

MINERAL WATER FROM SUPERMARKET VS. TAP WATER. SOME CONSIDERATIONS RELATED TO INNOCUITY

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Abstract

15 Romanian brands of mineral water were purchased from hypermarket. For each of the 15 mineral waters were determined the content of nitrates, nitrites and pH. The data obtained were compared with the content of nitrates, nitrites and pH of the tap water collected in 15 locations in Bucharest, according to data released by the Apa Nova operator. The results showed that the mean of tap water pH in Bucharest, although slightly higher than the tested mineral waters pH, did not differ significantly from the mean of mineral waters pH, being situated in the alkaline domain. The mean content of nitrates in tap water in Bucharest, did not differ significantly from that of the tested mineral waters ($t = 0.811$). Nitrates content of tap water in Bucharest was significantly distinct less, as the pH was higher ($r = 0.68^{**}$). Basically, the change in pH by one unit, lowers the amount of nitrate by 46%. Bucharest tap water nitrites content was significantly lower than that of tested mineral waters (0.005 mg/l to 0.0124; $t = 2.674^*$). Basically, Bucharest tap water contained up to 2.5 times less nitrites than the nitrites mean of tested mineral waters.

Key words: nitrates, nitrites, pH, mineral water, tap water

INTRODUCTION

Water is the main constituent of living matter and a substance essential for life [5]. In nature water is found never pure, being enriched with minerals taken from the soil layers through which it passes [2]. Consequently, this makes that there are no two identical types of water. Mineral water can be defined as a water from various natural or drilled sources, with special hygienic characteristics and positive effects on health [1]. Drinking water can be defined as a clear, odorless, colorless and tasteless liquid, harmless, free of pathogenic microorganisms or substances harmful to human [2].

The purpose of this paper is to analyze the quality of mineral waters sold on the Romanian market, compared to supplied tap water. There is a general trend in the behavior of Romanian consumers to avoid tap water, considered not sufficiently safe, from the toxicological point of view. This is due to the impression that investments in improving urban utility network of Bucharest, were not correlated with the rate of urban utility

network degradation [6].

MATERIALS AND METHODS

A total of 15 samples of mineral waters provided by 15 Romanian brands, were purchased in the first week of March 2014 from Titan Auchan shopping center (Bucharest). The main identification elements of analyzed Romanian brands are shown in Table 1.

For each of the 15 tested mineral waters were determined the content of nitrates, nitrites and pH.

The concentration of nitrates was determined using the acid fenoldisulfonic reaction method. This involves the formation of a yellow nitrofenolsulfonic derivative, whose intensity determined photometrically at 480 nm, is proportional to the nitrates content in the sample [7].

Nitrites content was determined by Saltzman method. The method is based on the property of nitrite ions to form, through a chemical reaction, a colored azo complex that can be photometric evaluated. In an acid medium,

nitrite ions react with sulfanilic acid to form a diazonium salt. The diazonium salt is coupled with N-naphthyl ethylenediamine, at pH = 2-2.5, to form a violet azo compound, whose absorbance is measured at a wavelength of 520 nm [7].

Table 1. Mineral water brand names and main key identifiers

No. sample	Commercial name	Source	Producer
P1	Bucovina uncarbonated	C7 SECU, Dorna Candrenilor, Suceava	Rio Bucovina SRL
P2	Bilbor	Q1, Bilbor, Harghita county (height rate 1114, Călimani mountains)	Bilbor Mineral Water SRL
P3	Zizin	F2, F4, Zizin, Braşov county	Apemin Zizin S.A.
P4	Dorna - Izvorul alb	White spring, Dealul Floreni - Dorna Candrenilor village, Suceava county	Coca Cola HBC SRL
P5	Apa Craiului	Spring water no. 5, Gâlgoaie, Dâmbovicioara, Argeş county	Cheresta Dîmbovicioara SRL
P6	Aqua Carpatica	Băjenaru spring, Păltiniş, Suceava county	Carpathian Springs S.A.
P7	Keia uncarbonated	Zăganului spring, Ciucaş, Prahova county	Nicolțana S.A.
P8	Perenna Premier uncarbonated	Călina, Caraş Severin county	Apollini Company SRL
P9	Cheile Bicazului	Bicazul Ardelean (drilling FH1), Neamţ county	Natural Aqua Group SRL
P10	Borsec uncarbonated	Făget Borsec, Harghita county	Romaqua Group S.A.
P11	Herculane uncarbonated	Domogled, Băile Herculane, Caraş Severin county	Carpatina S.A.
P12	Carpatina light mineral	Toşorog, Neamţ county	Carpatina S.A.
P13	Perla Covasnei	F1, Târgu Secuiesc, Covasna county	Covasna pearl S.A.
P14	Hera	Hera, Budureasa, Bihor county	European Drinks
P15	Tuşnad Spring fairy	Tuşnad, Harghita county	Apemin Tuşnad S.A.

To determine pH, we used a digital pH-meter. There are changes in pH value, on the variation of the potential difference between a glass electrode and a reference electrode, placed in the water sample to be analyzed.

In order to assess the safety of tested mineral waters in relation to tap water, supplied by the

Apa Nova Bucharest operator, we used a set of data from the operator website. Thus, we recorded the content of nitrates, nitrites and pH of the water supplied by Apa Nova, in 15 locations across the entire area of the town, in 05.05.2014 - 07.05.2014 period [4].

The obtained data are presented in Table 2.

Table 2. The content of nitrites, nitrates and pH of the water, supplied in 15 locations by Apa Nova Bucharest, between 05.05.2014 - 05.07.2014 [4]

No. sample	Area sampling	pH	NO ₂ ⁻ mg/l	NO ₃ ⁻ mg/l
1	Mihai Bravu Highway no. 290	7.55	0.005	4.57
2	Vitan Square	7.59	0.005	4.48
3	Aerogării Avenue	7.42	0.005	4.47
4	Norilor Square	7.27	0.005	6.75
5	Progresul Square	7.38	0.005	6.78
6	Amzei Square	7.47	0.005	4.62
7	Matache Square	7.49	0.005	4.52
8	Gemini Square	7.47	0.005	4.30
9	Chitila Highway	7.46	0.005	4.51
10	Domenii Square	7.46	0.005	4.51
11	Mitropolit Varlaam Street	7.47	0.005	4.61
12	Reşiţa Square	7.42	0.005	6.76
13	Fundeni Highway	7.37	0.005	4.51
14	Ialomiţei Valley	7.39	0.005	6.52
15	Olteniţei Highway	7.37	0.005	6.7

RESULTS AND DISCUSSIONS

Tap water in Bucharest was characterized according to the values in Table 2. We could notice a mean value of pH = 7.42 ± 0.08, an invariably nitrites content of 0.005 mg/l, respectively a nitrates content of 5.25 ± 1.07 mg/l.

As shown in Figure 1, the mean of tap water pH in Bucharest, although slightly higher than the mean of the tested mineral waters pH, did not differ significantly from this, being located in alkaline domain (t = - 0.954).

As is normal, since the tested tap water in Bucharest comes from a single source, pH variability is much lower than that of tested mineral waters (± 1.07% versus 5.73%).

Regarding nitrates content, the situation is the same. The content of nitrates mean in tap water in Bucharest (5.25 mg/l) was lower than the nitrates content mean of mineral waters (5.89 mg/l).

The difference between the two specimens was not statistically significant (t = 0.811).

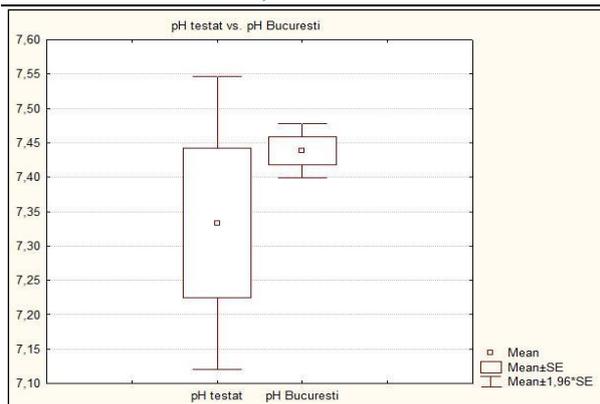


Fig. 1. Mineral waters pH vs tap water pH in Bucharest

We also noted that the nitrates variability mean in tap water samples in Bucharest, was much lower than that of mineral waters (Fig. 2).

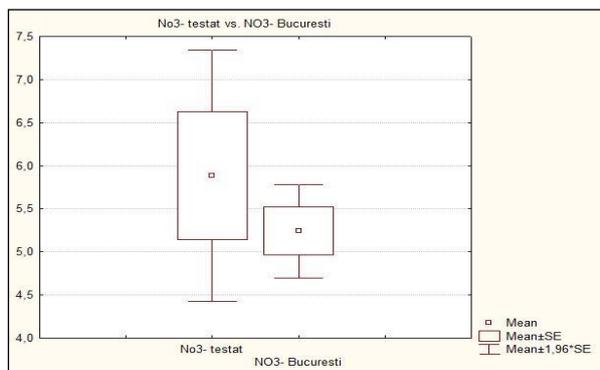


Fig. 2. Mineral waters NO₃⁻ content vs. tap water NO₃⁻ content

Nitrates content of tap water in Bucharest was significantly distinct less, as the pH was higher ($r = 0.68^{**}$).

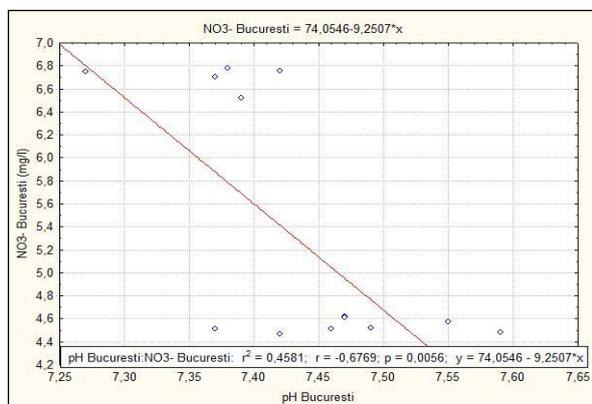


Fig. 3. Regression NO₃⁻ - pH for tap water in Bucharest

Basically, the change in pH by one unit lowers the amount of nitrate by almost 46% (determination coefficient $r^2 = 0.458$) (Fig.3).

Tap water in Bucharest presented a significantly lower content of nitrite than tested mineral waters (0.005 mg/l to 0.0124; $t = 2.674^*$). Basically, tap water in Bucharest had a content of nitrites up to 2.5 times lower than the nitrites mean of tested mineral waters (Fig.4).

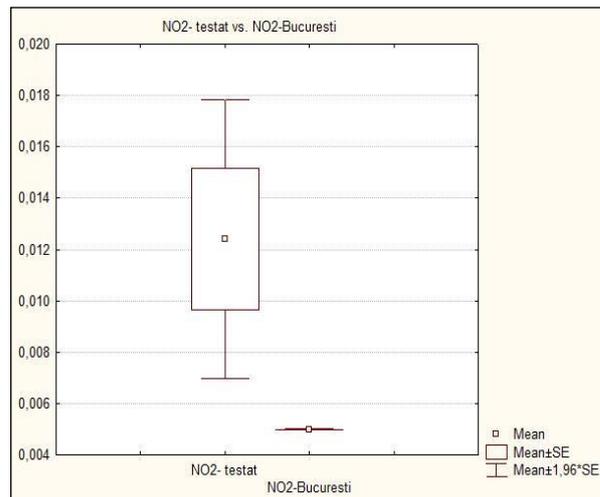


Fig. 4. Mineral waters NO₂⁻ content vs. tap water NO₂⁻ content

Accordingly, we believe that tap water in Bucharest is safer in terms of harmlessness, than tested mineral waters. This does not mean that exploitation of mineral waters is a simple commercially exercise for robbing consumers. Mineral waters constitute important sources of minerals necessary for human body, their therapeutic effects being validated on a historical scale.

CONCLUSIONS

The mean of tap water pH in Bucharest did not differ significantly from the mean of tested mineral waters pH, both being situated in the alkaline domain. The mean of nitrates content in tap water in Bucharest (5.25 mg/l) was lower than the mean of nitrates content of mineral waters (5.89 mg/l). The difference between the two specimens was not statistically significant ($t = 0.811$). Nitrates content of tap water in Bucharest was significantly distinct less, as the pH was higher ($r = 0.68^{**}$). Basically, the change in pH by one unit, lowers the amount of nitrates by 46%. Tap water in Bucharest has a

significantly lower content of nitrites than tested mineral waters (0.005 mg/l to 0.0124; $t = 2.674^*$). In fact, tap water in Bucharest contains up to 2.5 times less nitrites than the nitrites mean of studied mineral waters. In conclusion, drinking tap water is not a health hazard.

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