

**A COMPREHENSIVE STUDY OF THE PRESENCE OF SOME  
FOOD ADDITIVES IN NON ALCOHOLIC BEVERAGES IN  
REPUBLIC OF MACEDONIA FROM THE PERIOD 2008– 2012**

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## ✓ Introduction

Food additives are used in the modern food industry for maintaining food quality as well as promoting food safety. Additives are used in foods to replace the taste lost in processing, enhance their texture or appearance, prolong the shelf life, stop food from decaying. They are also used to enhance the flavour, to give an extra taste to the food products and to make foods more appealing.

The use of food additives in foodstuffs is regulated by European legislation and only authorised additives may be used in food specified in the legislation. Authorisation in this context means that the additive is included in a “positive” list as laid down in the legislation.

- ▶ The question of food additive safety is one that has received widespread attention in recent years?



## ✓ Objective of the study

- ▶ Soft drinks can contain many additives including artificial colorants, artificial sweeteners, preservatives, stimulants (caffeine), flavor components etc.
- ▶ In order to assure the quality of soft drinks, as well as their safety for human consumption, the main objective of this study research has been the determination of the presence of food additives in soft drinks produced and imported in the Republic of Macedonia.

## ✓ Samples

- ▶ A total of 872 samples were collected at retail level by officers of the Macedonian Food Agency over the period March 2008 to December 2012, for analysis of artificial food colours, artificial sweeteners, food preservatives, caffeine, quinine chloride, citric acid, phosphoric acid and ascorbic acid. The samples mainly comprised carbonated mineralised, and water based non alcoholic flavoured drinks, which were imported (751 samples) and produced (121 samples) in the Republic of Macedonia.

## ✓ Methods

FOOD ADDITIVE	METHOD
ARTIFICIAL COLORANTS	HPLC with DAD
ARTIFICIAL SWEETENERS, PRESERVATIVES AND ASCORBIC ACID	HPLC with DAD
CAFFEINE	HPLC with DAD
PHOSPHORIC ACID AND CITRIC ACID	ION CHROMATOGRAPHY with CONDUCTIVITY DETECTOR
QUININE	HPLC with FLUORESCENCE DETECTOR

## ✓ Results

The results of the presence of artificial food colorants in imported soft drinks

Food colorant	Number of tested samples	Number of positive samples	Concentration range (mg/L)	Maximum permitted level - MPL (mg/L)	Number of samples with colour content above MPL (mg/L)	Number of samples with colour detected but not labelled
Tartazine (E102)	550	283	<1.0 – 68.3	100	-	3
Sunset Yellow FCF (E 110)	560	260	<1.0 – 70.1	50	8	2
Quinoline Yellow (E 104)	505	242	<2.0 – 65.4	100	-	2
Carmoisine (E 122)	210	43	<1.0 – 70.5	50	5	1
Amaranth (E123)	185	55	<1.0 - 56.8	100	-	3
Ponceau 4R (E 124)	158	65	<1.0 – 69.8	50	3	2
Allura red (E 129)	149	48	<1.0 – 35.5	100	-	-
Erythrosine B (E 127)	92	58	<0.9 – 23.4	100	-	-
Brilliant Black BN (E 151)	87	42	<0.8 - 25.4	50	-	-
Brilliant Blue FCF (E 133)	21	10	<1.0 - 30.1	100	-	-

## The results of the presence of artificial food colorants in domestic soft drinks

Food colorant	Number of tested samples	Number of positive samples	Concentration range (mg/L)	Maximum permitted level - MPL (mg/L)	Number of samples with colour content above MPL (mg/L)	Number of samples with colour detected but not labelled
Tartazine (E102)	52	48	<1.0 - 43.3	100	-	3
Sunset Yellow FCF (E 110)	105	105	<1.0 - 80.3	50	3	2
Quinoline Yellow (E 104)	43	40	<2.0 - 55.4	100	-	-
Carmoisine (E 122)	18	15	<1.0 – 61.8	50	6	1
Amaranth (E123)	15	12	<1.0 - 66.8	100	-	1
Ponceau 4R (E 124)	23	18	<1.0 – 75.3	50	5	1
Allura red (E 129)	22	18	<1.0 – 15.5	100	-	-
Erythrosine B (E 127)	18	10	<0.9 – 13.4	100	-	-
Brilliant Black BN (E 151)	19	12	<0.8 – 28.3	50	-	-
Brilliant Blue FCF (E 133)	10	6	<1.0 - 15.1	100	-	-

- ▶ According to the obtained results, the most abundant artificial food colorants in tested samples (imported and domestic), were Tartazine (E 102) , Sunset Yellow FCF (E 110), and Quinoline Yellow (E 104). Tartazine was found in 51.4% of tested imported soft drinks (283 samples) and in 92.3% of tested domestic brands (48 samples).



**The results of the content of artificial food preservatives in imported brands of soft drinks**

<b>Food preservative</b>	<b>Number of tested samples</b>	<b>Number of positive samples</b>	<b>Concentration range (mg/L)</b>	<b>Maximum permitted level - MPL (mg/L)</b>	<b>Number of samples with colour content above MPL (mg/L)</b>	<b>Number of samples with colour detected but not labelled</b>
<b>Benzoic acid (E211)</b>	<b>85</b>	<b>80</b>	<b>83.4 – 178.5</b>	<b>150</b>	<b>3</b>	<b>3</b>
<b>Sodium benzoate (E210)</b>	<b>289</b>	<b>268</b>	<b>77.5 – 180.4</b>	<b>150</b>	<b>4</b>	<b>5</b>
<b>Sorbic acid (E200)</b>	<b>121</b>	<b>78</b>	<b>180.3 – 250.4</b>	<b>300</b>	<b>-</b>	<b>3</b>
<b>Potassium sorbate (E202)</b>	<b>156</b>	<b>95</b>	<b>175.6 – 310.2</b>	<b>300</b>	<b>2</b>	<b>4</b>

## The results of the content of artificial food preservatives in domestic brands of soft drinks

Food preservative	Number of tested samples	Number of positive samples	Concentration range (mg/L)	Maximum permitted level - MPL (mg/L)	Number of samples with colour content above MPL (mg/L)	Number of samples with colour detected but not labelled
Benzoic acid (E211)	55	5	83.4 – 108.5	150	-	-
Sodium benzoate (E210)	99	34	80.3 – 160.2	150	1	2
Sorbic acid (E200)	48	7	140.3 – 145.3	300	-	-
Potassium sorbate (E202)	59	8	155.6 - 140.2	300	-	-

- ▶ According to the obtained data, the most prominent preservative in imported soft drinks, as well as, in domestic brands was sodium benzoate (93.3%, and 34.3%, respectively). Sodium benzoate was present over the MPL in 1.5% of the tested imported samples and in 2.94% of domestic brands.

## The results of the content of artificial food sweeteners in imported brands of soft drinks

<b>Food sweetener</b>	<b>Number of tested samples</b>	<b>Number of positive samples</b>	<b>Concentration range (mg/L)</b>	<b>Maximum permitted level - MPL (mg/L)</b>	<b>Number of samples with colour content above MPL (mg/L)</b>	<b>Number of samples with colour detected but not labelled</b>
<b>Aspartame (E951)</b>	125	87	198.3 – 420.4	600	-	-
<b>Acesulfame potassium (E950)</b>	115	95	180.5 – 330.1	350	-	-
<b>Saccharin sodium (E954)</b>	52	43	55.8 – 77.9	80	-	-
<b>Cyclamate sodium (E952)</b>	48	40	230.5 – 270.1	250	1	2

## The results of the content of artificial food sweeteners in domestic brands of soft drinks

<b>Food sweetener</b>	<b>Number of tested samples</b>	<b>Number of positive samples</b>	<b>Concentration range (mg/L)</b>	<b>Maximum permitted level - MPL (mg/L)</b>	<b>Number of samples with colour content above MPL (mg/L)</b>	<b>Number of samples with colour detected but not labelled</b>
<b>Aspartame (E951)</b>	35	20	178.6 – 395.6	600	-	-
<b>Acesulfame potassium (E950)</b>	28	21	202.4 – 334.6	350	-	-
<b>Saccharin sodium (E954)</b>	26	22	67.8 – 115.3	80	1	3
<b>Cyclamate sodium (E952)</b>	26	23	118.5 – 220.5	250	-	-

- ▶ Artificial sweeteners are often used to control calorie intake and in certain medical conditions such as diabetes and hyperglycemia. According to our survey, aspartame was the most predominant sweetener in imported and domestic brands as well.

The results of the presence of citric acid, phosphoric acid, L- ascorbic acid , caffeine and quinine in imported brands of soft drinks

<b>FOOD ADDITIVE</b>	<b>Number of tested samples</b>	<b>Number of positive samples</b>	<b>Concentration range (mg/L)</b>	<b>Maximum permitted level - MPL (mg/L)</b>	<b>Number of samples with colour content above MPL (mg/L)</b>	<b>Number of samples with colour detected but not labelled</b>
<b>CITRIC ACID (E330)</b>	<b>156</b>	<b>128</b>	<b>1220 - 1680</b>	<b>*</b>	<b>-</b>	<b>-</b>
<b>ASCORBIC ACID (E300)</b>	<b>143</b>	<b>95</b>	<b>55.4 – 110.0</b>	<b>*</b>	<b>-</b>	<b>-</b>
<b>PHOSPHORIC ACID (E338)</b>	<b>98</b>	<b>68</b>	<b>530.4 – 551.2</b>	<b>700</b>	<b>-</b>	<b>-</b>
<b>CAFFEINE</b>	<b>98</b>	<b>68</b>	<b>140.6 – 149.7</b>	<b>150</b>	<b>-</b>	<b>-</b>
<b>QUININE HYDROCHLORIDE</b>	<b>48</b>	<b>38</b>	<b>76.5 – 83.5</b>	<b>85</b>	<b>-</b>	<b>-</b>

**\* MPL not established (The amount which is needed – Quantum satis)**

The results of the presence of citric acid, phosphoric acid, L- ascorbic acid , caffeine and quinine in domestic brands of soft drinks

<b>FOOD ADDITIVE</b>	<b>Number of tested samples</b>	<b>Number of positive samples</b>	<b>Concentration range (mg/L)</b>	<b>Maximum permitted level - MPL (mg/L)</b>	<b>Number of samples with colour content above MPL (mg/L)</b>	<b>Number of samples with colour detected but not labelled</b>
<b>CITRIC ACID (E330)</b>	45	40	1345 - 1560	*	-	-
<b>ASCORBIC ACID (E300)</b>	35	30	35.8 – 85.6	*	-	-
<b>PHOSPHORIC ACID (E338)</b>	16	16	480.5 – 550.6	700	-	-
<b>CAFFEINE</b>	16	16	135.6 – 145.3	150	-	-
<b>QUININE HYDROCHLORIDE</b>	10	10	78.6 – 80.7	85	-	-

\* MPL not established (The amount which is needed – Quantum satis)



## ✓ Conclusion

- ▶ The results obtained from the study showed that the most prominent additives in the imported soft drinks were found to be preservatives potassium sorbate and sodium benzoate, which were present in 80% of tested samples. Synthetic colorants were present in 44% of tested the samples, caffeine in 69% , artificial sweeteners in 78%, quinine chloride in 74% and citric, ascorbic and phosphoric acid in 73% of tested soft drinks. In domestic brands, preservatives were found in 21.0% of tested samples, artificial sweeteners in 75%, and synthetic colorants in 87.4%. The concentrations of caffeine, quinine chloride, citric acid, phosphoric and ascorbic acid in domestic brands of soft drinks were found to be similar to those found in imported samples.
- ▶ Soft drinks take an important part in the total daily intake of food additives. Therefore, the constant monitoring of their presence in non alcoholic beverages is needed to ensure compliance with food safety regulations as well as for calculating risk assessment.

**THANK YOU FOR YOUR ATTENTION**