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## FOOD EXPIRATION DATES - LABEL COMPLIANCE WITH REGULATIONS AND CONSUMER PERCEPTION

**Eldina Smječanin**

University of Sarajevo-Faculty of Health Studies, Bosnia and Herzegovina, [eldina.smjecanin@fzs.unsa.ba](mailto:eldina.smjecanin@fzs.unsa.ba)

**Ema Pindžo**

University of Sarajevo-Faculty of Health Studies, Bosnia and Herzegovina,

[ema.pindzo@fzs.unsa.ba](mailto:ema.pindzo@fzs.unsa.ba)

**Amar Žilić**

University of Sarajevo-Faculty of Health Studies, Bosnia and Herzegovina,

[amar.zilic@fzs.unsa.ba](mailto:amar.zilic@fzs.unsa.ba)

**Amela Salihović**

University of Sarajevo-Faculty of Health Studies, Bosnia and Herzegovina, [amela.salihovic@fzs.unsa.ba](mailto:amela.salihovic@fzs.unsa.ba)

**Abstract:** Labelling the expiration date of food is a legal obligation of all food business operators (FBO) and it is the most used information among consumers. The expiration date represents the length of time during which FBO guarantees that a certain food will retain its original properties and quality, provided that it is stored according to the instructions and that the packaging is not opened or damaged. There are different terms used to indicate the expiration date, which from the consumer's perspective can contribute to confusion regarding the interpretation and use of the date and consequently food rejection. This study aimed to examine the conformity of food labels regarding the expiration date's labelling and the consumer's perception in the context of understanding and interpreting the expiration date of food. This cross-sectional study included 941 prepackaged food products from five selected food categories sampled in three leading retailers in Sarajevo Canton and 400 respondents over 18 years of age of different socio-economic statuses. The following research instruments were used: a dedicated form prepared by the requirements of the current legal regulation related to food labelling and an anonymous survey questionnaire created as a result of a literature search and existing similar questionnaires. A high percentage of expiration dates on food labels was recorded (98.8%), however, compliance was recorded for only 68.3% of products. The best compliance was recorded in the category of dairy products. The expiration date of more than half of the products (57.9%) was marked with the phrase "Best before". Only 54% of respondents declared that they fully understood the meaning of the terms used to indicate the expiration date of food. By detailed analysis of the answers, only 3.5% of respondents gave the correct answer and understood the difference between the terms. There is a statistically significant difference in the understanding of the expressions used to indicate the expiration date regarding to the gender, age and professional education of the respondents ( $p < 0.05$ ). Better harmonization of food labels in terms of expiration dates is necessary, as well as an increase in the level of understanding and interpretation of the terms used to protect the health of consumers and reduce the amount of discarded food.

**Keywords:** food, food expiration dates, labels, consumers

### 1. INTRODUCTION

The expiration date mark is an indicator that informs how long food can be stored under certain conditions, without its organoleptic and microbiological changes occurring, which will affect its quality and safety, but also, consequently, the health and well-being of consumers (Patra et al., 2020; Moller et al., 2016). The expiration date is one of the most important information about food, which is an indicator for consumers of proper and safe food consumption. However, in order to "*convey the right message*" the expiration date must be correctly labelled on the food by the FBO and understood by consumers (Sokolić et al., 2015). Bosnia and Herzegovina (BA) harmonized the legislation in the field of food labelling with the European, and the requirements for food labelling regarding the expiration date of food are defined by the Regulation on the Provision of food information to Consumers ("Official Journal of BA" No. 68/13). According to the mentioned legislation, three expressions are used to indicate the expiration date of the product, such as: "*Best before*", "*Best before end*" and "*Use by*". The expression "Best before" refers primarily to food quality, and then to food safety, and is used to indicate the expiration date for most non-perishable food products. After the date marked "Best before", the FBO is no longer legally responsible for the quality of the food, however, the food can still maintain the expected quality for a longer period if the packaging is undamaged and if it is stored by the FBO's instructions. Marking the expiration date with the expression "Best before" is used when the date includes indication of a day. The term "Best before end" is indicated in other cases. In the case of perishable food which after a short period can pose an immediate danger to human health, the expiration

date required the use of the expression "Use by". This term refers to food safety. After the „Use by“ date, food is considered unhealthy and must not be consumed, sold, or donate (Regulation 2013/68; D’Amato et al., 2023). Different expressions of expiration dates can be used for the same food category, which can contribute to confusion about the meaning and use of dates from a consumer perspective. Ambiguous labelling is a major factor contributing to consumer confusion when it comes to food safety. It also affects their decision when choosing/purchasing a certain food product, and encourages potentially wasteful behaviour in terms of unnecessary discarding of food. A range of consumer research studies have shown that sociodemographic characteristics impact the knowledge and use of date marks among respondents (Kavanaugh & Quinlan, 2020; Davenporta et al., 2019; Zielińska et al. 2020). This study aimed to examine the conformity of food labels regarding the expiration date's labelling and the consumer's perception in the context of understanding and interpreting the expiration date of food.

## 2. MATERIALS AND METHODS

This descriptive, cross-sectional study was conducted in in two phases between May and July of 2017. The first part of the research included 941 pre-packaged products from five food categories dairy products (milk and cheese), breakfast cereals, packaged bread, fruit juices and fruit nectars, and candy products) analyzed in three retail chains in Sarajevo Canton, which were displayed on the shelves during the research period. In order to avoid double analysis of the same product, products that were already part of the assortment in the previous retail store were not considered. The retail chains were chosen to achieve extensive coverage of various FBO and present the comprehensive availability of prepackaged food products in the area of Sarajevo Canton. The general management of all three retail chains approved the research and data collection. An examination of the compliance of the food labels regarding the expiration date of food with the current legislation of BA (Regulation (BA) No 68/13 on the provision of food information to consumers) was carried out. A purpose-built form created in accordance with Regulation No 68/13 was used as a research instrument. The second part of the research included 400 respondents of both genders who were older than 18 years, of different socioeconomic statuses, living in Sarajevo Canton, who voluntarily agreed to participate in the research. An anonymous survey questionnaire based on previously conducted studies was used as a research instrument. SPSS for Windows statistical software platform (version 19.0, SPSS Inc, Chicago, Illinois, USA) and Microsoft Excel (version 11. Microsoft Corporation, Redmond, WA, USA) were used for the statistical analyses of data. Nominal and ordinal variables in the study were analyzed using the  $\chi^2$  test. For the limit of statistical significance, the value  $\alpha=0.05$  was used whereas  $p<\alpha$  was considered to be statistically significant for the value of the statistical test.

## 3. RESULTS

Table 1 shows the representation of the products that made up the sample. A high prevalence of expiration date marking was recorded in the total sample, as much as 98.8%. All dairy products had a marked expiration date on the packaging. Deviations were recorded in other categories.

**Table 1. Presentation of the products sample and the frequency of marking the expiration date regarding product categories**

Food category	Product samples in relation to the food category		Expiration date marked		Expiration date not marked	
	N	%	N	%	N	%
Milk	52	5.5	52	100.0	-	-
Cheeses	255	27.1	255	100.0	-	-
Breakfast Cereals	144	15.3	141	97.9	3	2.1
Packaged breads	92	9.8	90	97.8	2	2.2
Fruit juices and fruit nectars	202	21.5	199	98.5	3	1.5
Candies	196	20.8	193	98.5	3	1.5
<b>Total</b>	<b>941</b>	<b>100.0</b>	<b>930</b>	<b>98.8</b>	<b>11</b>	<b>1.2</b>

The total number of products with expiration dates marked on the package was 930. The expressions by which the expiration date of the food was indicated on the package are shown in Table 2. The most common expression used to indicate the expiration date regardless of the food category was "Best Before" (57.9%). More than half of the products had expiration dates marked with the expressions "Expiry date " or some other expression. These

expressions of marking the expiration dates of food are not prescribed by BA Regulation No 68/13 and had a significant impact on the conformity of food labels in this segment.

**Table 2. Most common expressions used to indicate the expiration date on the food labels**

Most common expressions used to indicate the expiration date on the food labels	N	%
Best before	539	57.9
Best before end	20	2.2
Used by	83	8.9
Expiration date	142	15.3
Another expression	146	15.7
<b>Total</b>	<b>930</b>	<b>100.0</b>

The conformity of the expiration dates expression that was marked on the food labels of the selected food category is shown in Table 3. In the total sample of products that had expiration dates on the package, 66.5% recorded compliance with Regulation No 68/13 regarding the correctness of marking the expressions of the expiration date on a food label, while 33.5% recorded a deviation from the legal regulation. The best compliance was recorded in the milk products, where all products were marked with an expression of the expiration date that aligns with Regulation No. 68/13. In the other food categories, non-compliance was recorded.

**Table 3. Compliance of food labels regarding the correctness of marking the expiration date**

Food category	Products that with expiration dates marked on the label		Expiration date aligned		Expiration date not aligned	
	N	%	N	%	N	%
Milk	52	100.0	52	100.0	-	-
Cheeses	255	100.0	148	58.0	107	42.0
Breakfast Cereal	141	97.9	87	61.7	54	38.3
Packaged breads	90	97.8	55	61.1	35	38.9
Fruit juices and fruit nectars	199	98.5	182	91.5	17	8.5
Candies	193	98.5	94	48.7	99	51.3
<b>Total</b>	<b>930</b>	<b>100.0</b>	<b>618</b>	<b>66.5</b>	<b>312</b>	<b>33.5</b>

Results in Table 4 indicated that most respondents were female (60.5%) and were in the age group of 27–45 years (39.0%). In analyzing the material status of respondents, slightly more than half of the respondents in Sarajevo Canton had a monthly income exceeding 900 BAM (54.3%). More than half of the respondents had a college education or university degree (51.4%), were married (53.8%), and had a child (58.0%).

**Table 4. Demographic and socioeconomic characteristics of the respondents (N = 400)**

Variables	N	%	
<b>Gender</b>	Male	158	39.5
	Female	242	60.5
<b>Age (Years)</b>	18–26	79	19.8
	27–45	156	39.0
	46–64	133	33.2
	65 and more	32	8.0
<b>Monthly income</b>	up to 500 BAM	81	20.2
	501–900 BAM	102	25.5
	901–1200 BAM	78	19.5
	1200 BAM more	139	34.8
<b>Marital status</b>	Married	215	53.8
	Single	166	41.5
	Cohabiting	19	4.7
<b>Children in household</b>	No	168	42.0
	Yes	232	58.0
<b>Level of education</b>	Primary school	17	4.3
	High school	177	44.3
	College	33	8.2
	University	173	43.2

BAM according to National Bank of Bosnia and Herzegovina the permanent fixed currency rate is  
1EUR = 1.95583 BAM

**Information that respondents most often use on food labels**

Respondents were asked to indicate what type of information they sought from food labels. Findings regarding responses to this question show that information on food labels that respondents (81.3%) most often read and gave the highest priority was the expiration date. The next most read information was the list of ingredients (49.0%), country of origin (44.0%), product brand (38.0%), and food additives (20.3%).

**Understanding the difference between the expressions used to indicate the expiration date of food**

When asked whether respondents understand the difference between the expressions that indicate the expiration date on food. 54.0% of the respondents completely, 23.0% partially understand the difference between the expressions "Best before", "Best before end" and "Use by", while 23.0% of respondents state that they do not understand this difference. In order to show the level of understanding of the expressions used to indicate expiration date among the respondents, we observed the answers of the respondents as a whole, taking into account the combinations of correct and incorrect answers that the respondents gave to the survey question, which is shown in Table 6. Detailed analysis confirmed a high percentage of socially desirable answers and that only 3.5% of the respondents knew the meaning of all three expressions used to indicate expiration dates on the product packaging in accordance with the Regulation No 68/13. The most significant number of respondents, 67.0%, did not answer correctly or stated that they did not know the meaning of any of the three mentioned expressions.

**Table 6. Presentation of the detailed responses of the surveyed population regarding the understanding of the difference between the expressions used to indicate the expiration date of food**

	N	%
Respondents who did not know the meaning of any of the three expressions	268	67.0
Respondents who knew the meaning of only one expression	59	14.8
Respondents who knew the meaning of the two expressions	59	14.8
Respondents who knew the meaning of all three expressions	14	3.5
<b>Total</b>	<b>400</b>	<b>100.0</b>

Table 7 shows the impact of the demographic and socio-economic characteristics of the respondents on the understanding of expressions used to indicate expiration dates on food. Examining the influence of the demographic and socio-economic characteristics of the respondents on the level of understanding of expressions used to indicate the minimum expiration dates of food, it was shown that there is a statistically significant difference in relation to the sex, age and professional education of the respondents ( $p < 0.05$ ). Female respondents showed better understanding compared to male respondents (38.4% vs. 24.7%). The age of the respondents also had an impact on the understanding of the expressions, where it was shown that respondents aged 18-26 compared to other age groups had a better understanding. Respondents with a university degree showed better understanding compared to other groups of respondents. Monthly income, marital status and parentage have no statistically significant impact on the understanding of the mentioned expressions among respondents ( $p > 0.05$ ).

**Table 7. Impact of demographic and socioeconomic characteristics of the respondents on understanding expressions of the expiration date of food**

			Respondents who did not know the meaning of any of the three expressions	Respondents who knew or partially knew the meaning	Total	$\chi^2$ test P
Gender	Male	N	119	39	158	0,004
		%	75.3%	24.7%	100.0%	
Gender	Female	N	149	93	242	0,004
		%	61.6%	38.4%	100.0%	
Age (Year)	18-26	N	47	32	79	0,004
		%	59.5%	40.5%	100.0%	
		N	99	57	156	
		%	63.5%	36.5%	100.0%	
		N	92	41	133	
Age (Year)	46-64	%	69.2%	30.8%	100.0%	0,101
		N	30	2	32	
Age (Year)	65+	%	93.8%	6.3%	100.0%	0,114
		N	59	22	81	
		%	72.8%	27.2%	100.0%	
		N	75	27	102	
		%	73.5%	26.5%	100.0%	
Monthly income	up to 500 BAM	N	50	28	78	0,237
		%	64.1%	35.9%	100.0%	
		N	84	55	139	
		%	60.4%	39.6%	100.0%	
Marital status	Married	N	157	64	221	0,001
		%	71.0%	29.0%	100.0%	
		N	102	60	162	
		%	63.0%	37.0%	100.0%	
Marital status	Neaženjen/ Neudeta	N	9	8	17	0,237
		%	52.9%	47.1%	100.0%	
Children in household	No	N	107	61	168	0,237
		%	63.7%	36.3%	100.0%	
Children in household	Yes	N	161	71	232	0,001
		%	69.4%	30.6%	100.0%	
Level of education	Primary school	N	13	4	17	0,001
		%	76.5%	23.5%	100.0%	
		N	135	42	177	
		%	76.3%	23.7%	100.0%	
		N	27	6	33	
Level of education	College	%	81.8%	18.2%	100.0%	0,001
		N	93	80	173	
Level of education	University	%	53.8%	46.2%	100.0%	0,001
		N	13	4	17	

#### 4. DISCUSSION

Food expiration date is used to determine the safety, freshness, usefulness and quality of food products, as well as to enable the consumer to make an adequate choice of food (Osei et al., 2012). The aim of this research was to examine the frequency of food expiration dates on food packages, their compliance with actual regulations in BA, as well as the perception and understanding of the expiration date statements among consumers. Analyzing the conformity of the food labels regarding the labelling of the expiration date of food, we noted a high percentage of products with a marked expiration date (98.8%). Deviation from the legal regulation was recorded in terms of the presence of dates in only 1.2% of products from all five selected food categories. Despite a fairly high percentage of representation of the expiration date on product packages from all five selected food categories, non-compliance was recorded in 33.5% of products. The inconsistency of the declaration is not only accompanied by the absence of the expiration date but also by the inadequacy of the expression used to indicate it on the product packages. In the case of one-third of the products, the expiration date was marked with the words "Rok trajanja" or some other word that is not defined by the provisions of Regulation (BA) No 68/13. The most common way of stating the expiration date of food was with the phrase "Best before" and for 57.9% of the products. Market research that was conducted in 8 EU Member States included the analysis of food labels of 2,296 products and recorded that the largest percentage of products (96.0%) had an expiration date with the indication "Best before". However, there are discrepancies in the use of expiration date expressions for the same food in different Member State countries. A significant problem was the legibility of the indicated expiration date, which could lead to misunderstanding among consumers and impact food waste (European Commission, 2018). The information that the respondents pay the most attention to when reading and using the information on food labels is the information on the expiration date of the product (81.3%), which is in correlation with other studies. Authors Bazhan et al., 2015; Mahdavi et al., 2012 in their research confirmed that the respondents give the highest priority to the expiration date in addition to other information on a food label. By surveying consumers about the understanding of the differences between certain expressions used to indicate the expiration date of food, we concluded that more than two-thirds of the respondents believe that they fully or partially understand these differences. However, when the respondents who stated that they fully or partially understood the mentioned differences were asked to explain them in their own words, it turned out that only 3.5% of the respondents knew the meaning of all three expressions, while the dominant per cent of those who did not know the meaning of any of three expressions used to indicate expiration date (as many as 67.0 %). This is a significant indicator of insufficient information or a very low level of understanding among consumers, although according to our research, it is evident that the majority of respondents are more interested in the expiration date than in other information listed on the food label. In an online survey conducted by the authors Kavanaugh & Quinlan, 2020, among 1042 respondents in the USA, the majority of respondents (81.6%) read information about the expiration date on food labels. However, only 57.4%, however, correctly identified what "best by, use by" meant. A 2015 study conducted by "TNS political & social network" at the request of the European Commission in 28 EU member states among 26,601 respondents showed that the majority of respondents (81%) always or often look at the expiration date on the food label, however, less than half of the respondents understand the meaning of the expressions "Best before" and "Use by" (Flash Eurobarometer 425, 2015). Authors Madilo et al., 2020 in a study conducted in Ghana noted that 85.9% of respondents consider the expiration date one of the three most important information on the food label. However, as in our research, when respondents were asked to explain their interpretation and meaning of the expiration date label, 62% of participants were not able to answer the question at all. In our research, it was shown that gender, age, and professional education have a statistically significant influence on the level of understanding of information about expiration dates. Female respondents showed better understanding compared to male respondents (38.4% vs. 24.7%), respondents aged 18-26 compared to other age groups have a better understanding, and respondents with a university degree, as expected, showed better understanding compared to other groups of respondents. Our research correlates positively with the research conducted by the authors Zielińska et al. 2020.

#### 5. CONCLUSIONS

The information on food that consumers attach the most important is information on the expiration date of the food. The practice of using information and the level of understanding among consumers in the Sarajevo Canton area is inversely proportional. The level of understanding of the expressions used to indicate the expiry date of food, among respondents is very low, which affects the efficiency of their use. The results obtained in this research indicate the need for consumer education in terms of a better understanding of the expression that states the date of use of food, but also for the education of FBOs who are responsible for food labels with the aim of providing better and clearer information to the consumer, all with the aim of protecting consumer health, but also unnecessary discarding of food.

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