

PHYSIOLOGICAL STATUS OF „RADLER“ TYPE PRODUCTS AS AFFECTED BY ENVIRONMENTAL CONTAMINATION FOLLOWING NATO AIR STRIKES ON THE REGIONS OF SERBIA

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Abstract: Beer-based drinks, „Radler“ type products in particular, arouse interest for a number of reasons. These newly produced drinks were obtained by mixing beer and soft drinks and are intended for a larger number of target groups than their each single component. Also, they combine advantages of both components in physiological respect. They have lower alcohol content than beer, are more palatable and refreshing, can be consumed in larger amounts, retaining beneficial and physiological value of beer. As NATO air strikes resulted in heavy environmental contamination, the question is raised about the safety of these drinks and the level of toxic elements in them as well about the level of micro- and macro-elements having beneficial effects on the body.

The paper gives the analysis results for 35 samples of different „Radler“ beer-based products manufactured by domestic producers. The level of elements belonging to three distinct groups of heavy metals and that of the most important micro- and macro-elements, of therapeutic and physiological value for the body, were determined. The obtained values were compared with available data on similar products in the world, with values obtained for domestic products in the period preceding environmental contamination, and, in the case of biologically important elements, with their contents in one of oligomineral-vitamin products.

Key words: beer-based products, heavy metals, macro- and micro-elements, physiological value.

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Introduction

Beer-based products, launched out on the world market not long ago, proved to be a very clever business move of beer manufactures. A selection of new products with the addition of cooling non-alcoholic beverages („Radler“ type drinks), refreshing non-alcoholic and alcoholic drinks („Long drink“ type) and a variety of stimulating caffeine type substances (energy drinks) enabled breweries to gain new markets and consumer target groups. Among these, „Radler“ type beverages are leading due to their refreshing nature and lower alcohol content than in beer. They are getting increasing popularity among youth. They can be consumed in relatively high amounts to quench the thirst but also to produce a particular physiological effect characteristic of beer. This was the reason why domestic beer industry started to manufacture such product.

It is well known that beer is one of the safest drinks from the physiological aspect. Beer enables human body to make up for water by intake of numerous substances essential to metabolism and has therapeutic properties (stimulates diuresis, prevents coronary disease). At the same time, it has relaxing and stimulating effects on the body (Leskošek-Čukalović, 1995). The stated facts certainly hold true only for moderate consumption of beer. Alcohol content, which is four times lower than in wine and ten times lower than in strong alcoholic drinks, is a factor still limiting safe daily intake of beer to approx. 1 liter. A mixture of beer and soft drink in the 1:1 ratio gives a new product that still has a particular physiological value, due to beer per cent in it, and is for sure more nutritive than standard soft drinks of the Coca Cola, Tonic, etc. type. There are very few biologically valuable components in soft drinks. Their nutritive and energy value mainly comes from sugar content (Niketić-Aleksić, 1989). Alcohol content in „Radler“ is 50% lower than in standard beer, so it can be easily resorbed and eliminated from the body (Leskošek-Čukalović, 1998). Consequently, limits for daily beer intake can not be applied to „Radler“ and allowable amounts, impossible to be measured in blood, are proportionally higher. „Radler“ type products can be consumed in substantially higher amounts than beer, therefore their physiological safety issue is even more significant. A number of facts are gaining in importance today.

Physiological value of beer is directly dependent upon raw material quality. The process of manufacturing is designed to eliminate and inactivate most well known harmful components and to prevent contamination of end-product. However, this applies only to conditions of normal urban pollution. All to date available data on the content of some components present in beer were obtained for standard production conditions i.e. raw materials were obtained under presence of harmful components developed by larger- or smaller-scale industrial pollution. Eleven-week NATO alliance bombing of our country was followed by ecological contamination never recorded before in the literature dealing with beer production. Estimates of contamination extent and intensity in different areas of food pro-

duction require time and serious laboratory analyses. But what can be stated at present is that approx. 780,000 - 1,027,000 tons of high-energy fuel was consumed for combustion in explosions of bombs and missiles, destruction of chemical plants and electrical power system, with altogether 39,000 - 51,000 flights of NATO aviation. Thus, on a relatively small area of Yugoslavia, the effect of kerosene energy consumption emitted to the atmosphere equaled 37,624,000 - 44,161,000 TJ (Todorović, 1999). This caused emission of numerous heavy metals that penetrated soil and water, not to mention cancerogenic vinyl chloride monomer, phosgene, hydrogen chloride, etc. developed by emission and combustion of heterogeneous chemical substances, which was all, luckily, or unluckily, of local character. Under such circumstances, the issue of physiological safety of beer and beer-based products can be viewed from a new angle.

To find out the effects of emission of some elements on the presence of heavy metals ions as well as on other essential micro- and macro-elements, investigations were conducted on the content of beer elements important in physiological respect. Beers of domestic producers, manufactured after NATO air strikes ceased, and beer-based „Radler“ type products were investigated.

Material and Method

Investigations included 5 series of „Radler“ type products obtained from 7 beer samples. Beers, manufactured between July 1 and August 1, 1999 by domestic producers, were taken from market, while soft drinks were laboratory-prepared. Soft drinks were prepared with the addition of the flavors such as forest fruits, bubble gum, herb, cola, lemon, manufactured by different producers e.g. „Akra“, „Greda“, „Mirna“ and others according to the recipe that meets the sensory demands of „Radler“ type products. The contents of the most important micro- and macro-elements were investigated: three groups of heavy metals (density $> 5 \text{ g/cm}^3$) - very toxic - *lead*, *cadmium* and *nickel*; less toxic micro-elements that must be present in diet but in very small amounts, for, if contrary, they may be toxic - *copper*, *iron* and *zinc*; and also important but less dangerous than the preceding ones - *cobalt* and *chromium*, as well as macro-elements - *calcium*, *magnesium*, *potassium*, *sodium* and *manganese*. The content of the investigated micro elements and Ca and Mg were determined by the method of atomic absorption spectrophotometry (Varian, spectrAA-10, while those of K and Na by flame photometry (Evans Electro Selenium Ltd.) (Jakovljević et al., 1998; Analytical Methods, 1985).

Results and Discussion

The contents of the elements investigated in the samples of prepared „Radler“ products, based on 7 different beers, are shown in Tables 1-5.

Tab. 1. - Content of the investigated elements in „Radler-forest fruits” samples

Element	„Radler” type products obtained from beers of various producers							Average values
	1	2	3	4	5	6	7	
Pb, mg/l	0.04	0.06	0.04	0.04	0.04	0.05	0.06	0.04
Cd, mg/l	0.0075	0.010	0.0075	0.0100	0.0075	0.0100	0.0075	0.0086
Ni, mg/l	0.02	0.04	0.02	0.02	0.03	0.04	0.04	0.03
Fe, mg/l	0.73	1.31	0.66	0.62	0.71	0.61	0.75	0.77
Zn, mg/l	0.36	0.41	0.33	0.32	0.35	0.35	0.33	0.35
Cu, mg/l	0.18	0.19	0.12	0.13	0.18	0.10	0.12	0.15
Co, mg/l	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02
Cr, mg/l	0.14	0.32	0.14	0.14	0.14	0.14	0.14	0.16
Ca, mg/l	63.2	62.1	65.8	72.2	57.8	64.8	58.7	63.5
Mg, mg/l	24.80	29.55	31.80	28.05	25.80	25.05	27.30	27.48
Na, mg/l	56.05	58.35	49.05	49.05	109.55	49.05	74.65	63.68
K, mg/l	192.05	210.05	195.05	177.05	215.05	192.05	218.05	199.91
Mn, mg/l	0.07	0.31	0.07	0.10	0.06	0.05	0.05	0.10

From the viewpoint of safety, the elements whose presence in foods must be determined first are heavy metals. They are toxic and accumulate in human body, especially in liver. Their half-life is several decades and their permissible level in foods is regulated by legal provisions (Jelinek, 1982; Buttaglia, 1984). The obtained results for levels of heavy metals, regulated for Pb and Cd by the 1992 legal provisions, show that all samples meet the prescribed criteria. Their content was found to be substantially below concentrations permissible for this type of products. Comparisons of current values with those obtained for similar samples last year show that the contents of the investigated elements have not changed much (Leskošek-Čukalović et al., 1999). Accordingly, despite contamination we were subjected to, these products have not changed their physiological value.

Tab. 2.- Content of the investigated elements in „Radler-bubble gum” samples

Element	„Radler” type products obtained from beers of various producers							Average values
	1	2	3	4	5	6	7	
Pb, mg/l	0.04	0.06	0.04	0.04	0.04	0.05	0.06	0.05
Cd, mg/l	0.0075	0.0100	0.0075	0.0100	0.0075	0.0100	0.0075	0.0086
Ni, mg/l	0.025	0.040	0.025	0.025	0.030	0.045	0.045	0.034
Fe, mg/l	0.38	0.97	0.32	0.27	0.37	0.27	0.41	0.43
Zn, mg/l	0.38	0.42	0.34	0.34	0.36	0.36	0.35	0.36
Cu, mg/l	0.22	0.22	0.16	0.17	0.21	0.13	0.16	0.18
Co, mg/l	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02
Cr, mg/l	0.020	0.200	0.020	0.020	0.025	0.020	0.020	0.046
Ca, mg/l	59.1	58.0	61.7	68.1	53.7	60.7	54.6	59.41
Mg, mg/l	25.10	29.85	32.10	28.35	26.10	25.35	27.60	27.78
Na, mg/l	55.15	57.45	48.15	48.15	108.65	48.15	73.75	62.78
K, mg/l	191.45	209.45	194.45	176.45	214.45	191.45	217.45	199.31
Mn, mg/l	0.07	0.31	0.07	0.10	0.07	0.06	0.06	0.11

In beer, maximum allowable *lead* level is 0.3 mg/l. Values found in samples are within the range between 0.04 and 0.06 mg/l, whereas in previous analyses

they ranged from 0.03-0.06 mg/l. The situation with *cadmium* is almost identical, though not pronounced that much. Its maximum permissible concentration in beer is 0.03 mg/l. Values found do not exceed the said values and were found only in products obtained on Cola flavor basis. In other samples, Cd content was below 0.01 mg/l. Values obtained in previous investigations lead to identical conclusions. In most products, Cd content was 0.01 mg/l, however, in the case of some flavors (Cola, pineapple) values of 0.05 mg/l were found. *Nickel* content, as distinguished from Pb and Cd, does not undergo legal provisions, so its content in beer can be compared only against standards for drinking water (max. 0.05 mg/l) (1992, Act). Values found in beer ranged from 0.02 - 0.04 mg/l, except for two samples where Ni concentration was 0.05 mg/l. These are the values that fall into the range of those established in previous investigations, and, on average, they are even lower.

Tab. 3. - Content of the investigated elements in „Radler-herb” samples

Element	„Radler” type products obtained from beers of various producers							Average values
	1	2	3	4	5	6	7	
Pb, mg/l	0.04	0.06	0.04	0.04	0.04	0.05	0.06	0.05
Cd, mg/l	0.0075	0.0100	0.0075	0.0100	0.0075	0.0100	0.0075	0.0086
Ni, mg/l	0.02	0.04	0.02	0.02	0.03	0.04	0.04	0.03
Fe, mg/l	0.49	1.08	0.43	0.38	0.48	0.38	0.52	0.54
Zn, mg/l	0.44	0.49	0.41	0.40	0.43	0.43	0.41	0.43
Cu, mg/l	0.18	0.18	0.12	0.13	0.17	0.09	0.12	0.14
Co, mg/l	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02
Cr, mg/l	0.015	0.195	0.015	0.015	0.020	0.015	0.015	0.041
Ca, mg/l	65.1	64.0	67.7	74.1	59.7	66.7	60.6	65.4
Mg, mg/l	25.00	29.75	32.00	28.25	26.00	25.25	27.50	27.68
Na, mg/l	55.15	57.45	48.15	48.15	108.65	48.15	73.75	62.78
K, mg/l	192.35	210.35	195.35	177.35	215.35	192.35	218.35	200.21
Mn, mg/l	0.06	0.30	0.06	0.09	0.06	0.05	0.05	0.10

Fe, Zn and Cu are heavy metals whose toxicity is expressed only in higher concentrations. But they have functions of micro-elements and are needed in small amounts.

Iron is involved in the production of hemoglobin, myoglobin and some enzymes. It affects proper vitamin B metabolism, supports growth, increases immunity and prevents fatigue. Its content in the investigated products ranged from 0.27 - 1.3 mg/l, compared with data in previous analyses that ranged from 0.54 - 1.04 mg/l. The said values are close to the ones recorded previously for soft drinks. They are slightly higher compared with values characteristic for domestic and foreign beers, however, they are still within the physiological limits (Tab. 6) (Mindel Erl, 1997). Our legal provisions do not regulate Fe content in beer and soft drinks, while in fruit juices its permissible level is 15 mg/l and in wine 5 mg/l (the 1992 Act).

Zinc directs and controls effective course of biological processes in the body

and maintains enzyme systems and cells. It is essential to protein synthesis, blood stability and maintenance of acid-alkaline balance (Mindel Erl, 1997). There are not legal provisions regulating allowable Zn levels in beers and soft drinks, whilst limits were given for wine (5 mg/l) and fruit juices (15 mg/l). Values obtained deviate slightly from one sample to another and are, on average, below 0.4 mg/l, which is considerably below values for the previous period (0.67 - 1.17 mg/l). Zn content reduction was caused by the reduction of this element in beer. This indicates that our beers have approached foreign beers as to this parameter (0.01 - 0.25 mg/l.). It is interesting to note, on the other hand, that Zn is an element found in most vitamin pills. For example, one „Oligovit“ pill (ICN Yugoslavia) contains 0.75 mg of Zn. This means that consumption of 1 liter of „Radler“ drink makes up for 50% of Zn that would otherwise be taken in a pill form. Zn amount contained in one pill is recommendable as a supplement to daily diet during periods of increased activities and immunity reduction.

Copper, as a catalyst, enhances the rate of oxidation in cells. It is needed for transforming body iron into hemoglobin, is a constituent of amino acid tyrosine, enabling it to produce pigments in hair and skin and is essential to vitamin C utilization (Mindel Erl, 1997). Values obtained in the investigated samples were slightly lower than in previous investigations. Cu was found to be in the range between 0.05 and 0.22 mg/l, which is slightly lower than values obtained in previous analyses (0.1-0.26 mg/l). As it is the case with zinc our legal provisions do not regulate permissible Cu levels in beer and soft drinks. Limits are given only for fruit juices (5 mg/l), wine (3 mg/l) and strong alcoholic drinks (10 mg/l). The levels most frequently found in drinking water are between 0.18 and 0.36 mg/l. Compared to „Oligovit“ pills, it comes out that it is the amount in the order of magnitude of 30%.

Tab. 4. - Content of the investigated elements in „Radler-cola“ samples

Element	„Radler“ type products obtained from beers of various producers							Average values
	1	2	3	4	5	6	7	
Pb, mg/l	0.04	0.06	0.04	0.04	0.04	0.05	0.06	0.05
Cd, mg/l	0.027	0.030	0.027	0.030	0.027	0.030	0.027	0.028
Ni, mg/l	0.02	0.04	0.02	0.02	0.03	0.04	0.04	0.03
Fe, mg/l	0.71	1.30	0.65	0.60	0.70	0.60	0.74	0.76
Zn, mg/l	0.42	0.47	0.39	0.38	0.41	0.41	0.39	0.41
Cu, mg/l	0.14	0.14	0.08	0.09	0.13	0.05	0.08	0.10
Co, mg/l	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.02
Cr, mg/l	0.02	0.20	0.02	0.02	0.02	0.02	0.02	0.04
Ca, mg/l	59.6	58.5	62.2	68.6	54.2	61.2	55.1	59.9
Mg, mg/l	24.90	29.65	31.90	28.15	25.90	25.15	27.40	27.58
Na, mg/l	57.2	59.5	50.2	50.2	110.7	50.2	75.8	64.8
K, mg/l	192.65	210.65	195.65	177.65	215.65	192.65	218.65	200.51
Mn, mg/l	0.07	0.31	0.07	0.10	0.07	0.06	0.06	0.11

Cobalt and *chrome* are heavy metals having important functions in the body too. They are less risky for their toxicity than the aforementioned heavy metals.

Co is a constituent of vitamin B12, and is important for erythrocytes. Cr effects metabolism of sugar in conjunction with insulin, supports growth and is important for prophylaxis and reduction of high blood pressure. Both Co and Cr levels do not undergo legal provisions, however, certain data can be taken for a standard. It is considered that an adult needs around 0.2 mg of Cr daily, Cr content in beer being most frequently approx. 7.5 mg/l (ref. Eco-beer). In the majority of analyzed samples, the concentration found was about 0.02 mg/l. Only in the case of „forest fruits“ flavor and of beer produced by one manufacturer the value found was approx. 0.2 mg/l. Similar results were obtained in previous investigations. Co content in all samples was in nearly identical concentration of 0.02 mg/l. Such Co level in one liter of drink is lower by one a half than the daily recommended amount of Co.

Tab. 5.- Content of the investigated elements in „Radler-lemon“ samples

Element	„Radler“ type products obtained from beers of various producers							Average values
	1	2	3	4	5	6	7	
Pb, mg/l	0.04	0.06	0.04	0.04	0.04	0.05	0.06	0.05
Cd, mg/l	0.0075	0.0100	0.0075	0.0100	0.0075	0.0100	0.0075	0.0086
Ni, mg/l	0.03	0.04	0.03	0.03	0.03	0.05	0.05	0.04
Fe, mg/l	0.61	1.20	0.55	0.50	0.60	0.50	0.64	0.66
Zn, mg/l	0.40	0.44	0.36	0.36	0.38	0.38	0.37	0.38
Cu, mg/l	0.15	0.15	0.09	0.10	0.14	0.06	0.09	0.11
Co, mg/l	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.020
Cr, mg/l	0.02	0.20	0.02	0.02	0.02	0.02	0.02	0.046
Ca, mg/l	61.6	60.5	64.2	70.6	56.2	63.2	57.1	61.9
Mg, mg/l	24.70	29.45	31.70	27.95	25.70	24.95	27.20	27.38
Na, mg/l	56.5	58.8	49.5	49.5	110.0	49.5	75.1	64.1
K, mg/l	191.75	209.75	194.75	176.75	214.75	191.75	217.75	199.91
Mn, mg/l	0.07	0.31	0.07	0.10	0.06	0.05	0.05	0.10

In estimating physiological value of „Radler“ type products, emphasis should be placed on *calcium* and *magnesium*. Ca maintains vitality of bones and teeth, has favorable influence on heart function and rhythm, relieves insomnia and supports iron metabolism (Mindel Erl, 1997). Ca content in all investigated products was approx. 62 mg/l. This value exceeds Ca content in all domestic and foreign beers by around 50%. In either cases, this type of drinks can not be treated as foods rich in Ca. But, their consumption actually provides intake of Mg together with Ca. Mg is needed for the metabolism of Ca and vitamin C and P, Na and K. It activates enzyme reactions, forms Mg-ATP complex, activates amino acids and succinates, takes part in stimuli transmission, protein decomposition, reduces cholesterol (Leskošek-Čukalović, 1994). The investigated products contain, with slight deviations, approx. 27 mg/l of Mg, which is about 35% less than the level found in average domestic beers. Though this is not high amount, consumption of 1 liter of drink can meet daily needs of an adult by approx. 10% (Tab.6).

Tab. 6. - Recommended and maximum permissible daily doses, and quantities at which the investigated elements have toxic effect

Element	Recommended daily dose, mg	Maximum permissible daily dose, mg	Toxic effect, g
Fc	12-15	50	3
Mn	2-5	-	-
Cu	1.5-3	250	-
Zn	15-22	60	2
Co	-	-	-
Ni	-	-	-
Pb	-	0.35	0.0008
Cd	-	0.12	-
Cr	0.2	-	-
K	2.500	-	18
Na	200	-	14
Ca	800-1.200	-	2
Mg	250 - 350	-	-

Sodium and *potassium* are also essential to the body. They directly influence normal growth and functions of some organs. They affect the value of osmotic pressure in the body liquors, enzymatic decomposition of carbohydrates and electric capacity of cell membranes. Not only is their total content important but their relative ratio first of all. High K and low Na contents cause diuretic effects, so by eliminating excessive water from the body they have favorable influence in the treatment of cardiovascular diseases, hypertension and edema (Piendl, 1981; Piendl et al. 1988). As well known, it is the K : Na balanced ratio in beer that makes beer's effects on the body very favorable. In all samples approx. 200 mg/l of K and 48-59 mg/l of Na was found, except in one beer. These are slightly higher Na and substantially lower K levels compared with world Pils type beers, therefore stronger diuretic effect is not to be expected. Na content is, on the other hand, low enough to place these products into the category of low Na-content foods, since they contain less than 120 mg/l of Na (Piendl et al., 1985; Piendl et al., 1988; Heyse 1989).

And finally, *manganese*, a trace element, with defined functions in the body, also present in most multi vitamin pills. It takes part in enzyme activation important for proper utilization of biotin, vitamins B1 and C. It is needed for bones structure and proper digestion. The content found in the investigated samples ranged from 0.05 - 0.31 mg/l. This value can replace 10 - 60% of Mn contained in one „Oligovit“ pill.

Conclusion

Beer-based products, especially combination of beer and soft drinks, have a broad spectrum of properties. They have lower alcohol content than beer, are more palatable and refreshing, can be consumed in larger amounts, but at the same time retaining beer's beneficial and physiologically valuable properties. Beer is known

to be one of „the safest“ beverages and most contaminants, as can be expected, are not transferred into end-product. However, all available data are related to the conditions of smaller- or bigger-scale urban and industrial pollution. The extent of warfare actions and large-scale environmental contamination (that our country was subjected to) resulting in intoxication of this type of products at local level is an open question. Actually, the question is posed as to their safety and presence of some toxic elements as well as to the level of micro- and macro-elements that have physiological and therapeutic effects on the body.

The results of analysis of 35 samples of „Radler“ type products, manufactured after the war stopped, demonstrate that there was no increase in the content of any toxic element. The values found are within the range or even below that characteristic for this type of products offered on domestic market. The values are substantially below legally allowed maximum or within the limits for similar products in the world. The data related to the presence of biologically important elements producing beer's favorable effects on the body call for our attention, on the other hand. Their content is normally lower than in beer and these products can not be treated as their source. However, comparison with oligomineral-vitamin product „Oligovit“ (ICN Yugoslavia) points to some facts of interest. Consumption of 1 liter of „Radler“ provides the intake of 10% of Mg, 10-60% of Mn, 30% of Cu, 50% of Zn and 50% of Co. The said amounts are supplied by one pill of „Oligovit“ recommendable as a supplement to everyday diet of children and adults.

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UTICAJ EKOLOŠKOG ZAGAĐENJA IZAZVANOG DELOVANJEM NATO ALIJANSE NA PROSTORIMA SRBIJE NA FIZIOLOŠKI STATUS PROIZVODA TIPA „RADLER”

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Rezime

Pića na bazi piva, a pogotovo proizvodi tipa „Radler” interesantni su sa više aspekata. Predstavljaju jedan nov proizvod dobijen kombinacijom piva i gaziranih bezalkoholnih pića namenjen većem broju ciljnih grupa od pojedinačnih komponenata od kojih su proizvedeni, a ujedno sa fiziološkog aspekta objedinjuju prednosti svakog od njih. Sadrže niži sadržaj alkohola od piva, pitkija su i više osvežavaju, mogu se piti u većim količinama, a istovremeno u određenoj meri zadržavaju blagotvorna i fiziološki vrlo povoljna svojstva piva. Upravo iz tog razloga postavlja se pitanje njihove zdravstvene ispravnosti i prisustva pojedinih toksičnih elemenata kao posledica ekološkog zagađenja uzrokovanog vazдушnim dejstvima NATO alijanse, odnosno mikro- i makro elemenata čiji sadržaj ima povoljno delovanje na organizam.

U radu su prikazani rezultati analize 35 uzoraka različitih Radler proizvoda dobijenih na bazi piva različitih domaćih proizvođača. Određen je sadržaj elemenata koji spadaju u tri karakteristične grupe teških metala kao i najznačajnijih mikro- i makroelemenata koji imaju terapijski i fiziološki značaj za organizam. Rezultati analize 35 uzoraka proizvoda tipa „Radler” proizvedenih nakon završetka ratnih dejstava, pokazuju da u pogledu ni jednog toksičnog elementa nije došlo do porasta sadržaja i da su nađene vrednosti u granicama, ili čak ispod vrednosti karakterističnih za proizvode

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ove vrste na domaćem tržištu. Vrednosti su znatno ispod zakonski regulisanih maksimuma i u granicama koje se sreću i u srodnim proizvodima u svetu. Sa druge strane, interesantni su podaci koji se odnose na prisustvo biogenih elemenata koji su uzrok povoljnog delovanja piva na organizam. Njihov sadržaj u proizvodima tipa „Radler” je niži u odnosu na pivo i ovi proizvodi se ne mogu tretirati kao njihov izvor. Međutim, poređenje sa oligomineralnim vitaminskim preparatom „Oligovitom” (ICN) ukazuje na neke interesantne činjenice. Unošenjem 1 l ovih proizvoda unosi se 10% Mg, 10-60% Mn, 30% Cu, 50% Zn i 50% Co koja se inače unosi pilulom „Oligovita” kao preporučena dnevna dopuna svakodnevne ishrane dece i odraslih.

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