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Evaluation of Dietary Exposure to Certain Preservative Food Additives: A Pilot Study

Bazı Koruyucu Gıda Katkı Maddelerine Diyetle Maruziyetin Değerlendirilmesi-Pilot Çalışma

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ABSTRACT

Aim: *This study aims to evaluate dietary exposure to some preservative food additives (benzoate, sorbate, nitrite, nitrate) in young adults and compare exposure levels with acceptable daily intake.*

Material and Method: *A total of 48 individuals were included in this study. To determine the intake levels of preservative food additives, a semi-quantitative processed food frequency questionnaire was used. Daily additive intakes were compared with the acceptable daily intake (ADI) set by the European Food Safety Authority to evaluate whether there was a risk of exceeding the ADI.*

Results: *Average daily intakes of benzoate, sorbate, nitrite, and nitrate were calculated as 0.13 ± 0.25 mg/kg, 0.86 ± 1.00 mg/kg, 0.02 ± 0.0.3 mg/kg and 0.007 ± 0.01 mg/kg, respectively. Increased energy intake from processed foods correlates with higher sorbate intake ($r=0.538$ $p\leq0.000$). Sorbate intake exceeds ADI in 4.1% of individuals and nitrite intake in 8.3%. Dietary benzoate and nitrate intake were below the ADI in all participants.*

Conclusion: *In this study, although the frequency of individuals exceeding the preservative additives intake was low, increasing the frequency and amount of consumption of ultra-processed foods increase the risk of exposure. To determine risks, each country needs more dietary additive exposure estimations.*

Keywords*: Food additives, Dietary exposure assessment, Ultra-processed foods, Healthy eating*

ÖZET

Amaç: *Bu araştırma, yetişkin bireylerde bazı koruyucu gıda katkı maddelerine (benzoat, sorbat, nitrit, nitrat) diyetle maruz kalmanın değerlendirilmesini ve maruz kalma miktarlarının kabul edilebilir alım düzeyi ile karşılaştırılmasını amaçlamaktadır.*

Gereç ve Yöntem*: Toplam 48 kadın ve erkek çalışmaya katılmıştır. Katılımcıların koruyucu gıda katkı maddelerinin alım düzeyleri yarı nicel işlenmiş besin tüketim sıklığı formu ile belirlenmiştir. Bireylerin günlük katkı maddesi alımları, Avrupa Gıda Güvenliği Otoritesinin belirlediği kabul edilebilir alım (ADI) ile kıyaslanarak ilgili katkı maddesinin aşma riski olup olmadığı değerlendirilmiştir.*

Bulgular: *Katılımcıların günlük ortalama benzoat, sorbat, nitrit ve nitrat alımları sırasıyla 0.13 ± 0.25 mg/kg, 0.86 ± 1.0 mg/kg, 0.02 ± 0.0.3 mg/kg ve 0.007 ± 0.01mg/kg olarak hesaplanmıştır. Ultra işlenmiş besinlerden gelen artmış enerji alımı, daha yüksek sorbat alımı ($r=0.538$ $p\leq0.000$) ile ilişkilidir. Bireylerin %4.1'inde sorbat alımı %8.3'ünde ise nitrit alımı ADI değerini aşmaktadır. Diyetle benzoat ve nitrat alımı tüm katılımcılarda ADI değerinin altındadır.*

Sonuç: *Bu pilot araştırmada ilgili koruyucu gıda katkı maddesi alım miktarlarını aşan bireylerin sıklığı az olmasına rağmen bu besinlerin tüketim sıklığının ve miktarının artması koruyucu katkı maddelerine maruz kalma riskini artırabilir. Bu bağlamda her ülkenin kendi risk değerlendirme çalışmalarını yürütebilmesi için katkı maddelerinin diyetle maruz kalma hesaplamalarını içeren daha fazla çalışmaya ihtiyaç vardır.*

Anahtar kelimeler: *Gıda katkı maddeleri, Diyetle maruz kalma, Ultra işlenmiş besinler, Sağlıklı beslenme*

INTRODUCTION

Socioeconomic status, urbanization, industrialization, trade policies, increased employment for women, changes in consumer attitudes, increase in the food supply, and changing lifestyles are responsible for changes in individuals' eating behavior (Reardon, Timmer, Barrett, & Berdegué, 2003, Kearney, 2010;). There is a tendency to switch from home-cooked foods to processed and packaged food consumption. This trend is seen not just in developed and industrialized countries, but also in developing countries, including Türkiye (Caballero, 2002; Popkin, 2003; Gina Kennedy & Shetty, 2004). To ensure food security, it is critical to enhance food production and reduce food loss, preserve the quality of food and extend its shelf life. This scenario also brings about the use of food additives (Yurttagül & Ayaz, 2008). With this increasing trend in processed food consumption, the intake of food additives is also increasing. In this context, the increased intake of dietary food additives and the fact that many have adverse effects on human health if consumed excessively raises concern (Jain & Mathur, 2015).

Benzoic acid and its benzoate salts (sodium, potassium and calcium) are used to inhibit the growth of Escherichia coli, Listeria monocytogenes, Aspergillus sp. Penicillium sp. in processed and cured meat products, therefore avoiding botulism (EFSA, 2016). It is used in a wide range of foods and food groups, such as soft drinks, jams, desserts, chocolate, ice cream, pickles, baked goods, condiments, foods containing strawberries and dairy products, to protect against microbiological risks of various bacteria, yeasts and fungi that cause food poisoning. They are the most frequently used food additives by the food industry (Anand & Sati, 2013). Benzoates have been associated with chronic urticaria, asthma, atopic dermatitis, rhinitis and anaphylaxis, studies supporting allergy-related findings are limited (Rangan & Barceloux, 2009). High doses may cause histamine and prostaglandin release, ulcers, and changes in gastric mucus secretion. It is also suspected that sodium benzoate may cause the development of acute urticaria and angioedema in some individuals, increase asthma attacks, have neurotoxic and carcinogenic effects, and cause (Nettis, Colanardi, Ferrannini, & Tursi, 2004; Skypala, Williams, Reeves, Meyer, & Venter, 2015). Sorbates are salts or esters of sorbic acid, a naturally occurring organic acid. Potassium sorbate (E202) and sorbic acid (E200) are the most commonly used forms in the food industry. These compounds disrupt the normal functioning of microorganisms, preventing cells from dividing and growing. This effect helps extend the shelf life of food products. Processed cheeses, milk-based desserts, various sauces, and bakery products are the foods in which sorbates are most commonly used (EFSA, 2015).

Nitrites and nitrates are antimicrobial substances used to protect foods against bacterial, mold, and yeast spoilage, extend shelf life and preserve the natural color and flavor of foods. Especially, nitrite and nitrate are food additives that are inevitably used in the meat industry (EFSA, 2017a; 2017b). When the Turkey Nutrition and Health Survey (TNHS) 2017 results are compared with the TNHS 2010 results, it is seen that the daily average amount of meat group consumption, including processed meat products, has increased in male and female individuals over the age of 19 (TBSA, 2019). Excessive intake of nitrites and nitrates can lead to stomach cancer, which is seen as a result of the formation of nitrosamines, which are reported by the International Agency for Research on Cancer (IARC) to be possibly or probably carcinogenic to humans. Nitrosamines are formed endogenously in humans as a result of the conversion of nitrate to nitrite and the combination of nitrite with secondary amines in protein foods in the acidic environment of the stomach (IARC, 1987; Mensinga, Speijers, & Meulenbelt, 2003). Such nitrosamines can also be formed in processed dried meat products and/or during the heating of meat products at high temperatures (Xie et al., 2016).

One of the most significant aspects of the risk assessment process is exposure assessment, defined as people’s entire intake of a chemical agent (JECFA, 1987). Exposure assessment of food additives and their potential risks to human health must be determined, and risk analyzes of these substances must be carried out regularly. The main purpose of dietary intake evaluations of food additives is to protect consumer health and provide a basis for legal regulations. Since different subgroups of the population are exposed to different amounts of these dietary chemicals, estimating the likely lifetime consumption by age. In addition, consumers should know the frequency and amount of food consumption to which these food additives are added (Karakaya, 2019).

This research aims to evaluate dietary exposure to some preservative food additives (benzoate, sorbate, nitrite, nitrate) in young adults aged 19-45 and compare exposure amounts with daily acceptable intake levels (ADI).

MATERIALS AND METHOD

Research Type

The research is a pilot study planned as a descriptive observational.

Study Population and Sample

This research was conducted by face-to-face interviews with 48 male and female individuals aged 19-45 who live in town between October 2021 and January 2022. Having chronic diseases diagnosed by a doctor, such as diabetes, liver diseases, kidney diseases, primary and secondary hypertension, gastrointestinal system diseases, cardiovascular disease, oncological and hematological diseases, which require medication use and a special medical nutritional treatment, pregnant, lactating and menopausal women were excluded. Individuals who volunteered to participate in this study, aged 19-45, literate and able to answer the questions were included in the research.

Data Collection Tools

The participants' demographic characteristics and nutritional habits were evaluated by applying a general survey form. To determine the dietary intake levels of some preservative food additives (benzoate, sorbate, nitrite, nitrate), a semi-quantitative processed food consumption frequency form designed by the researcher based on the NOVA food classification system defined by Monteiro et al. (2019) (Monteiro, Cannon, Lawrence, Louzada, & Machado, 2019) was used individuals' total energy intake and energy intake from ultra-processed foods were obtained from semi-quantitative food consumption frequency.

General Survey Form: A face-to-face interview method was applied to the survey form, consists of 20 closed-ended questions, which includes the sociodemographic characteristics of individuals, including subheadings such as age, gender, marital status, education level, profession, and socioeconomic status. In the general survey form, individuals' disease information, medication use, smoking, and alcohol consumption were also asked. To evaluate eating habits, skipping meals, the most frequently skipped meal, frequency of consumption outside the home, generally preferred meal(s) for consumption outside the home, and type of food were questioned.

Processed Food Frequency Questionnaire: NOVA classification evaluates foods in four groups according to the degree of processing. The first group of the designed food frequency questionnaire includes unprocessed or minimally processed foods, the second group includes processed additives used in cooking, the third group includes processed foods, and the fourth group includes ultra (advanced) processed foods. Ultra-processed foods, which are in the fourth group of the processed food frequency questionnaire, were determined according to the food categories in which the use of preservative food additives (benzoate, sorbate, nitrite and nitrate) is allowed, concerning the Turkish Food Codex Food Additives Regulation 2023 (Türk Gıda Kodeksi Gıda Katkı Maddeleri Yönetmeliği, 2023). Approximately one portion amount of a total of 106 food items including ultra-processed foods, was adapted according to the portion size in Turkey Dietary Guideline 2015 (TÜBER, 2015) and the amount sold in the market. Foods according to average consumption frequency; It was evaluated in 8 categories: twice a day or more, every day, 1-2 times a week, 3-4 times a week, 5-6 times a week, twice a month, once a month and less than/never once a month. The amount of consumption of the relevant food item at a time was questioned as ½ portion, 1 portion, 2 portions.

Research Application Process

First, a daily consumption amount of processed foods containing preservative food additives, designed according to the NOVA category, was determined from the consumption frequency in the last year and the single-day consumption amount. Total energy intake from the processed food frequency questionnaire and energy intake from ultra-processed foods were calculated. Afterwards, the amount of additives contained in processed foods containing preservative food additives was calculated based on the maximum permitted use levels (MPL) in the Turkish Food Codex Food Additives Regulation (Türk Gıda Kodeksi Gıda Katkı Maddeleri Yönetmeliği, 2023). The dietary exposure level to preservative food additives was obtained by multiplying the daily consumption amount of foods containing the relevant additives and the amount of additives they contain (MPL). Individuals' daily additive

intake (mg) calculated per body weight (kg) is compared with the ADI [acceptable daily intake amount (mg/kg body weight)] values determined by the European Food Safety Authority (EFSA) and the risk of exceeding the ADI value of the relevant additive is determined. It was evaluated whether or not (EFSA 2015; EFSA, 2016; EFSA, 2017a, 2017b).

Ethical Consideration

Ethics committee approval was received from the Non-Interventional Clinical Research Ethics Committee of a Bandırma Onyedi Eylul University (Date: 30.06.2021 and Approval no: 2021/53).

Data Analysis

Data obtained in the study were analyzed statistically using IBM SPSS 25 (IBM Corpn., Armonk, NY, USA). The statistical significance level was accepted as $p<0.05$. Descriptive statistics (number, percentage, minimum and maximum values, mean and standard deviation) were used. The suitability of the data for normal distribution was analyzed with the Kolmogorov-Smirnov test. Descriptive statistical parameters (mean, standard deviation, minimum and maximum) were calculated and Spearman Correlation analysis was performed.

RESULTS

The study included 48 individuals with an average age of 28.6 ± 9.32 years (19-45 years). It was determined that the majority of individuals (91.6%) had an education level of 8 years or more, were single (70.8%) and students (47.6%), and did not use cigarettes (75%) or alcohol (72.9%). It was determined that 91.7% of individuals skipped meals and the most frequently skipped meal was lunch. Dinner is the most commonly preferred meal outside the home. Fast-food is the most generally preferred outside (Table 1).

According to the data obtained from the processed food frequency questionnaire, the average daily intake of benzoate, sorbate, nitrite, and nitrate per body weight of individuals is 0.13 ± 0.25 mg/kg, 0.86 ± 1.00 mg/kg, 0.02 ± 0.03 mg/kg and 0.007 ± 0.01 mg/kg, respectively. While the average daily intake of benzoate, sorbate, nitrite and nitrate in men was 0.23 ± 0.44 mg/kg, 0.43 ± 0.30 mg/kg, 0.03 ± 0.03 mg/kg and 0.01 ± 0.02 mg/kg, respectively; Among women, it is 0.09 ± 0.10 mg/kg, 1.04 ± 1.13 mg/kg, 0.02 ± 0.03 mg/kg and 0.0042 ± 0.01 mg/kg, respectively. When individuals' exposure levels to preservative food additives are compared with ADI values, the percentage of dietary intake of benzoate, sorbate, nitrite, and nitrate meeting ADI values are respectively; 2.73 ± 5.12%, 28.91 ± 33.61%, 38.06 ± 51.43%, 0.18 ± 0.47% (Table 2). Intake of sorbate in 4.1% of the participants; nitrite in 8.3% exceeds the ADI value. Dietary intake of benzoate and nitrate was below the ADI value in all participants (Figure 1).

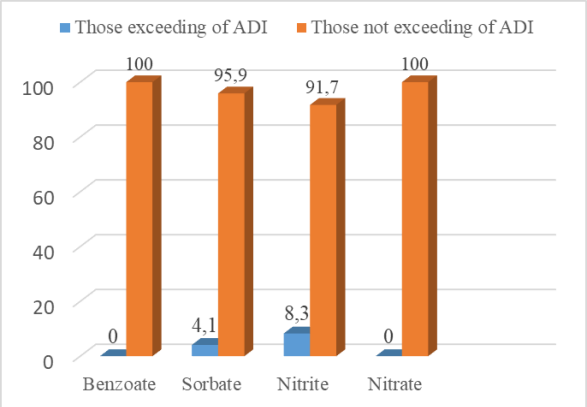

Figure 1. Distribution (%) of Individuals Exceeding ADI Values as a Result of Comparing Individuals' Dietary Intake of Preservative Food Additives with ADI Values

The relationship between the percentage contribution of energy intake from ultra-processed foods to individuals' total energy intake and the amount of dietary exposure to preservative food additives (mg/kg body weight/day) is shown in Table 3. Accordingly, as the proportion of total energy intake calculated from the processed food frequency questionnaire coming from ultra-processed foods (NOVA classification Group 4) increases, the intake amount of sorbate per body weight also increases and there is a strong significant relationship between them (Spearman's correlation test, $r = 0.548$; $p<0.001$). There was no significant relationship between nitrite, nitrate, and benzoate intake and the percentage contribution of energy from ultra-processed foods (Table 3).

Table 1. Distribution of Demographic Characteristics and Nutritional Habits of Individuals by Gender

Variables	**Male (n=14)**		**Female (n=34)**		**Total (n=48)**	
Age (Year)	$\overline{X}$ ±SS 34.07±8.15 (19-45)		$\overline{X}$ ±SS 26.14±8.15 (19-45)		$\overline{X}$ ±SS 28.65± 9.32 (19-45)	
	Number	**%**	**Number**	**%**	**Number**	**%**
Education Status						
≤8 years	1	7.2	3	8.8	4	8.4
>8 years	12	92.8	31	91.2	44	91.6
Marital status						
Married	7	50.0	7	20.6	14	29.2
Single	7	50.0	27	79.4	34	70.8
Job						
Housewife	-	-	6	17.6	6	12.5
Student	1	7.1	22	64.7	23	47.6
Employee	9	64.3	6	17.6	15	31.3
Self-employment	4	28.6	-	-	4	8.4
Smoking Status						
I use	5	35.7	7	20.6	12	25.0
I don't use	9	64.3	27	79.4	36	75.0
Alcohol Consumption Status						
I use	4	28.6	9	26.5	13	27.1
I don't use	10	71.4	25	73.5	35	72.9
Skipping Meals						
Yes	11	78.6	33	97.1	44	91.7
No	3	21.4	1	2.9	4	8.3
Most Frequently Skipped Meal *						
Breakfast	3	27.3	8	24.2	11	25.0
Lunch	5	45.5	22	66.6	27	61.4
Dinner	-	-	2	6.0	2	4.54
Snacks	5	45.5	12	36.4	17	38.6
Frequency of Food Consumption Outside the Home						
2 times a day	2	14.3	3	8.8	5	10.4
1 time per day	5	35.7	-		5	10.4
5-6 times a week	-	-	3	8.8	3	6.2
3-4 times a week	2	14.3	7	20.6	9	18.8
1-2 times a week	5	35.7	14	41.2	19	39.6
2 times a month	-	-	7	20.6	7	14.6
The Most Frequently Preferred Meal Outside the Home**						
Breakfast	4	28.6	3	8.8	7	14.6
Lunch	9	64.3	13	38.2	22	45.8
Dinner	8	57.1	26	76.5	34	70.8
Snacks	3	21.4	3	8.8	6	12.5
The Most Frequently Preferred Food Type Outside the Home						
Fast-Food Foods (Hamburger, Döner, Kebab, Pita, Lahmacun, Raw Meatballs, Gözleme, etc.)	13	92.9	31	92.2	44	91.7
Home cooking	1	7.1	3	8.8	4	8.3

*Percentages are based on the number of individuals skipping meals and-more than one individual are responding

Table 2. Individuals' Average Intake of Preservative Food Additives per Body Weight (mg/kg body weight) and Percentages of Meeting ADI (mg/kg body weight) Values

	Male (n=14)		Female (n=34)		Total (n=48)	
	Additive intake (mg/kg body weight)	**ADI %**	**Additive intake (mg/kg body weight)**	**ADI %**	**Additive intake (mg/kg body weight)**	**ADI %**
	$\overline{X}$ ±SS	$\overline{X}$ ±SS	$\overline{X}$ ±SS	$\overline{X}$ ±SS	$\overline{X}$ ±SS	$\overline{X}$ ±SS
Benzoate	0.23 ± 0.44	4.48 ± 0.90	0.09 ± 0.10	1.92 ± 2.06	0.13 ± 0.25	2.73±5.12
Sorbate	0.43 ± 0.30	14.43 ± 10.29	1.04 ± 1.13	34.87 ± 37.96	0.86 ± 1.00	28.91 ± 33.61
Nitrite	0.03 ± 0.03	47.57 ± 50.26	0.02 ± 0.03	34.14 ± 52.13	0.02 ± 0.03	38.06 ± 51.43
Nitrate	0.01 ± 0.02	0.36 ± 0.55	0.0042 ± 0.01	0.11 ± 0.42	0.0073 ± 0.018	0.18 ± 0.47

ADI = Acceptable daily intake (mg/kg/body weight)

Table 3. The Relationship Between the Percentage Contribution of Energy Intake From Ultra-Processed Foods to the Total Energy Intake of Individuals and the Exposure Level of Preservative Food Additives (mg/kg body weight/day)

		Contribution of Ultra-Processed Foods to Total Energy Intake (%)	**Nitrite (mg/kg body weight)**	**Nitrate (mg/kg body weight)**	**Benzoate (mg/kg body weight)**	**Sorbate (mg/kg body weight)**
Contribution of Ultra-Processed Foods to Total Energy Intake (%)	r	1,000	0.182	0.129	0.227	**0.548** *
	p	-	0.214	0.382	0.121	**0.000**

Spearman's correlation test *p<0.001

DISCUSSION

Food additives are chemical substances to which individuals in population and its subgroups, which are critical in food security and safety, may be exposed throughout their lives. With the increase in ultra-processed food consumption, especially since the 20th century, exposure levels to additives have also increased, bringing the risk of exceeding ADI values. Although exceeding the ADI value may cause adverse health risks, the percentage of exceeding the ADI value for a long time should also be known to cause adverse health effects (Bayram & Ozturkcan, 2021).

In a study conducted to determine dietary exposure levels to nitrite and nitrate in 1474 adult men and women in France, a seven-day food consumption record form was used to obtain food consumption data. A chemical analysis method was used to determine the amount of additives in foods. As a result of the study, only nitrite and nitrate intakes in the 95th percentile exceeded the ADI value; Average preservative additive intakes were found to be below ADI values (Menard, Heraud, Volatier, & Leblanc, 2008). A similar study was conducted in Spain on 41 446 male and female individuals aged between 29 and 69. As a result of the data obtained from chemical analysis and semi-quantitative food frequency questionnaire, it was concluded that nitrite intake exceeded ADI values at average consumptions (Jakszyn et al., 2006). Nitrite intake has been determined to be higher than the ADI value, attributed to the consumption of sausages and frozen meats in Türkiye (Cebioğlu & Önal, 2018). In a recent study conducted on 433 adults in a similar sample to our research (mean age 25.8 ± 9.48 years, 72.3% female, 27.7% male). The consumption of frozen meat/chicken/fish products was determined by food frequency questionnaire and dietary exposure was calculated based on maximum permitted levels. It has been reported that nitrite and nitrate exposure at the 95th percentile exceeds the ADI value (Bayram & Ozturkcan, 2022).

In the dietary exposure study conducted in Belgium, according to the calculation obtained from the two-day food consumption record and MPL values of 641 individuals aged 18-40, the average benzoic acid intake was found to be

below the ADI value; It was stated that the ADI value was exceeded at the 94th percentile in the adult group (Bilau, Matthys, Vinkx, & De Henauw, 2008). Similarly, in our study, the percentage of participants' average daily preservative additive intake meeting the ADI values is below 50%, and only 4.1% of them have sorbate intake and 8.2% have nitrite intake above the ADI values. According to this study's findings, there is no risk of exceeding acceptable daily intakes of preservative additives in the selected sample. The high education level of the individuals participating in our research may be effective in these results.

According to the results of our research, as the proportion of total dietary energy intake from ultra-processed foods (NOVA Group 4) increases, the intake amount of sorbate per body weight also increases (Spearman's correlation test, $r = 0.548$; $p<0.001$). No statistically significant relationship was found between nitrite, nitrate and benzoate intake per body weight and the contribution of ultra-processed foods to total energy intake. Adopting a Western-style diet causes an increase in processed food consumption. According to many epidemiological studies, processed food consumption is increasing daily, and exposure to food additives may exceed ADI values. According to research, consumption of processed foods containing additives can constitute 25-50% of the total daily energy intake (Moubarac et al., 2013; Adams & White, 2015; Louzada et al., 2015; Steele et al., 2016; Cediel et al., 2018; Zhong, Wu, Chen, Huang, & Hu, 2018). In our research, the participants' preferred food for out-of-home is fast food. Their preference for food also shows that a Western-style diet has been adopted.

Dietary exposure studies are a very important in food additive risk assessment studies. Exposure studies must be carried out at regular intervals to carry out risk assessment studies in our country (FAO/WHO, 2014). Studies on dietary exposure to food additives in Türkiye are insufficient due to the lack of knowledge in population subgroups and the lack of comprehensive food consumption data. Although there are studies investigating the consumption of foods containing food additives in our country when the literature is reviewed (Cebioğlu & Önal, 2018; Melekoğlu, 2021; Acıduman Subaşıay, 2022), no studies have been found that evaluate chronic exposure to benzoate, sorbate, nitrite and nitrate in young adult, through semi-quantitative processed food frequency questionnaire.

This research is a pilot study, so the sample size is limited and only includes young adult men and women. Individuals who live in town are included in the study. The findings do not reflect average exposure levels in various subgroups (such as infants, young children, adolescents, pregnant women, and elderly) in Türkiye. Although another limitation of the study is that the amount of preservative food additives in foods cannot be determined using chemical analysis methods, the amount of relevant preservative food additive intake was determined using a semi-quantitative processed food frequency questionnaire applied with a face-to-face method developed for foods containing these additives specifically. Since the processed food frequency questionnaire asks about consumption in the last year, it provides a more accurate estimate of chronic exposure to additives.

CONCLUSION

This study is a descriptive pilot study examining the assessment of exposure risk of preservative food additives (benzoate, sorbate, nitrite and nitrate), which are widely allowed for use in many food categories in Türkiye. In the study, exposure assessment to preservatives was carried out using the conservative approach (MPL method) recommended by EFSA. Estimated mean exposure levels per body weight to preservatives were below the ADI percentages. However, sorbate and nitrite intake were observed to be above the ADI value in some participants.

Preservative food additives are chemical substances that are allowed to be used in certain amounts in a wide range of food categories to ensure microbial stability and improve the shelf life and organoleptic properties of foods. Given the increasing concern about food additives in food supply, the health outcomes of additives need to be the responsibility of both the producer and the consumer and be monitored more closely. These chemicals are tightly controlled by regulatory bodies such as EFSA, the Food and Drug Administration (FDA), and the Joint FAO/WHO Expert Committee on Food Additives (JECFA) globally. Especially processed meat products, soft drinks, carbonated drinks, sauces, and processed cheeses are ultra-processed foods with preservative chemicals. Increasing the frequency and quantity of consumption of ultra-processed foods brings with it the risk of exposure

to preservative additives. More studies that include dietary exposure calculations of additives are needed so that each country can conduct its risk assessment studies.

Ethics Committe Approval

Ethics committee approval was received for this study from the Bandırma Onyedi Eylul University Non-Interventıonal Research Ethics Committee (Date: 30.06.2021, and Approval No: 2021/53).

Author Contributions

Idea/Concept: K.D.E; E.K.; Design: K.D.E; E.K.; Supervision/Consulting: E.K; Analysis and/or Interpretation: K.D.E.; E.K.; Literature Search: K.D.E.; Writing the Article: K.D.E; E.K.; Critical Review: E.K; K.D.E.

Peer-review

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Conflict of Interest

The authors have no conflict of interest to declare.

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