) may be one of the most detrimental of post-harvest categories of food waste because the energetic inputs that go into getting the product into home refrigerators (e.g. transportation inputs, thermal energy inputs, packaging systems etc.) are lost when the product is not consumed (Williams & Wikström, 2011). Manfredi, Fantin, Vignali, and Gavara (2015) encourage research on innovative technologies to reduce food waste in order to improve food sector sustainability and conclude that "The connection between packaging design and food waste is a decisive aspect in the evaluation of actual environmental sustainability…"

Milk and other waste is due in part to consumer confusion with food

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https://doi.org/10.1016/j.foodqual.2017.12.016
Received 31 August 2017; Received in revised form 22 December 2017; Accepted 22 December 2017
Available online 24 December 2017

label dates (Broad Lieb, Ferro, Nielsen, Nosek, & Qu, 2013), which has stimulated non-governmental organization proposals (Harvard Center for Health Law and Policy Innovation, 2017), industry group initiatives (Grocers Manufacturing Association, 2017), executive branch guidance (USDA, 2016) and legislative proposals (H.R. 5298 and S. 2947, 2016) that push for harmonization and clarification of date labeling on foods. Research suggests that food label dates influence consumer evaluation of food products (Aschemann-Witzel, Jensen, Jensen, & Kulikovskaja, 2017; Newsome et al., 2014; Wansink & Wright, 2006) and that both label dates and label date language (use by, sell by, etc) influence intended food discard behavior (Wilson, Rickard, Saputo, & Ho, 2017). Verbeke and Ward (2006) confirm that date labels are among the most sought information on food labels, while Van Boxstael, Devlieghere, Berkvens, Vermeulen, and Uyttendaele (2014) find that two-thirds of subjects consult label dates to assess the edibility of foods.

Dairy products were among the first foods to feature date labels in the United States with the introduction of 'sell by' in the 1960's in response to consumer demand (Newsome et al., 2014). Further, there is no uniform process for selecting the dates placed on milk packages and many other foods because for most foods date labels reflect deteriorating quality below the limits deemed acceptable by the manufacturer but not a decrement in product wholesomeness or safety. The resulting label date thresholds vary considerably across states, leading many to seek a more systematic method for establishing these dates (Broad Lieb et al., 2013).

Understanding how consumers react to date labels on milk is an important first step to develop a more systematic method for establishing dates and for exploring alternative date labeling formats or alternative labeling technologies that could assist consumers in discard decisions. To explore the claims from the above literature that the current date labeling system contributes to premature consumer discard of milk, we postulate that the presence of date labels leads consumers to discard milk more often than if consumers had no date on the label to guide their decision. That is, we postulate that the rate of discard would be lower if consumers were to rely solely on their own sensory assessments of quality in the absence of current package dates.

2. Methods

Eighty-eight consumers were recruited to one of twelve sessions held on a single weekday at the Ohio State University Sensory Evaluation Center. Recruitment occurred by emailing announcements to the center's existing database of individuals who have participated in past activities or who have indicated interest. Inclusion criteria included: (a) subject personally consumes fluid milk at least twice per week, (b) subject's household purchases milk at least once during a typical week, and (c) subject is age 18 or older. Exclusion criteria include any olfactory deficits, color blindness, subject smokes but refuses to refrain for at least 2 h prior to their scheduled appointment, or subject disregarded directions to not wear perfume/colognes. Subjects were compensated with $20 cash.

After arrival and consent, research staff read aloud initial instructions to subjects and then randomly seated subjects in one of eight sensory booths equipped with a computer. Subjects followed instructions on the computer and completed three sets of activities: sensory assessments, hypothetical choice experiments, and a survey. Below we describe the first half of the sensory assessment activities, which is the focus of this article.

Subjects were presented two flights of milk with the order of flight presentation counterbalanced across subjects. Each flight contained four commercially bottled half gallon plastic containers of whole fat pasteurized cow's milk. One flight's containers were imprinted with the standard date label used by the bottler that contains the words 'sell by' followed by a three letter abbreviation of the month and a two-digit number for the day (see Fig. 1). The other flight's containers were identical but omitted 'sell by' and the date information.

Fig. 1. Example of container with date label.

Each flight contained one container of milk bottled 15 days, 25 days, 30 days and 40 days prior to the study date. The sell-by date for the commercial bottler providing the containers was 18 days after the day of bottling, meaning that the containers with a date label would appear as 3 days prior, 7 days post, 12 days post and 22 days post the sell-by date, respectively. Before sensory assessments began, subjects were reminded of the day's date and each evaluation booth had the current date posted in a visible location. All containers held milk obtained from the same commercial bottling process and bottling facility and all were transported and continually stored together at 4 degrees C in commercial refrigerators where temperature was continuously recorded to ensure temperature maintenance. Two days prior to the study, seals were broken and 600 ml of milk (about a third) was removed from each container to approximate a partially used milk container. All containers were exposed to room temperature during subject evaluation, which lasted approximate three minutes, before being returned to refrigeration between evaluation sessions. Each of the eight samples across the two flights was assigned a unique, randomly-generated three-digit number that was affixed to the top and side of the container. These numbers were used by subjects to identify samples during the experiment.

Subjects followed instructions provided on the computer screen in their booth. Subjects were presented with the first flight of containers and then told to select a particular sample number from the tray, where the order of sampling among the four containers within each flight was counterbalanced across subjects within each session for both flights via the individualized computer instructions provided in booth. Subjects were told to sniff the inside of their own forearm, open the container, and then sniff but not taste the milk in the bottle. They were then asked to indicate via the computer interface "…whether you would keep the milk or discard the milk (e.g. pour it down the drain or however you discard unwanted milk in your home) if it were in your home refrigerator…" The response options were keep, discard or unsure. Those indicating 'keep' or 'unsure' were then asked to enter the number of days they think they would keep the milk prior to eventual discard if the milk were in their home refrigerator.

These instructions were repeated until all four containers in the flight were evaluated. Subjects returned the flight through a small door in the sensory booth and then were given the second flight. The same instructions were repeated for the second flight. Per instructions, no subject in any session consumed any milk. Instructions emphasized not drinking the milk so that the milk could be used for later sessions. The subjects then evaluated two additional flights of milk not detailed here, completed a set of hypothetical choice experiments not analyzed here, and completed a computerized survey focused on personal and household characteristics, including typical milk consumption and

Table 1
Summary Statistics by Participant (N = 88).

Characteristic		% or Mean ± S.D.
Female (%)		55.7
Age		39.2 ± 13.4
Race (%)	White	78
	African American	10
	Asian	9
	Other	3
Income (%)	< $20,000	9
	$20,000 - $39,999	11
	$40,000–$59,999	20
	$60,000–$79,999	21
	$80,000–$99,999	15
	$100,000 +	24
	Mean: Bracket Midpoints[a]	$74,318
Education (%)	High School Degree or less	8
	Associate's Degree or Some College	20
	College Degree	44
	Beyond College Degree	28
Household Size	# of members	2.6 ± 1.2
Residence (%)	Urban	43
	Suburban	44
	Rural	13
Milk Purchased at Home (%)	Skim	13
	1% milkfat	17
	2% milkfat	50
	Whole milk	18
	Other	2
Weekly Milk Usage (%)	< ½ gallon	26
	½ gallon	31
	1 gallon	19
	1.5 gallons	11
	2 gallons	9
	> 2 gallons	4
Any Milk Discarded at Home in Last 7 days? (%)	No	60
	Unsure	5
	Yes	35

Notes: a – income brackets are consolidated for summary purposes and included: < $10,000, $10,000–$19,999; $20,000–$29,999; $30,000–$39,999; $40,000–$49,999; $50,000–$59,999; $60,000–$69,999; $70,000–$79,999; $80,000–$89,999; $90,000–$99,999; $100,000–$149,999; and $150,000 and greater. Midpoint for $150,000 and greater bracket was set at $175,000.

purchasing behaviors. Key characteristics captured during the survey are summarized in Table 1.

Data analysis was conducted in Stata (version 14.2). The dependent variable equals one if the subject said the milk in the container would be discarded and equals zero if the subject responded 'keep' or 'unsure.' Results are very similar if samples marked 'unsure' are reclassified as 'discard' and set equal to 1. Pairwise group differences were tested with a *t*-test constructed with robust standard errors clustered at the subject level. Multivariate analysis explaining the discard decision is performed via a logistic regression analysis, which is estimated via maximum likelihood and features robust standard errors clustered at the subject level. Logistic regression results are presented as odds ratios (OR). Explanatory variables include characteristics of the milk evaluated (days since bottling, presence of date label, order of flight presentation, session fixed effects) and subject characteristics (age, education, race, household size, income, typical milk purchasing behavior, reported disposal of milk in own household during past seven days). Statistical significance is set at the 5% level.

3. Results

The raw intended discard percentages by label type for samples that were presented 15, 25, 30 and 40 days since bottling are displayed in Fig. 2 along with standard error bars. The black bars are those for samples featuring the standard sell-by label; intended discard trends upward with additional days since bottling. The intended discard for the samples in containers without date labels is represented by the gray bars; there is no discernable trend across the increasing days since bottling. Among in-date milk (15 days), intended discard is significantly lower for the samples in containers with date labels. Among post-date milk (25, 30 and 40 days) intended discard is higher among samples in containers with date labels (in two of the three cases, the difference is statistically significant).

Across all samples of milk, subjects were 28% more likely to say they would discard milk with a date label than without a date label (48.9% vs. 38.1%, Table 2), which is a statistically significant difference. Among past-date samples this increases to 40% more likely (64.0% vs. 45.8%, Table 2). The 15 day samples were in containers with a sell-by date three days later than the date of the study. For these samples subjects were 37% less likely to discard milk with the date label than samples in the undated containers (33.0% vs. 52.3%, Table 2).

Four multivariate analyses are presented in Table 3: the full sample (column 1), all post-date samples (column 2), all in-date samples (column 3), and all samples without dates (column 4). The presence of a date label has a positive and statistically significant effect on intended discard in both the full data set (column 1, OR = 1.672) and for the data from post-date samples (25, 30 and 40 days, column 2, OR = 2.906). However, among the samples that are in-date (15 day samples, column 3) the presence of a date label has a statistically significant negative effect (OR = 0.374) once all other experimental and individual factors are controlled. Also, among the in-date samples, there is a significant effect of the order of the flight presentation, where samples were less likely to be intended for discard (OR = 0.356) if the first flight randomly assigned to the subject contained date labels. No significant order effect is present in any other model.

Significant income effects are present in all models; respondents reporting higher household income report fewer intentions to discard milk. For example, in the full data set we find intended discard is significantly lower among individuals reporting household income of $50,000–$99,999 (OR = 0.521) and > $100,000 (OR = 0.376) than the base category of < $50,000. Respondents in households reporting more than two household members are significantly more likely to discard milk than respondents from smaller households in the full sample and in two of the three subsamples.

4. Discussion

In the absence of a date label, subjects rely on smelling and visually inspecting the container contents to determine whether they would discard the milk sample if it were in their own household. Fig. 2 (gray bars) suggest that in the absence of a date on the label, intended discard has little relationship to the number of days since the milk was bottled. For example, column 4 of Table 3 presents regression results for the subset of samples that omit date information, and these results reveal no statistically significant differences in intended discard between the omitted category (milk 15 days post-bottling) and milk 30 days post bottling, while milk in containers without dates that were bottled 25 and 40 days prior to the experiment had significantly lower discard intentions than milk without dates that was 15 days post bottling.

As no objective measure of milk quality is available for this data, and as no universal indicator of consumer acceptability based on objective milk quality attributes currently exists, we interpret the respondents' discard intentions for the milk samples without dates on their labels as the best indicator of milk quality for the purposes of assessing the effects of removing dates on sustainability via pre-mature product discard. One plausible explanation for this pattern of intended discard across the four bottling dates is that there was simply natural variation in the milk produced and bottled on the different days used in

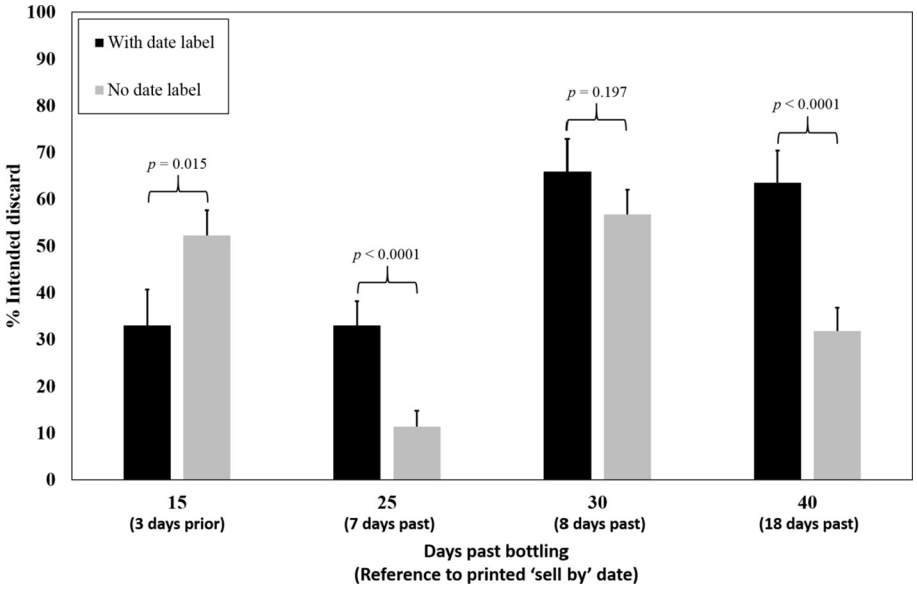

Fig. 2. Intended discard by bottling date and label treatment with pair-wise *t*-test results.

Table 2
Pairwise Tests – Intended Discard by Label and Milk Storage Days.

	N	% Intended Discard	*p*	Ratio: With/No Date Label
All Samples				
No Date Label	352	38.1	0.001	1.28
With Date Label	352	48.9		
Past-Date Samples				
No Date Label	264	45.8	0.000	1.40
With Date Label	264	64.0		
In-date Samples				
No Date Label	88	52.3	0.015	0.63
With Date Label	88	33.0		

p-values correspond to *t*-tests between category means based on standard errors clustered at the participant level. Past-date samples are those evaluated at 25, 30 and 40 post bottling while in-date samples are those evaluated at 15 days post bottling.

this experiment. These differences could have resulted in the milk bottled 25 days prior to the experiment being significantly higher in perceived quality than the 40 day milk (OR = 0.089 vs. OR = 0.374, $p = .000$), which is significantly higher than the 15 day milk (OR = 0.374 vs. OR = 1.000, $p = .006$), which is not statistically different from the 30 day milk (OR = 1.000 vs. OR = 1.236, $p = .565$). Our participants were not expert panelists, and they may have struggled to identify and accurately assess the sensory characteristics contributing to milk quality. For example, perhaps the 15-day milk was produced on a day shortly after a new feed source became widely available to the herds servicing this bottler, which could have caused a change in the sensory profile of the milk but no change in spoilage or other quality traits. Participants may have detected the sensory change and, when prompted about discard intentions, may have answered to discard the milk with the different sensory profile. However, when asked the same question in the presence of an in-date label, participants' familiarity with the date labeling system may have helped them overrule concerns that a distinct sensory profile held implications for shelf life. In such a case, date labels may help prevent the early discard of a satisfactory product with distinct sensory profiles.

Hence, for these samples of milk and these participants, labels featuring a date stimulate consumers to increase their intended discard of milk among post-date samples (Table 3, column 2) and stimulate consumers to decrease their intended discard of milk among in-date samples (Table 3, column 3). Therefore, regardless of whether samples are in-date or post-date, the provision of a date on the label changes intended discard behavior compared to a consumer forced to rely only upon sensory evaluation of the product.

For samples in containers with a date label, the intended discard rate did increase with the days since bottling, though this occurred largely through a discrete increase between the samples bottled 25 and 30 days prior to the study. The increase in intended discard did not correspond to the onset of the sell-by date, which was set at 18 days post bottling and would be expected to induce a discrete jump in intended discard between the 15 day and 25 day post-bottling samples. Previous research with yogurt revealed a significant decline in perceived acceptability, healthfulness and freshness between samples dated a day before and a day after the study date, but no change in risk and safety ratings over this same date span (Wansink & Wright, 2006). However, Wansink and Wright (2006) did not specifically assess intended discard.

Our analysis revealed a significant effect of the order of flight presentation among in-date samples. When the first flight of milk containers featured a sell-by date, subjects intended to discard the in-date samples significantly less often than subjects whose first flight omitted the sell-by date. This may suggest that subjects facing this ordering of sample flights had a stronger idea that milk samples were in a generally acceptable range of days post bottling. In contrast, those evaluating the first flight of samples in the absence of any dates may have had greater ambiguity concerning the days since bottling and were perhaps more cautious in terms of indicating likely discard.

Respondents reporting higher household income consistently had lower discard intentions. The economics literature has a long tradition of hypothesizing that risk taking increases with income and wealth with the theory being that additional resources build a buffer that allows better-off individuals to survive any unfavorable outcomes associated with risky behaviors (Stiglitz, 1969). With regard to risk taking with one's health, in Dohmen et al.'s (2011) analysis of data from > 19,000 Germans, they document that individuals with higher household incomes state willingness to take greater risks with their personal health (Table A.1, column 6 in Dohmen et al., 2011), even after controlling for a broad array of personal and other household characteristics. While we did not ask respondents if they viewed consuming past-date milk as a health risk, the pattern of higher income respondents being less willing to discard such milk is consistent with this theory and past literature.

We also found that discard intentions are significantly higher among respondents from larger households. While we did not ask the age of these additional household members, this pattern would be consistent with respondents in households with children imposing tighter quality

Table 3
Odds ratios from logistic regression models of intended discard.

Covariate	(1) Full Sample	(2) Post-date Samples	(3) In-date Samples	(4) Samples with No Date Label
Date Label on Container (vs. no date label)	**1.672** **(0.001)**	**2.906** **(0.000)**	**0.374** **(0.016)**	–
Days post bottling (15 days omitted)				
25 days	**0.355** **(0.000)**	–	–	**0.089** **(0.000)**
30 days	**2.291** **(0.000)**	**7.291** **(0.000)**	–	1.236 (0.565)
40 days	1.254 (0.277)	**3.821** **(0.000)**	–	**0.374** **(0.006)**
1st Flight had Date Labels (vs. 1st Flight omitted Date)	0.766 (0.165)	0.951 (0.835)	**0.356** **(0.005)**	0.899 (0.712)
Income Range (< $50,000 omitted)				
$50,000 - $99,999	**0.521** **(0.004)**	**0.526** **(0.034)**	0.372 (0.164)	**0.425** **(0.015)**
$100,000 +	**0.376** **(0.000)**	**0.441** **(0.017)**	**0.136** **(0.000)**	0.511 (0.070)
Female (Male omitted)	0.977 (0.919)	1.043 (0.888)	0.759 (0.453)	0.845 (0.580)
White (vs. all other)	1.005 (0.984)	1.021 (0.942)	0.898 (0.773)	0.801 (0.519)
Age (< 30 omitted)				
30 – 50 years	1.084 (0.722)	1.015 (0.957)	1.462 (0.369)	1.032 (0.924)
> 50 years	0.682 (0.208)	0.562 (0.121)	1.113 (0.864)	0.633 (0.275)
> 2 Household Members	**1.630** **(0.019)**	**1.745** **(0.039)**	1.759 (0.121)	**2.445** **(0.001)**
Education (≤ High School omitted)				
Associate's Degree	1.178 (0.746)	1.640 (0.465)	0.390 (0.379)	3.047 (0.137)
Some College but no Degree	1.633 (0.233)	1.344 (0.549)	**3.632** **(0.037)**	1.746 (0.333)
Bachelor's Degree	1.348 (0.361)	1.249 (0.572)	1.972 (0.247)	1.822 (0.230)
Master's Degree	1.884 (0.128)	2.020 (0.165)	1.842 (0.352)	2.841 (0.075)
Doctoral/ Professional Degree	1.151 (0.754)	1.177 (0.758)	1.192 (0.853)	0.900 (0.874)
Weekly Milk Usage (< ½ gal omitted)				
½ gallon	1.002 (0.995)	0.979 (0.946)	1.097 (0.862)	1.080 (0.838)
1 gallon	1.156 (0.626)	1.196 (0.632)	1.082 (0.881)	1.339 (0.403)
1.5 gallons	0.990 (0.997)	0.811 (0.700)	1.693 (0.474)	0.599 (0.242)
2 gallons	0.727 (0.427)	1.047 (0.929)	**0.156** **(0.000)**	1.075 (0.903)
> 2 gallons	0.399 (0.167)	0.437 (0.294)	**0.188** **(0.031)**	0.547 (0.418)
Preferred Milk Type (Skim omitted)				
1%	0.698 (0.316)	0.631 (0.321)	0.715 (0.571)	0.655 (0.293)
2%	0.897 (0.745)	0.903 (0.814)	0.799 (0.731)	0.875 (0.714)
Whole	0.636 (0.282)	0.600 (0.324)	0.660 (0.536)	0.480 (0.133)
Other	**0.316** **(0.049)**	0.258 (0.201)	0.292 (0.438)	0.991 (0.991)
Any Milk Discarded at Home in Last 7 days? ('No' is omitted)				
Unsure	**0.385** **(0.030)**	**0.247** **(0.012)**	0.897 (0.873)	**0.311** **(0.027)**
Yes	1.032 (0.880)	1.178 (0.521)	0.675 (0.319)	1.704 (0.903)
Session Fixed Effects	Not Reported	Not Reported	Not Reported	Not Reported
N	704	528	176	352
Pseudo-R^2	0.119	0.181	0.176	0.202

Dependent variable equals 1 if subject indicated sample would be discarded if owned by subject and equal 0 otherwise. *p* – values from a *t*-test based upon a null hypothesis of no effect of the explanatory variable (H_0: OR = 1) and robust standard errors clustered at the subject level. Bolded entries are significant at the 5% level or less. Session fixed effects were included in the regression but are not individually reported.

control by intending to discard milk deemed of marginal quality either due to pure sensory assessment (column 4 of Table 3) or due to a combination of sensory and label date information (columns 1 and 2 of Table 3).

To our knowledge, this is the first experiment designed to assess how the removal of date labels from food containers affect the intended discard behaviors of consumers. Hence, the results should be interpreted with caution until replication and additional experimentation can confirm the results. In particular, this experiment featured a modest sample size of only adults drawn from a single metropolitan area; only a single label date term ('sell-by' rather than other terms such as 'best by'); samples with no temperature or other handling abuse; samples from a limited range of post-bottling dates (15–40 days); and a single type of milk (whole versus 2% or skim). Each generalization could feasibly alter how the removal of date labels affects intended discard behavior. Further, no attempt was made to assess the impact of date label removal on purchase intent. Finally, given the significant order effect estimated for the 15-day milk subsample, additional experimentation to understand the effect of the order of sample presentation on consumer intended discard behavior is warranted.

5. Conclusions

Milk is among the most wasted foods at the consumer level in the United States, and previous research has pointed to date labels as a partial cause of discarded milk. To isolate the potential role of date labels in consumer discard behavior for pasteurized cow's milk, we had regular milk drinkers evaluate by smell and sight two flights of milk samples bottled 15–40 days prior to the study: one flight in containers with a standard sell-by date set at 18 days post bottling and the other flight in containers without a date label. We find the presence of a date label alters the intended discard rate of milk compared to a situation in which consumers must rely only upon their sensory assessment of the container and its contents.

The presence of a date label is associated with a significantly higher intended discard rate among samples that would be considered post-date in most date labeling systems. However, for samples that would be considered in-date, the intended discard rate is higher for samples in containers lacking date labels. Hence, the date labeling of milk may induce discards of putatively past-date milk that would be considered acceptable for continued consumption if consumers only relied upon their own sensory assessment. However, simply removing label dates may not achieve large reductions in milk discards, as the absence of a date label appears to induce significantly more discards of putatively in-date milk. Needless to say, in order for any benefits to arise from the removal of date labels in reducing discards of out-of-date milk, the milk must first survive (i.e., not be discarded) when in-date. Furthermore, the use of date labels first started because of consumer demand for date labeling on milk and other products (Newsome et al., 2014), and it is

likely that consumers today still prefer some guidance from package labels when assessing whether or not to discard milk.

These results suggest to us that less milk could be discarded through innovation in milk date labeling systems, and/or with enhanced consumer education about existing milk date labels. Our finding that the presence of date labels leads to different intended discard behaviors suggests that innovative date labeling or enhanced education about existing date labels could provide consumers guidance concerning discard decisions which could empower consumers to better rely upon their senses when evaluating products like milk, which poses minimal health or safety risks from post-date consumption. We also suggest that further research is needed to create an index of consumer acceptability based upon objective measurements of milk. Such an index could further enhance quality control and package labeling efforts along the milk supply and consumption chain that could support both the consumer experience and sustainability.

Acknowledgements

The authors acknowledge the support of Melody Leidheiser of the Ohio State University Sensory Evaluation Center, research assistance of Jessica Miao, Subbiah Nagappan, Sravanti Paluri, and Rosemarie Sabath, and Tamarack Dairy for supplying the milk directly off the production floor.

Funding

This work was supported by the Van Buren program, the Earl B. Poling Fund, the Dale A. Seiberling Food Engineering Lab, and a seed grant entitled “A demonstration of advanced shelf life monitoring to reduce in home food waste,” provided by the Sustainable and Resilient Economy Discovery Theme Program at Ohio State University, and the Ohio Agricultural Research and Development Center.

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