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EVALUATION OF CUSTOMER AWARENESS OF MELAMINE DISHWARE SAFETY

Daily use of the dishware may be associated with health risks in the event of incorrect use. The aim of the study was to analyse consumer behaviours on the market of melamine dishware and assess their knowledge relating to the potential health risks associated with using these products. The survey was conducted in the form of a questionnaire containing 16 single- and multiple choice questions. Study included 100 people. The results show that consumers are familiar with melamine dishware and are willing to use it, primarily because of its functionality and lightweight. Consumers are not interested in information placed on the label of melamine dishware and do not pay attention to the information on its safe use. Consumers have little knowledge relating to the potential risks associated with using melamine dishware, as well as its potential impact on the human health.

Keywords: *consumer, melamine, dishware safety*

INTRODUCTION

The quality and safety of dishware is becoming more important for consumers, especially in terms of the toxicity of chemicals used to produce it [20]. One such a compound is melamine, a substance that causes a lot of controversies, and safety of which is often challenged.

Melamine, also called cyanuramide (2,4,6-triamine-1,3,5-triazyne), is an aromatic compound belonging to the family of amines, triazine derivative, colourless, slightly soluble in water, its pH is slightly alkaline [8, 13]. It is an organic compound with a chemical formula of $C_3H_6N_6$, in the form of a white crystalline powder. Melamine has fire retardant properties, is non-flammable, which does not react with the air to give an explosive mixture. Melamine is commercially synthesized from urea, by thermal decomposition of urea to cyanic acid and ammonia in an catalytic endothermic reaction or in a non-catalytic high pressure process [13].

Melamine is produced in large amounts primarily for use, in combination with formaldehyde, in the synthesis of thermosetting melamine formaldehyde resins. They are widely used in the production of: laminates, protective coatings, automotive paints, glues and adhesives, paper and textile coatings, veneer finishes, plastics for the electrotechnical industry, flame retardants, as well as household items, primarily dishware [13, 19, 20, 22]. Consumers are willing to purchase

melamine dishware because it is relatively cheap, light, heat resistant, durable (unbreakable and scratch resistant) and come in a wide array of shapes, colours and patterns.

Due to the presence of as many as six nitrogen atoms per molecule, which amount to 66% of the molecule mass, melamine is ideally suited for the purpose of inflating the protein content of food and feed, because the determination of the total protein content in these products is based on an analysis of the nitrogen content of the sample, and the commonly used analytical methods are not effective in distinguishing protein nitrogen from non-protein [11, 13, 14, 21]. Chemical similarity to the protein molecule makes melamine into the choice product used for nutrition content falsification by overstating the actual protein content in food and feed [8, 11, 17, 20]. In addition to being deliberately added to food, melamine may also migrate into food as a result of daily household use of melamine dishware, which could be one of the important exposure sources of melamine in humans. The degree of migration of melamine increases with temperature (sharply at temperatures 60–70°C) and is higher in the case of tableware of worse quality [1, 17].

Studies on the toxicity of melamine have confirmed that it is non-genotoxic, non-carcinogenic and non-teratogenic compound [8, 13]. However, despite the low toxicity, it could form insoluble crystals in combination with cyanuric acid, leading to the formation of kidney stones. This can lead to obstructive nephropathy or acute kidney failure and ultimately death, particularly in infants and young children. This also can lead to albuminuria, chronic kidney disease and hypertension [5, 11, 14, 17, 19, 21]. For adults, melamine is only dangerous in very high concentrations [17, 21]. Recent studies indicate that exposure to melamine may increase the risk of urolithiasis in adults [14].

Applying statistical analysis to the toxicological data, the World Health Organization recommended the tolerable daily intake (TDI) for melamine of 0,2 mg per kg body weight per day [10, 19]. The European Commission has set the maximum level for melamine in food of 1 mg/kg for powdered infant formula and 2,5 mg/kg for other food product [5].

Another substance that can migrate from tableware to food is formaldehyde – which can be harmful to human health [16]. It is classified as a Group 1 carcinogen by International Agency for Research on Cancer (substances with a proven carcinogenic effect), it is a strong irritant, and cytotoxic and carcinogenic by inhalation [15, 16]. Like the melamine itself, formaldehyde release risk is higher when the dishware is used at higher temperatures, so melamine containers should not be used to heat food in microwave ovens [16].

Materials and articles intended to come into contact with food, including food containers, utensil and dishware, are covered in the European Union by regulations that specify requirements it must meet in terms of health and safety [6]. The basic requirements for materials and articles intended to come into contact with food are set out in Regulation (EC) No 1935/2004 of the European Parliament and of the Council of 27 October 2004. Substances migrating from materials and articles intended to come into contact with food may represent a significant source of contamination of food with substances harmful. Therefore, according to the

requirements set out in Regulation (EC) No 1935/2004 materials and articles intended to come into contact with food shall be manufactured in compliance with good manufacturing practice so that, under normal or foreseeable conditions of use, they do not transfer their constituents to food in quantities which could endanger human health, bring about an unacceptable change in the composition of the food and bring about a deterioration in the organoleptic characteristics thereof [15, 18]. In addition to the general requirements contained in the Regulation 1935/2004, in order to ensure the health of the consumer The European Commission specific provisions establish lists of substances authorized for use in materials and articles intended to come into contact with food, as well as the limit for their migration to food. All substances before being placed on the list must be subjected to a risk assessment [7]. The product meets the requirements if the migration does not exceed the permissible limits and if there is no evidence of an adverse effect of the product tested on the organoleptic characteristics of the food. Materials and articles intended to come into contact with food that does not meet such requirements should not be marketed because it poses a potential health hazard to the consumer [6].

According to good manufacturing practice it is necessary to manufacture plastic materials in such a way that they are not releasing more than 10 mg of substances per 1 dm^2 of surface area of the plastic material [2]. In the case of melamine specific migration limit, defined as the maximum permitted amount of a given substance released from a material or article into food or food simulants, is 2,5 mg/kg, while in the case of formaldehyde specific migration limit is 15mg/kg [2, 3, 12]. Conformity of products with these requirements should be confirmed by appropriate tests performed in accordance with the rules established in the European Union [6].

The analysis of data on notifications submitted from 2002 to 2016 via the RASFF system (Rapid Alert System for Food and Feed) functioning in the European Union shows that there were 1891 notifications reported to the system regarding materials and articles intended to come into contact with food that did not meet regulatory requirements and criteria for safety and constituted direct or indirect threat to human health. Among those notifications, 12% concerned melamine dishware [9].

Most of the notifications regarding melamine dishware were associated with exceeding the permissible migration limit of formaldehyde into food or food simulants (74% of notifications). Less often, the notifications concerned exceeding the allowable migration limit of melamine (18% of notifications) and exceeding the allowable overall migration limit (6% of notifications). The remaining group of notifications (2%) concerned the lack of the required declaration of the importer, confirmed by laboratory tests, that these products do not release into food or food simulants substances above the allowable limits [9].

The analysis of notifications regarding materials and articles intended to come into contact with food submitted via the RASFF system indicates that the majority of identified threats (80% of notifications), primarily concerning the risk of migration of formaldehyde into food, concerned tableware originating in China and Hong Kong [9, 16]. In order to reduce the risk to consumers' health, which can be

created by products from that region, the European Commission adopted Commission Regulation (EU) No 284/2011 of 22 March 2011 laying down specific conditions and detailed procedures for the import of polyamide and melamine plastic kitchenware originating in or consigned from the People's Republic of China and Hong Kong Special Administrative Region, China [4, 12]. Since 2011, such products have been subject to special border controls in regards to their fulfilling the requirements for the compulsory documentation confirming compliance with the rules and compulsory tests regarding specific migration [16].

Since melamine dishware is very popular and widely used in daily life, it is important for consumer to know how to use it safely. The aim of the study was to analyse consumer behaviours on the market of melamine dishware and assess their knowledge relating to the potential health risks associated with using these products.

1. MATERIAL AND METHODS

The study was conducted by means of a survey with the use of the author's own questionnaire. The questionnaire consisted of two parts. The first part contained subject-specific questions relating to the behaviour of respondents on the market of melamine dishware and their knowledge on potential health risks associated with using melamine dishware. This section contains 10 single- and 6 multiple choice questions. The second part of the questionnaire contained questions relating to the structure of respondents (respondent details).

The study was conducted in October 2015 and May 2016. 145 people participated in the survey – 76 women and 69 men from Pomeranian Voivodeship. The biggest group of respondents (57 people) were people between 18 – 35 years old, next people aged 36–50 years (43 people), further people over 50 years (31 people) and 14 people under 18 years old. Respondents were selected randomly. Most of the respondents (96 people) were people with a university degree, 38 respondents declared they have completed secondary education, 7 people completed vocational education, and the remaining 4 people completed elementary education.

2. RESULTS AND DISCUSSION

The first section of questions contained in the questionnaire concerned consumer behaviours on the market of melamine dishware. In the first question, the respondents were asked whether they were familiar with melamine dishware. To this question most respondents (78%) answered affirmatively, the remaining group of respondents declared that they were not familiar with melamine dishware.

In most cases, respondents use melamine dishware in their households (68% of responses), 24% of respondents declared that they did not use it. The smallest group of participants in the survey (8%) had difficulties with answering such a question.

The respondents were asked to indicate how often they purchased melamine dishware. The conducted study shows that most of the respondents (31%) make melamine dishware purchases once a year. Further respondents declared that they purchased melamine dishware a few times a year (25% of responses), less than once a year (14% of responses) and once a month (8% of responses). The remaining group of respondents (22%) declared that they did not purchase melamine dishware.

The survey also aimed at identifying the type of melamine dishware which the respondents used in their households (to this question respondents could select more than one answer). When analysing the answers, it was confirmed that the respondents most often used cups – such a response was given by 22% of respondents. The second place in terms of frequency of using was taken by bowls (19% of responses). Further respondents indicated platters (17% of responses), plates (16% of responses), cutting boards (14% of responses) and cutlery (7% of responses). Only 5% of respondents declared that they use melamine utensils, such as ladles, skimmers, spaghetti spoon and spatulas.

When asked to identify users of melamine dishware within the household, the majority of the survey respondents stated that such dishware was used by all members of the household (45% of responses). 33% of respondents said that such dishware was used mainly by children, and 22% of the respondents indicated mainly adult users.

The respondents were also asked to indicate factors which impact decisions made by them relating to the purchase of melamine dishware. The obtained results confirm that most respondents (46%) purchase melamine dishware because of its functionality. A slightly smaller group of respondents purchase it because of their appearance (35% of responses) while the smallest group of respondents (19%) declared that they purchased melamine dishware because of its price.

The respondents were also asked whether melamine dishware was a good substitute for porcelain. To this questions most respondents (44%) answered negatively while 35% of respondents answered: probably no. Further respondents indicated: probably yes (10% of responses) and definitely yes (6% of responses). The smallest group of respondents (5%) had difficulties with answering such a question.

When analysing the approach of the respondents to the information placed on the label of melamine dishware it was confirmed that more than half of the respondents (52%) did not read such information. The remaining group (48%) declared that they always read the label prior to making the purchase.

Another question aimed at identifying the key important features of the dishware (this question was multiple choice question). The obtained results confirm that the key importance for respondents is constituted by its lightweight (44% of responses). Further, the respondents answered that melamine dishware

was dishwasher safe (18% of responses), unbreakable (13% of responses) and heat resistant (10% of responses). In turn, the least importance for respondents relates to scratch resistance (8% of responses) and low temperature resistance (7% of responses).

When analysing the approach of the respondents to the melamine dishware it was confirmed that the biggest group of respondents (36%) would probably recommend it to friends. A slightly smaller group of respondents (29%) would definitely recommend it. Melamine dishware has also its opponents – 21% of respondents would definitely not recommend it to friends while the remaining group (14%) would probably not recommend it.

The second group of questions aimed at assessing the knowledge of respondents relating to melamine dishware safety. To the question of what melamine is, most respondents (79%) answered correctly, namely it was a type of plastic. The remaining answers to this question provided by the respondents were wrong. In the opinion of 13% of respondents melamine is a type of porcelain while 8% answered that melamine was a type of tempered glass.

In the opinion of the majority of respondents (43%) melamine dishware is safe for human health while 31% of respondents had difficulties with the assessment of its safety. In the opinion of the remaining group of people participating in the survey (26%) melamine dishware is safe.

The survey also aimed at assessing the knowledge of respondents relating to the potential health risks associated with using melamine dishware. In this question the questionnaire allowed to select more than one answer. The results of the analysis of answers provided by the respondents indicated their small level of knowledge in this scope. The biggest group of respondents (75%) had difficulties with answering such a question. The small group of respondents correctly answered that melamine dishware had possible carcinogenic effects (7% of responses), could cause migration of toxic substances into the food (6% of responses) and could cause kidney diseases (2% of responses). The remaining answers to this question provided by the respondents were wrong. In the opinion of survey participants melamine dishware could cause allergies (5% of responses), could reduce the nutritional value of food (4% of responses), could cause changes in the organoleptic properties of food (2% of responses) and could cause faster spoilage of food stored in them (1% of responses).

When asked how they used melamine tableware (this question was multiple choice question), the most common answers indicated use for preparation and consumption of food and drinks (37% of responses). Further, respondents declared that they washed it in the dishwasher (33% of responses), used for heating food in the microwave (16% of responses). The smallest group of respondents (14%) declared that they used melamine dishware for storing food in the refrigerator.

When asked to identify actions that could increase the risks posed by melamine dishware (to this question respondents could select more than one answer), in most cases (53%) respondents declared complete lack of knowledge in this scope. Only 28% of survey participants correctly answered that the increase in

risk could be caused by using the tableware to heat food up in the microwave. The remaining answers to this question provided by the respondents were wrong. According to 16% of respondents, the threat may arise from washing the tableware in the dishwasher, and 3% said that storing melamine tableware in the refrigerator could increase the risks.

The last question aimed at checking knowledge of the respondents relating to the type of products in which, besides dishware, melamine was used (this question was multiple choice question). Analysis of the obtained results enabled to state that similarly to the previous questions, most of the respondents (60%) had a problem with answering such a question. The small group of people participating in the survey correctly answered that melamine was used, among others, in the production of automotive paints (7% of responses), paper and textile coatings (3% of responses) and veneer finishes (2% of responses). The remaining answers to this question were wrong. In the opinion of 18% of survey participants melamine is used in dentistry, 7% of respondents indicated that melamine was used as a food preservative while 3% stated that it was component of drug products.

CONCLUSIONS

On the basis of the research one can conclude that:

1. Daily use of the tableware may be associated with health risks in the event of incorrect use.
2. Melamine tableware is well known to consumers and keenly used because of its convenience and lightweight.
3. Consumers are not interested in information placed on the label of melamine dishware and do not pay attention to the information on its safe use.
4. The knowledge of consumers relating to the potential risks associated with using melamine dishware, as well as their potential impact on the human health, is small.

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