



THE SYSTEM OF DATE LABELLING IN THE FOOD SUPPLY CHAIN – THE WEAK LINKS FROM THE PERSPECTIVE OF FINAL CONSUMERS

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ABSTRACT. Background: Open date labelling influences the role that final consumers play as actors in the food supply chain in waste prevention and reduction. The aim of this study was to examine the date labelling system from the perspectives of consumers' experience taking into consideration both technical aspects of date labels readability as well as their understanding of the concept of the shelf-life dates.

Methods: The face to face interview method (n=1145) was applied with the use of the interview questionnaire. Research was conducted in Poland.

Results: Despite declared interest in date labelling, consumers of food products experience difficulties with the system in force. Identified problems cover the physical layer of food packaging such as the font size, the presence of information, its readability and accessibility, and the occurrence of two date types on the basis of food quality and safety concept. Problems with correct interpretation of 'use by' and 'best before' dates were more often observed in the group of youths and with vocational education. The difficulties with too small font of the date information were more often claimed by the elderly food buyers.

Conclusions: Actions for improvement should be undertaken by FBO's, legislators and educators in order to achieve economic, environmental and social benefits from clear and consumer-friendly date labelling system. The actions should be matched to a given population group because different sub-groups face separate problems with the dates on food packaging.

Key words: date labelling, use by date, minimum durability date, shelf-life, food packaging, food waste.

INTRODUCTION

A global challenge to reduce food waste has a great potential to improve sustainability of the food supply chains [Bhat and Jōudu 2019, Kowalska 2017]. Food waste contributes to the environmental impact of the food sector. According to FAO data, one-third of all food produced for human consumption is lost or wasted globally, which is equal to ca. 1300 million tons per year [FAO 2019]. Every year almost 90 million tons of food are wasted in the EU countries, which is about 20% of EU food production [Fusions 2016]. Global food waste generates significant negative

environmental effects in addition to the unnecessary usage of resources consumed in the manufacture of the wasted food [Krishnan et al. 2020]. The recognition of food waste as a pressing sustainability challenge represents a growing concern in the political agenda of national and international organizations [Lemaire and Limbourg 2019, Papargyropoulou et al. 2014]. The Sustainable Development Goals (SDGs) for sustainable consumption and production aim at halving global food waste at retail and consumer levels as well as reducing food losses along production and supply chains [United Nations 2015]. It is important how the parties in the supply chain (producers, retailers and

consumers) deal with this information. Several types of initiatives that differ in terms of their aims and characteristics were discussed in literature, including information and capacity building, which focuses most strongly on motivating consumer's food waste avoidance behaviour and strengthening consumer's abilities [Aschemann-Witzel et al. 2017]. Food loss and waste management in all segments of the supply chain requires proper handling of a food product. Often important reason for food disposal is not consuming the product before its expiration. Not understanding the concept of food labelling is related to throwing out unused food. A risk-based approach was developed in the EU according to which perishable food is labelled with the 'use by' date, in contrast to microbiologically stable food products, which are marked with the minimum durability date ('best before'). Recent works show that some people tend to treat minimum durability dates as if they were the 'use by' dates. Confusion over the interpretation of date labels at the consumption stage results in consumer discarding safe and edible food contributing to the global food waste [Patra et al. 2020, Soethoudt et al. 2013]. Considering this, and with half of the global mass of wasted food which is discarded in households, understanding the meaning of shelf-life dates and proper handling of 'best before'-labelled food is crucial in preventing wastage of food [Dobernig and Schanes 2019, Fusions 2016].

Packaging is argued in literature to have a great potential as far as its contribution to sustainable development is concerned. It can contribute to efficient resource utilization in the supply chain, as well as to avoiding product waste by providing sufficient protection and preservation of its content [Lindh et al. 2016]. One of the most important functions of packaging is the communication with consumers and other actors in the supply chain from the manufacturer to the end of life cycle [Grönman et al. 2013]. Food packaging is a carrier of information about a product which includes inter alia open date labelling. Driven by a readable code for retail employees and by consumers open date labeling has been a major benefit at retail in achieving effective stock rotation. It is intended to be understandable in the supply chain both by

consumers and individuals who are responsible for the product and for ensuring high product quality and food safety to consumers [Newsome 2014].

Final consumers are the last actors in the food supply chain. Their role is crucial, as their individual preferences and lack of awareness can exacerbate food loss and waste [Toussaint et al. 2021, Bhattacharya and Fayezi 2021]. The role of final consumers as the actors in the food supply chain in food waste prevention and reduction covers several routines and practices such as planning and shopping, maintenance of proper conditions and time of storage, rational consumption and food sharing [Ocicka and Raźniewska 2018]. In the EU the discussion began on the need and justification of 'best before' labelling on some food products [Council of the European Union 2014]. The topic is ambiguous as some studies showed consumer's uncertainty about product freshness or even a higher likelihood of throwing away the product with no 'best before' date [Secondi 2019; Samotyja 2015]. Moreover, dates first appeared on food packages as populations became further removed from food production and their ability to determine product freshness decreased [Newsome 2014]. Therefore it seems that the dates are not necessarily redundant but there are some barriers that stop efficient flow of information in the supply chain to the final consumer. Therefore, the aim of this study was to examine the date labelling system from the perspectives of consumers' experience taking into consideration both technical aspects of food labels readability as well as their understanding of the shelf-life dates concept. This paper is structured as follows. The next section details the methodology providing an explanation of the research approach, subsequent section presents the findings and discussion. Finally, the paper finishes with conclusions with closing remarks.

MATERIAL AND METHODS

The research was conducted in Poland in 2019. The research sample (n=1145) was selected using the quota method (selection criteria: age, sex and place of residence) and met the demand for maintaining the relative

representativeness of the research population. The structure of the research sample was presented in Table 1. Respondents declared the systematic purchase of food products. The face to face interview method was applied with the use of the interview questionnaire. It contained 20 questions regarding perception and understanding the date labelling system, perception of health risk related to consumption of food past ‘use by’ or ‘best before’ dates and household food-waste behaviour. In the present work the selected issues were presented regarding consumer interest in date labelling and also consumers’ experiences and problems they face with the shelf-life labelling. Consumers’ understanding and interpretation of date labelling system were also examined.

Table 1. The structure of the research sample

Variable	Characteristics	Percentage (%)
Gender	female	45.3
	male	54.7
Age	under 20	2.2
	20 - 29	17.3
	30 - 39	20.0
	40 - 49	13.4
	50 - 59	14.7
	60+	32.4
Education	vocational	18.2
	secondary	31.1
	bachelor degree	21.7
	master degree	29.0

Source: own work

RESULTS

In Table 2 the data about respondents’ propensity and circumstances for checking shelf-life dates on food packaging was presented. Nearly 94% of respondents in this study declared checking the shelf-life information. Most often they look for the dates at the point of purchase than before consumption, during a pantry and fridge overview and finally during unpacking of food after purchase. In comparison to women, men less often pay attention to the discussed issue during shopping. One male in ten does not check the dates at all. The behaviour of young people below 20 stands out from the population – one quarter of them do not check the dates printed on the food packaging. The highest interest in reading the date labels was showed among respondents with higher education whereas in the group of people with vocational education it was less often observed. This group also represents the highest percentage of these who do not check the date labels at all. An European survey highlighted that over 80% of European Union citizens checked the ‘use by’ and ‘best before’ dates on food packaging when shopping and preparing meals. Women more often than men admitted that they check the dates. This practice was more popular with 55+ population than with young people [European Commission 2015].

Table 2. Circumstances for checking shelf-life dates on food packaging

		At the point of purchase	During unpacking at home	Before consumption	During fridge and pantry overview	I do not check the dates
Total		55.1	5.5	25.8	7.6	5.9
Gender	female	58.3	4.7	26.5	7.9	2.6
	male	51.0	6.7	25.1	7.5	9.8
Age	under 20	40.0	4.0	28.0	4.0	24.0
	20 - 29	52.0	4.6	28.1	10.7	4.6
	30 - 39	56.1	7.0	27.6	2.2	7.0
	40 - 49	53.9	4.6	27.0	8.6	5.9
	50 - 59	59.3	6.0	22.2	7.8	4.8
	60+	55.6	5.5	24.4	9.3	5.2
Education	vocational	47.2	5.5	23.6	14.6	9.0
	secondary	55.8	6.4	24.9	5.2	7.8
	bachelor degree	56.5	4.2	31.0	6.7	1.7
	master degree	58.9	5.9	23.4	6.9	5.0

Source: own work

In the opinion of more than 67% respondents the system of date labelling of food is easy (Figure 1). Nearly 20% of people

buying food had no opinion, and nearly 14% admitted that this system is difficult for them.

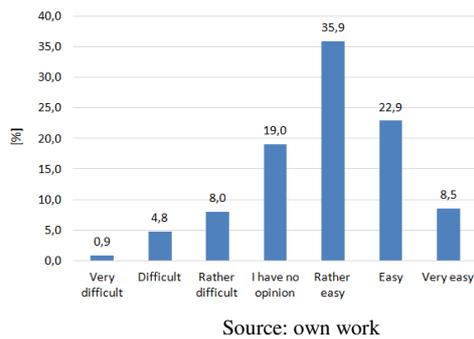


Fig. 1. Evaluation of food date labelling system by consumers

Further investigation showed that despite declarations and common interest in the date labels, food consumers face difficulties with finding, reading and understanding the shelf-life information (Table 3). Four in ten respondents stated that they had problems with finding this information on the packaging. Nearly 20% noticed that the information was unreadable (it was hidden or blurred). In the opinion of 13% of respondents the font was too small to read the date. Surprisingly, negligible percentage of respondents (2.4%) said that

they were not able to understand the information. Only 20% of respondents have never had problems with reading the information about the ‘use by’ or ‘best before’ date. The percentages were higher in the group of the male than in the group of female respondents. Taking the age of respondents into consideration, there are differences between the analyzed sub-groups. People over 50 less often than others said that they had never experienced problems with reading the date labels. At the same time they more often, in comparison to younger respondents, pointed out that the size of the font was the reason for problems. Nearly half of respondents below 30, more than in other groups, had problems with finding the date on the food packaging. About 5% of respondents admitted that the date information was removed after the package had been opened. In a study of Świda et al. [2018] it was shown that the older the consumers were, the more problems with finding the expiration date they had. Eye tracking revealed that the time required to find the date strongly depended on where exactly this information was printed on the packaging.

Table 3. Problems that consumers experience with reading shelf-life date on the food packaging

		Finding the date was difficult	Font was too small	Information was unreadable (it was hidden or blurred)	I was not able to understand the information	The date was removed after the package had been opened	I have never had any problems
Total		40.0	13.1	19.2	2.4	5.2	20.1
Gender	female	40.9	13.3	21.3	2.3	5.8	16.4
	male	38.9	12.5	17.0	2.5	4.3	24.8
Age	under 20	44.0	8.0	8.0	0.0	4.0	36.0
	20 - 29	44.7	3.6	17.8	3.0	7.1	23.9
	30 - 39	39.8	11.5	17.7	1.8	7.1	22.1
	40 - 49	38.6	8.5	19.6	2.0	7.2	24.2
	50 - 59	38.7	16.7	22.0	2.4	1.2	19.0
	60+	38.5	20.2	20.2	2.5	4.1	14.5
Education	vocational	37.4	21.7	20.7	3.9	3.4	12.8
	secondary	41.7	14.9	19.2	1.5	5.8	16.9
	bachelor degree	41.9	7.1	17.4	3.3	7.1	23.2
	master degree	38.6	11.5	19.3	1.9	3.7	24.9

Source: own work

In accordance with Regulation, mandatory food information shall be marked in a visible place in such a way as to be easily visible, clearly legible and, where appropriate, indelible. It shall not in any way be hidden, obscured, detracted or interrupted by any other written or pictorial matter or any material [Regulation (EU) No. 1169/2011]. The study

highlighted four reasons for problems which food consumers face: (1) the location of the print, (2) no legibility of the print, (3) font size, (4) the possibility of removing overprinted date. All of them are on the side of entities which place food on the market. These issues should be handled with a special care as they may constitute a weak link in the food date

labelling system. The fifth identified reason for problems occurring during reading the dates is related to consumer knowledge and awareness. We asked our respondents about the meaning of the ‘best before’ date using the date formats presented in Table 4. The correct interpretation of the ‘best before’ date is that this food can be consumed past this date although its quality may not be optimal. Over 60% of respondents were able to give the correct answer. About 20% of them thought that one should not consume such food, 5% of respondents were not able to interpret the meaning of the ‘best

before’ date. The incorrect answers that food should not be consumed after passing the ‘best before’ date occurred more often in the group of elder respondents than younger ones. Despite the fact that people below 20 rarely gave incorrect interpretation of minimum durability date relatively high percentage of them, in comparison with other groups, was not able to answer the question at all. Respondents with vocational education had the highest problems with interpretation of the ‘best before date’.

Table 4. Interpretation of the ‘best before’ date

Best before 05.06.2020		After this date			
		Food can be consumed, its quality is good	Food can be consumed, its quality may not be good	Food should not be consumed	I do not know
Total		13.9	61.1	19.9	5.1
Gender	female	11.2	62.9	20.5	4.5
	male	15.6	58.8	19.8	5.8
Age	under 20	4.0	76.0	4.0	16.0
	20 - 29	8.1	77.7	12.2	2.0
	30 - 39	14.9	63.2	19.3	2.6
	40 - 49	10.5	64.1	19.6	5.9
	50 - 59	16.6	53.8	24.3	5.3
Education	60+	17.3	51.3	23.8	7.3
	vocational	19.8	45.0	23.3	11.9
	secondary	13.3	61.1	22.5	3.2
	bachelor degree	9.5	72.7	14.9	2.9
	master degree	13.6	63.2	18.9	4.3

Source: own work

Nearly 80% respondents were able to correctly interpret the meaning of the ‘use by’ date (Table 5). Additionally, when it comes to this date type, young people had the highest problems with assigning its meaning. One quarter of people under 20 was not able to give any answer, in comparison to a few percent in other groups, although they knew that expired food labelled with the ‘use by’ date should not be consumed. In turn, the last issue was not so clear in the group of seniors, who were most likely to consume the expired food products – over 21% would consume them under certain conditions. Inadequate interpretation was also observed in the group of respondents with vocational education. Only 71% of them knew that food should not be eaten after its ‘use by’ date, the others would consume it or were not able to answer this question. Labuza et al. [2008] stated that in the US in 2001 fewer people were able to identify correctly the meaning of the date labels on milk products

than in the 1980’s. Leib et al. [2016] pointed that millennials tend to regard date labels as food safety indicators instead of making a distinction between the ‘use by’ and ‘best before’ dates. The obtained results should encourage food business operators (FBO’s) to use the efficient means to enhance awareness of final food consumers represented by young generation through information flows. Bipolarity in the youngest part of population was observed. On the one hand young people know what should not be done after food expiration, on the other hand – one quarter of them do not read the date labels and the same number is not able to give any interpretation of the ‘use by’ date. It implies the need of personalization of the action taken to make the message suitable for the particular recipient.

Table 5. Interpretation of the ‘use by’ date

Use by 05.06.2020		After this date			
		Food can be consumed, its quality is good	Food can be consumed, its quality may not be good	Food should not be consumed	I do not know
Total		3.7	12.4	79.0	4.9
Gender	female	3.7	12.8	78.7	4.8
	male	3.7	11.8	79.6	4.9
Age	under 20	0.0	4.2	70.8	25.0
	20 - 29	2.6	7.7	87.2	2.6
	30 - 39	1.8	13.2	82.4	2.6
	40 - 49	3.9	9.8	81.7	4.6
	50 - 59	6.0	11.3	78.6	4.2
	60+	4.3	16.8	72.0	6.8
Education	vocational	7.5	11.4	70.6	10.4
	secondary	4.1	15.1	76.8	4.1
	bachelor degree	2.9	10.9	84.2	2.1
	master degree	1.6	10.6	82.9	5.0

Source: own work

To verify respondents’ self-esteem regarding the dates it was examined which problems with interpretation are experienced by people who said that the date-labelling system is easy (Table 6). The results are far from ideal. Only two thirds gave the correct answer that food can be consumed after passing the minimum durability date. Slightly more than 20% respondents in this group believe that consumption of food products past best before date is undesirable. Regarding the ‘use by’ date, 83% of respondents who felt good with the date labelling system correctly

matched the meaning of this date type. These results are only a few percentage points higher than those obtained in the entire population tested. The results showed that a certain percentage of respondents (nearly 14 %) for whom the system was easy would not consume food after the ‘use by’ date. They prove that despite respondents’ thinking that the system of date labelling is easy, their actual knowledge is not satisfactory. This observation highlights the need to take appropriate action at the level of legislators and FBO’s to improve the food date labelling system.

Table 6. Interpretation of the shelf-life dates by consumers who claimed that the system of date labelling is easy

	After this date			
	Food can be consumed, its quality is good	Food can be consumed, its quality may not be good	Food should not be consumed	I do not know
Best before 05.06.2020	12.7%	65.5%	20.3%	1.6%
Use by 05.06.2020	3.0%	11.5%	83.4%	2.1%

Source: own work

Previous studies showed that despite the fact that consumers are aware of the differences between the ‘use by’ and ‘best before’ dates, they have difficulties in correctly referring them to the quality and safety of a given food product. In Belgium only 70% of respondents were able to tell the differences between the two types of date labelling [Van Boxstael et al. 2014]. It was found that less than 60% of teenagers in Greece were able to prove their knowledge of the labelling system in the selection test regarding ‘use by’ dates

and only 20% in relation to the ‘best before’ dates [Gialitakis and Chrysochoidis 2006].

CONCLUSIONS

The analysis of the food date labelling system from the perspective of final consumers indicated its weaknesses which do not allow for the effective fulfillment of its role. The system is not fully efficient in terms of supporting the policy of safe and sustainable food chains. The presented data show two

kinds of underlying problems that final consumers face. The first one is related to technical aspects of food packaging – design of the label and packaging, quality of the print and the size of the font. Compliance with applicable law in terms of regulated issues is important but may not be enough. It is important that presented information is clearly shown and accessible. This is the area within which the action should be undertaken by the FBO's. The second problem arises from consumers' understanding of the food labelling concept. Misinterpretation of minimum durability dates negatively affects the mass of edible food present on the market and can contribute to the environmental burden resulting from throwing away manufactured products. Lack of consumers' certainty regarding the safety of expired food exacerbates this problem. And finally, lack of education in the area of 'use by' date concept affects consumers' safety. Actions targeted at a specific population should be undertaken by FBO's, legislators and educators in the pointed areas in order to achieve economic, environmental and social benefits from clear and consumer-friendly date labelling system. Apart from taking actions aimed at educating the society, it is necessary to make young people more interested in shelf-life dates, and help seniors to familiarize themselves with the information. Improvement of the date labelling system can contribute to safe and sustainable food supply chain.

ACKNOWLEDGMENTS AND FUNDING SOURCE DECLARATION

This study was supported by the National Science Centre (Narodowe Centrum Nauki), Poland [grant number 2017/27/B/HS4/00805].

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