

Outstanding therapeutic and dietetic potential of silicon-rich mineral waters – Brazil, Poland and Spain approaches and cases.

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Environmental factors, like climate, hydrological conditions, geological settings influence groundwater chemistry, including dissolved silicon content. In most natural waters the dominant form of dissolved silicon is orthosilicic acid, H_4SiO_4 . Chemical composition and pH of solution, and solubility of mineral phases are the main variables which govern silicon concentration in groundwaters. There have been also proposed that in natural waters dissolved silicon might occur as hydroxyaluminosilicate colloids, which probably play important role in controlling the bio-availability of aluminium and its toxicity for living organisms. Concentration of dissolved silicon was also found to be a useful indicator for the authenticity of bottled natural mineral water and to distinguish them from bottled surface waters.

The silicon element occurs naturally in foods as silicic acids, and silicates. In drinking waters silicon is mainly present as an orthosilicic acid. The present-day interest in silicic acid in health care originates from the reputed health benefits of both bathing and partaking of mineral or medicinal waters rich in it, since the second half of the nineteenth century. Bio-medical researches proved that silicon is an element essential for human health and the only form of bio-available silicon for human is orthosilicic acid. It occurs in the largest concentrations in raw or poorly-processed plant products, some mineral and medicinal waters, and also in some beers. Unfortunately, our diet is strongly depleted bio-available silicon.

Si-rich mineral waters are considered as one of the best nutritional sources of bio-silicon. The silicon levels in mineral waters varies widely, usually from 3.3-30.0 mg/l. The essential daily absorption of silicon have in drinking water an exceptional source, were these intakes would increase slightly when presented at low-TDS waters.

In Poland, since 1954, silicic acid is regarded as a component which provides therapeutic benefits in

waters used in balneology, and waters that have over 25 mg/L Si (i.e. siliceous waters) are formally considered as medicinal (therapeutic) ones.

Siliceous waters can pursuit a beneficial action on old people, especially with gastrointestinal diseases, diabetes, metabolism dysfunctions, neurodegenerative diseases. Also, they are prescribed with skin diseases; have anti-inflammatory action, amplify antitoxic liver function with the help of adsorptive and detoxification properties of silicic acid. In Brazil, this focus does not exist.

For concise illustration of comparative author's study cases, selected data on silicon in groundwaters from Brazil (Amazon Region), Poland (medicinal waters from spas in the Sudetes), Spain (Galicia Region) and World bottled brands (www.mineralwaters.org, 2012) were tabelarized (Table 1).

Table 1. Median silicon concentration and selected physico-chemical parameters in studied waters.

Group	Sample size	Si	°C/pH/TDS/Al
Brazil	57	21.6	29.0/6.0/282/0.2
Poland	33	20.7	14.9/6.1/760/0.034
Spain	49	20.8	25.3/8.24/334/0.052
World bottled waters	711	21.4	20/7.0/877/0.18

Si, Al and total dissolved solids (TDS) given in mg/L

Conclusions

The Si element values to the characteristic biological activity, at concentrations that ensure the therapeutic status of water and specify how it can be used for medical treatment and epidemiological/nutritional essentiality. Some of these grades were found especially in waters from studied regions, because of different causes of origin and with potential to be therapeutic and health-promoting applications.