

THE PERCEPTION ON USAGE OF THE FOOD PRESERVATIVES BY CONSUMERS IN NORTH MACEDONIA*

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Abstract

Preservatives are one of the most commonly used additives in many food products, such as: soft drinks, fruit and vegetable products, processed meat, various sweet desserts, mayonnaise, ketchup, sauces, wines and beers, some types of milk products, etc. Their use in our country, as well as in other countries around the world, is regulated by law. As part of this research, an anonymous survey of different population groups (children, adolescents and adults) was conducted in order to determine how familiar consumers are with the term food additives, and especially with the preservatives, the benefits of their use versus the adverse effects on human health. The questionnaire consists of 29 questions, divided into 4 groups, namely Demographic data, Knowledge of healthy habits, Knowledge of additives and Knowledge and use of preservatives. The results of the survey conducted on 392 participants from North Macedonia show that the largest percentage of respondents (67.60%) answered that they know what preservatives are, but when asked to list which preservatives they know, only 26.28% of respondents answered correctly, 5.87% partially correctly, 8.42% incorrectly, and 59.44% did not know how to answer. When asked if they were informed about the risk of consuming large amounts of preservatives in the diet, 50.26% respondents answered affirmatively, 38.01% were partially informed, and 11.73% were not informed. The results of this research indicate that there is a need for better education and awareness of consumers about the use of preservatives in their diet, as well as about the risks of their intake.

Keywords: *consumer's perception; food preservatives; survey*

INTRODUCTION

Preservatives are chemical substances capable of retarding or arresting the growth of microorganisms to prevent processes such as fermentation, acidification, or decomposition, which cause deterioration of flavor, color, texture, appearance, and nutritive value.

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Preservatives are often used in combination with physical methods; such combinations may allow the preservatives to be used at lower concentrations, thus retaining the quality of the product (Samal *et al.*, 2017; Surekha and Reddy, 2014).

The most widely used preservatives added to certain foods are: benzoates (E210 -E219), benzoic acid (E210) or its sodium salt (E211), sorbates (E200 – E209), potassium (E212) or calcium (E213) salt. Sodium benzoate and benzoic acids are mostly used in acidic food products like fruit juice, carbonated drinks, pickles and jams (Samal *et al.*, 2017). Soft drinks are the major contributor to the dietary benzoic acid exposure in many Western countries (WHO, 1999). However, there are large differences in the permitted levels for soft drinks among international, national and regional standards (Ming Maa *et al.*, 2009). The use of benzoic acid is authorized in the European Union in several food groups on the condition of respecting the maximum use levels (Directive 95/2/EC; European Commission 1995), which are all expressed as benzoic acid equivalents (Vandevijverea *et al.*, 2009).

Different amounts are required for effective antimicrobial activity. Benzoic acid inhibits yeast at pH 4. The most common preservatives are benzoates (sodium benzoate), used in the range 0.01 – 0.10 % and sorbates (sorbic and potassium sorbate) used in the range 0.03 – 0.10 % (García-García and Searle, 2016).

Several scientific bodies have conducted toxicological evaluations of benzoic acid and its salts and have established the acceptable daily intake (ADI) of 0 to 5 mg/kg body weight per day, expressed as benzoic acid equivalents (Darch *et al.*, 2021).

Although preservatives are beneficial for packaged food, they do have some adverse effect on human health. For example, the cytotoxicity of sodium benzoate, as a food preservative, have been demonstrated. All preservatives cause hyperactivity on regular usage (Kane *et al.*, 2024; Samal *et al.*, 2017). Sodium benzoate has also been linked to hyperactivity in children when mixed with other artificial food colors (McCann *et al.*, 2007). Benzoates are strictly forbidden for asthma patients because it worsens the condition. Benzoates are also reported to cause rhinitis, chronic urticarial and flushing in some cases. Sodium benzoate is found to form carcinogenic benzene while used with vitamin C or ascorbic acid. Though the amount of benzene form is low but it is a risk factor to cause cancer. It is also reported that benzoates can cause brain damage. Sorbates can cause urticarial and contact dermatitis in some cases (Samal *et al.*, 2017). The main aim of this research was to determine how familiar are the consumers in North Macedonia with the term food additives, especially the preservatives and the benefits of their use versus the adverse effects on human health.

MATERIALS AND METHODS

This research was conducted through an anonymous survey involving 392 participants from North Macedonia over the age of 12. The average time to complete the survey was about 13 minutes. This anonymous online survey was conducted in the period from February to June 2022 on the territory of the Republic of North Macedonia.

The questionnaire was prepared by the authors of the paper and consisted of 29 questions, divided into four groups: Demographic data (5 questions), Knowledge of healthy habits (11 questions), Knowledge of additives (5 questions) and Knowledge and use of preservatives (8 questions). The questionnaire was distributed electronically through the media platform Forms, to professors, colleagues, students, as well as their friends and relatives. After completing the research period, a statistical analysis of the collected data was performed by using Microsoft Excel. The first step consisted of a tabular presentation of the responses received to each individual question, followed by summarizing the data. After statistical processing, the results are presented in analytical and graphic form.

RESULTS AND DISCUSSION

Demographic data were presented in the first part of the survey, consisting of 5 questions, where a sociodemographic characterization was made in order to obtain a more detailed description of the participants. Namely, the questions were aimed to determine the age, gender, living environment, level of completed or current education and the occupation or profession of the participants. According to the obtained results, most of the participants 269 (68.62%) were aged 30 – 64 years; 90 (22.98%) participants were aged 19 – 29; 28 (7.14%) were aged 12 – 18; and 5 (1.30%) were older than 64 years. Of the 392 participants, 325 (82.90%) were female, while 67 (17.10%) were male. Of them, 366 (93.37%) lived in cities, and 26 (6.63%) lived in rural areas. From the obtained responses regarding the degree of completed or current education, it can be concluded that the majority of respondents, 203 (51.80%) had BSc degree, 74 (18.90%) had completed secondary education, and 35 (8.90%) were students. This is followed by 50 participants (12.80%) who had completed master's studies, while 26 respondents (6.60%) had completed doctoral studies. 2 respondents (0.50%) had completed specialization, 1 participant (0.25%) had primary education, and 1 participant (0.25%) answered that is not relevant. To the question about profession, most of the respondents were: graduated engineers, doctors, pharmacists (78; 19.90%), graduated economists, lawyers (73; 18.62%), students (41; 10.46%), academic professors (36; 9.18%), teachers (30; 7.65%), technicians and laboratory workers (secondary education), (24; 6.12%), economists/lawyers (secondary education), (22; 5.61%); pupils (7; 1.78%). Out of the total number of respondents, 12 (3.06%) were unemployed, while 69 (17.60%) answered that they had "other" occupation. *Knowledge of healthy habits* were presented in the second part of the survey, which contained 11 questions in order to determine how much the participants know and practice healthy habits. The first three questions refer to the body mass and height of the participants. According to their answers, the majority of respondents, 151 (38.52%) had a body mass in the range of 60 to 70 kg, 83 (21.17%) had more than 80 kg, 80 (20.41%) had less than 60 kg, while 78 (19.90%) respondents had a body mass in the range of 71 to 80 kg.

In terms of body height, the responses of the participants were as follows: 222 (56.63%) had a body height between 160 and 170 cm, 111 (28.3 %) participants were between 171 and 180 cm tall, 31 (7.91%) had a body height above 180 cm, while 28 (7.14%) were below 160 cm. The BMI is calculated by dividing an adult's weight in kilograms by their height in meters squared. Regarding the respondents' opinion about their body mass, 224 (62.24%) thought that it was within normal limits, 138 (35.21%) participants were overweight, and 10 (2.55%) of them thought that they had a lower body mass than normal. A higher BMI increases the risk of developing long-term conditions, such as type 2 diabetes and heart disease.

The next few questions refer to whether the respondents played sports, to which the majority, 189 (48.22%) answered that they played sports recreationally, also a large number of them, 169 (43.11%) answered that they did not play sport at all, while 34 (8.67%) actively played sports. Regarding the type of sport, most of them did: walking 51 (32.08 %), running 16 (10.06 %), fitness/gym 20 (12.58%), cycling 13 (8.18%), football/basketball 10 (6.29%), volleyball /handball 6 (3.77%), yoga/pilates 14 (8.80 %), martial arts 14 (8.80%), and 15 (9.44%) played other sports.

Furthermore, participants were asked, if they slept at night, where 354 (90.30%) responded that they did, 23 (5.87%) sometimes slept, and 15 (3.83%) did not sleep. In addition to this question, for those who did not sleep, followed the question "If not, is it because of work responsibilities or personal choice", where 73.33% did not sleep due to work obligations, and 26, 67% did not sleep due to personal choice. Of the participants who answered "Sometimes", 50.00 % did not sleep due to work obligations, and 50% did not sleep due to personal choice.

Then followed questions in order to determine whether the participants pay attention on the quality of their diet. Thus, to the question "Do you pay attention to the quality of your diet?", the majority of respondents 224 (57.14%) answered affirmatively, 144 (36.74%) answered that they sometimes paid attention, and 24 (6.12%) did not pay attention to the quality of the diet. To the question "Do you pay attention to the caloric value of your diet?", 152 (38.78%) respondents answered that they did not pay attention, approximately as many respondents (146, 37.24%) answered that they sometimes paid attention, while 94 (23.98%) respondents answered affirmatively.

In addition, the participants were asked whether they were informed about the positive effects of the products they consume, where 218 (55.61%) answered affirmatively, 136 (34.70 %) responded that they were partially informed, and 38 (9.69%) were not informed. Similar results were also obtained when asked whether they were informed about the negative effects of the products they consumed, where 230 (58.67%) responded affirmatively, 125 (31.89%) responded "partially", while 37 (9.44%) responded "no".

The third part of the survey consisted of 5 questions on *Knowledge of additives*. The questions and the obtained results are presented in Figure 1.

For the question "Do you know what food additives are?" the majority of respondents, 295 (75.26%) knew what food additives are, 82 (20.92%) had partial knowledge, while 15 (3.82%) did not know what food additives are. As addition of the previous question,

followed "Do you think you are sufficiently informed about the meaning of food additives?", where the majority of respondents, 162 (41.33%) answered that they were partially informed, 141 (35.97%) answered that they were sufficiently informed, and 89 (22.70%) answered that they were not sufficiently informed about the meaning of food additives.

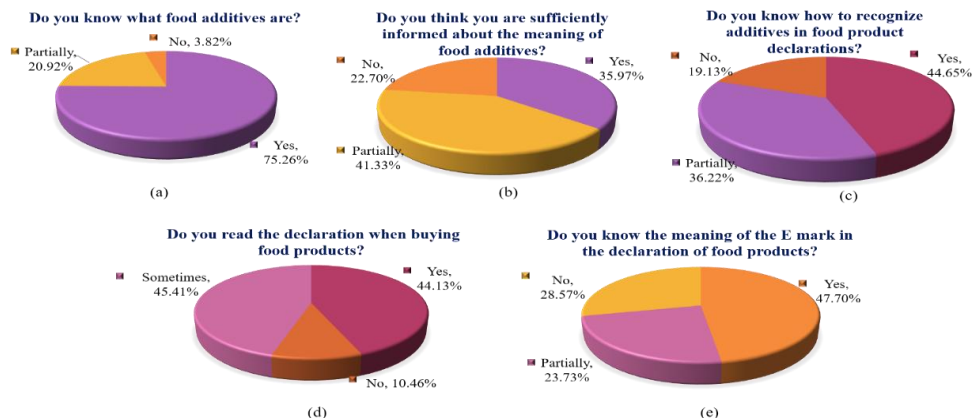


Figure 1. The answers to the questions about the knowledge of additives

When respondents were asked "Do you know how to recognize additives in food product declarations?" less than half, 175 (44.65%) respondents knew how to recognize additives, 142 (36.22%) partly knew, while 75 (19.13%) did not know. Then, the respondents were asked if they read the composition of the declaration when buying food products, the majority of respondents 178 (45.41%) answered that they sometimes read it, approximately the same number of respondents, 173 (44.13%) answered affirmatively, while 41 (10.46%) respondents answered that they did not read it.

The next question in the survey was whether did consumers know the meaning of the E number in the declaration of food products. The majority of respondents, 187 (47.70%) knew it, but this number was less than half of the respondents. Of those surveyed, 93 (23.73%) answered that they partially knew it, and 112 (28.57%) did not know the meaning of the E number in the food product declaration.

Knowledge and use of preservatives, given in the fourth part of the survey was in purpose to obtain more detailed information about how much did the respondents know and use preservatives. As can be seen in Figure 2, the first question from this section was "Do you know what preservatives are?", to which more than half of the respondents (265, 67.60%) answered affirmatively, 114 (29.08%) partially knew, and 13 (3.32%) did not know what preservatives are. Then the respondents were asked if they could list some preservatives, to which only 103 (26.28%) participants answered correctly, and 23 (5.87%) answered partially correctly.

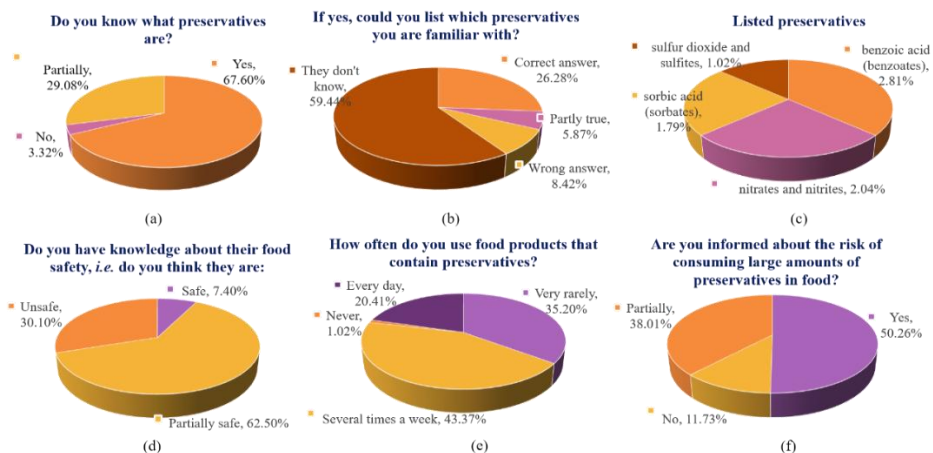


Figure 2. Some answers regarding to knowledge and use of preservatives

According to the answers, more than half of the respondents 233 (59.44%) did not know any preservative, and 33 (8.42%) gave incorrect names of substances as preservatives. Of the correct answers, the most listed were: benzoic acid and benzoates (11, 2.81%), nitrates and nitrites (8, 2.04%), sorbic acid and sorbates (7, 1.79%), and sulfur dioxide and sulfites (4, 1.02%). Considering that the use of preservatives can have adverse effects on consumer health, the respondents were asked "Do you have knowledge about their food safety, i.e. do you think they are: safe, partially safe or unsafe?". The obtained answers show that the majority of respondents 245 (62.50%) considered them partially safe, 29 (7.40%) thought that they are safe, while 118 (30.10%) thought that they are not safe.

To estimate the intake quantity of food products containing preservatives, the participants were asked the question "How often do you use food products containing preservatives?". The answers showed that the majority of respondents used products with preservatives several times a week (170, 43.37%), and 138 (35.20%) used them very rarely. Also, 80 (20.41%) participants consumed such products daily, and 4 (1.02%) answered that they never consumed such products. To the question "Are you informed about the risk of consuming large amounts of preservatives in food?", about half of the respondents 197 (50.26%) answered affirmatively, 149 (38.01%) respondents were partially informed, while 46 (11.73%) gave a negative answer.

According to a study by Legesse *et al.* (2016) conducted in Ethiopia, 64% of respondents were unaware of the possible negative consequences of food additives and 70% would continue to consume even after seeing the consequences. At the same time, a large part of consumers were not interested in reading product declarations.

Today, on the market, there is a wide and diverse range of food products containing preservatives. Therefore, the question "Which food products containing preservatives do you use most often in your diet?" was asked with the possibility of multiple answers (Figure 3). Of the products offered, the answers showed that consumers mostly

consumed dairy products (275, 70.15%), followed by mayonnaise (167, 42.60%), mushrooms (156, 39.80%) and processed fruit and vegetables (154, 39.28%), then soft drinks (103, 26.27%), wine (74, 18.88%), beverages with a low alcohol content (37, 9.44%), and 70 (17.86%) of responses were given for other products. Additionally, consumers were asked to indicate the daily/weekly consumption amount of food products containing preservatives. According to the obtained results, the majority of respondents (216, 55.10%) did not answer, 36 (9.18%) of respondents did consume very few of them or very rarely, 31 (7.91%) consumed up to 500 g (500 mL) per week, 14 (3.57%) respondents consumed more than 1 kg (1 L) per week, 15 (3.83%) respondents consumed large quantities and very often, 13 (3.38%) respondents consumed often (several times a week), and 62 (15.82%) respondents answered with “other”.

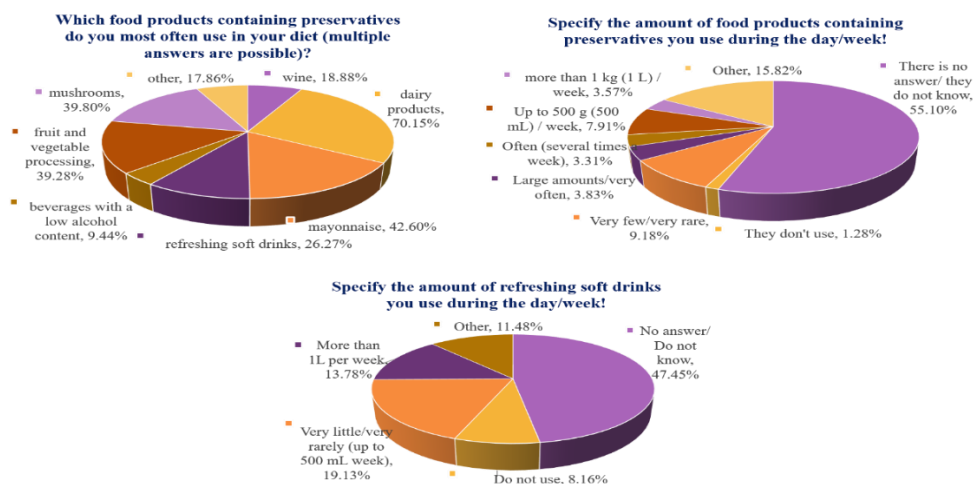


Figure 3. Some answers regarding to knowledge and use of preservatives

As the last question in the survey, respondents were asked to indicate the daily/weekly amount of soft drinks they consumed, where 186 (47.45%) participants did not answer, 32 (8.16%) did not use, 75 (19.13%) used very little / very rarely (up to 500 mL week), 54 (13.78%) had used more than 1L per week and 45 (11.48%) answered "other".

CONCLUSIONS

This research provides an overview of consumer knowledge and use of preservatives by different population groups in the Republic of North Macedonia.

The obtained results showed that consumers are partially informed about the meaning of food additives, very few consume them in large quantities, and most consumers avoid them or use them rarely and in small quantities.

The results of the survey showed that the majority of respondents (67.60%) thought they knew what preservatives are, but 59.44% of them did not know how to specify a single preservative, 8.42% answered incorrectly, 5.87% answered partially correctly, and only 26.28% answered correctly.

The results of this research indicated that there is a need for better education and of raising the awareness of consumers about the use of preservatives in their diet, as well as about the risks of their intake.

These results could be a good base for further research in order to estimate the risk of consuming high amounts of food products containing preservatives.

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PERCEPCIJA UPORABE KONZERVANSA U HRANI OD STRANE POTROŠAČA U SJEVERNOJ MAKEDONIJI

Sažetak

Konzervansi su jedni od najčešće korištenih aditiva u mnogim prehrambenim proizvodima, kao što su: bezalkoholna pića, proizvodi od voća i povrća, mesne prerađevine, raznih deserata, majoneza, kečapa, umaci, vina i piva, neke vrste mlečnih proizvoda itd. Njihova upotreba u našoj zemlji, kao iu drugim zemljama širom svijeta, regulisana je zakonom. U okviru ovog istraživanja sprovedena je anonimna anketa kod različitih populacijskih grupa (djeca, adolescenti i odrasli) kako bi se utvrdilo koliko su potrošači upoznati s pojmom aditiva u hrani, a posebno s konzervansima, prednostima njihove upotrebe u odnosu na štetnog uticaja na ljudsko zdravlje. Upitnik se sastoji od 29 pitanja, podijeljenih u 4 grupe, i to Demografske podatke, Spoznanje zdravih navika, Spoznanje aditiva i Spoznanje i upotreba konzervansa.

Rezultati ankete sprovedene na 392 učesnika iz Severne Makedonije pokazuju da je najveći procenat ispitanika (67,60%) odgovorio da zna šta su konzervansi, ali na pitanje da navedu koje konzervanse znaju, samo 26,28% ispitanika je tačno odgovorilo, 5,87% delimično tačno, 8,42% netačno, a 59,44% nije znalo da odgovori. Na pitanje da li su informisani o riziku konzumiranja velikih količina konzervansa u ishrani, 50,26% ispitanika je odgovorilo potvrdno, 38,01% je delimično informisano, a 11,73% nije informisano. Rezultati ovog istraživanja ukazuju da postoji potreba za boljom edukacijom i podizanjem svijesti potrošača o upotrebi konzervansa u ishrani, kao i o rizicima njihovog unosa.

Ključne riječi: *percepcija potrošača, konzervansi u hrani, anketa*