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Suggestion for Establishment of Minimum Limits for Constituent Minerals in Drinking Water

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Abstract

Indian foods nowadays, as per test reports, exhibit negligibly small contents of synthetic pesticides and metal contaminants. However, minerals can't be compared with synthetic pesticides in context of public health. To some extent minerals are present in water and foods. Mineral deficiency may pose serious threat to public health. There are chances of mineral water fabrication too. In the light of Indian, United States and European Union regulations as well as World Health Organization guideline for dissolved solids in drinking water, it is suggested that minimum limits for ionic constituents of mineral water be established by the Food Safety Authority.

Keywords: Brix; Total dissolved solids; Pesticides

Abbreviations: AOAC: Association of Official Analytical Chemists; Brix: Concentration expressed as degree which stands for per cent, particularly of sugar in syrup, measured with the help of refractometer; EU: European Union; EFSA: European Food Safety Act; FDA or US FDA: Food and Drug Administration (US); FSS Act: Food Safety and Standards Act, enacted in 2006 in India; FSSAI: Food Safety and Standards Authority of India; FSSR: Food Safety and Standards Regulation (Indian food regulation enforced in 2011 in compliance to FSS Act 2006); Inorganic Compounds: Chemical compounds made up of electrically charged constituents called ions, anions (negatively charged) and cations (positively charged); Ionic Contents of Minerals: Contents of individual ions say calcium, magnesium, sodium, copper, chloride, sulfate etc. in water; NPOP: National Program on Organic Production (India); Organic Compounds: Chemical compounds made up of elements carbon, hydrogen, oxygen, nitrogen and sulfur in general for example; Organic Farming or Agriculture in Organic Way: Farming process which follows the way of avoidance of synthetic pesticides (contradiction: synthetic pesticides are mostly organic compounds, but the way of their avoidance in agriculture is called organic farming, this contradiction is not realized in Hindi because organic farming is called Jaivic Krushi that means bio-farming); ppm: Parts Per Million (mg/Kg that stands for milligrams of a constituent per kilogram of composition, very near to mg/Lit that stands for milligrams of solute per liter of solvent in the case of water as solvent); RO: Reverse Osmosis; TDS: Total Dissolved Solids; WHO GDWQ: World Health Organization Guidelines for Drinking Water Quality.

Introduction

The synthetic pesticides applied in farms to protect crops are mostly organic compounds. The inorganic content, in the form of minerals, is of course naturally present in water and foods but a substantial part of minerals nowadays enters biosphere as pollutant due to vast industrialization and urban expansion. Recently Indian agriculture is on organic way with avoidance of synthetic pesticides and acceptance of natural neem (*Azadirachta indica*) juice as crop protection agent. Obviously, the pesticides in Indian foods might be assumed to follow decreasing trend. The test reports generally verify this assumption. But mineral contents too have been detected many times in nominal concentration in Indian processed foods. Deforestation has been Indian scenario, perhaps therefore is soil erosion leading to mineral deficient foods [1]. Possibly both the RO (reverse osmosis) and natural mineral water are used in food processing in India. However, possibility of mineral water fabrication can't be negated due to very low amount of TDS (total dissolved solids) lower limit, that is 150 ppm, and no lower limit establishment for ionic constituents of mineral water in FSSR (Food Safety and Standards Regulation) 2011. The mineral deficient foods might lead to several diseases in people. Therefore, the author of this article suggests for increasing lower TDS limit and establishing minimum limits for entire ion profile of mineral water.

Materials and Methods

Contaminants test profile of an Indian food product

Indian food articles, particularly milk and water, are exhibiting low levels of pesticides and metal contaminants. The analytical reports of sugar syrup based *chhana* (a kind of soft cheese) sweet articles, belonging to northern Rajasthan, highlight almost absence of synthetic pesticides and several heavy metals. All the pesticides (listed in FSSR 2011) as well as cadmium, arsenic, mercury and tin – as per report – are too less to be detected by using normal test equipment following AOAC method [2]. It would be worth mentioning that FSSR allows tin in canned foods up to 250 ppm. As per report, tin content in canned *chhana* sweets has been found to be less than 0.10 mg per kg. For such a product, the maximum limits for lead and copper specified by FSSR are 2.5 and 30 ppm which are reported to exist as 0.05 mg per kg and 0.26 mg per kg respectively by an accredited laboratory. In this context two questions arise; first: whether FSSR limits for pesticides and metal contaminants are stringent enough and second: whether Indian foods including water despite being organic are mineral deficient.

Low pesticides and mineral contaminants

One thing is sure; Indian agriculture now is speedily on the organic way. This achievement might be considered as the success story of NPOP (National Program on Organic Production) and the impact of strong

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pesticide-cancer correlation (as strong as or stronger than tobacco-cancer correlation) on the farmers. When synthetic pesticides are not appreciably applied in farms, obviously farm produce as well as milk and water would be organic in nature. It is also true, at the same time, that India has been fast undergoing horizontal urban expansion that is perhaps now near to saturation. The increasing trend of 'no expansion' or 'vertical expansion' of urban area might be presumed to result into probably decreasing metal contamination in water streams. Therefore FSSAI (Food Safety and Standards Authority of India) might region-wise investigate the entire situation and come up with more stringent upper limits for pesticides and metal contaminants, if possible.

Possibility of low mineral status

On June 25, 2015 FSSAI proposed upper limit of lead 0.2 ppm for berries and 0.1 ppm for fruits and vegetables in general (for brassica vegetables 0.3 ppm) [3]. As per regulation 2011, the tolerance limit of both the lead and the tin for these articles had been 2.5 ppm as foods not specified. The same for cadmium in leafy vegetables and several fruiting vegetables were proposed in 2015 to be 0.2 and 0.05 ppm respectively that had been 1.5 ppm as other foods. The Authority may feel free to come up with proposal for possible stringency of metal contaminants upper limit in other several articles too if much gap between currently allowed limit and observed data exists. It is observed in several cases that contents of synthetic pesticides as well as metals like tin, arsenic, cadmium and mercury are too less to be detected by AOAC methods using normal precision equipment. It is the excellent situation if pesticides are absent in foods. But almost absence of metals that are usually expected to exist to some extent in water, milk and farm produce hints at the other side of the story that means mineral deficiency particularly with low diversity.

Mineral status of water in use

The mineral contents in processed food very much depend on the source of water used in. The canal water from a dam is basically rain water and obviously has lower contents of dissolved solids. The canal water from rivers might possess higher contents of dissolved minerals than that from dam. There is much more possibility of containing still higher mineral contents in the case of groundwater.

TDS limits: FSSR v/s FDA

The natural mineral water belonging to natural or drilled sources from underground water must have total dissolved solids (TDS) in the range 150-700 mg/Liter as per FSSR 2011. It is worth noting that a big gap exists here between lower and upper limits. The Regulation also ascertains only the maximum levels (not minimum) for a few inorganic salts namely copper, manganese, zinc, barium, antimony, nickel, silver, magnesium, calcium, sodium, arsenic, cadmium, chromium, mercury, lead, selenium, cyanide, sulfate, chloride, borate, fluoride, nitrate, nitrite and sulfide. Furthermore, the Regulation does not ascertain any minimum level for TDS in the packaged drinking water which means derived from surface water or underground water or sea water subjected to specified treatments, namely decantation, filtration, aeration, filtration with membrane filter, depth filter, cartridge filter, activated carbon filter, de-mineralization, re-mineralization, reverse osmosis (RO) and packed after disinfecting the water to a level that shall not lead to any harmful contamination. Any of the packaged drinking water, unpackaged RO water and natural mineral water is worth using in the food processing.

The food regulations, worldwide, seem to be unanimous on ascertaining only the upper limit for mineral constituents in potable water and not the lower levels. The US Food and Drug Administration classifies mineral water as water containing at least 250 ppm TDS originating from a geologically and physically protected underground water source, and no minerals may be added to this water. It is worth noting that US food regulation essentially demands lower levels of total dissolved solids in natural mineral water to be 250 ppm which is 100 ppm more than that in Indian food regulation. But FDA, like FSSR, is silent on minimum limits of constituent minerals in mineral water.

Inorganic contaminants limits: EU v/s India

The Commission of the European Union too establishes only the maximum concentration limits and not the minimum levels of mineral constituents in water. The legal requirements for the maximum limits of constituents which may be harmful in excess but are naturally present to some extent in natural mineral waters in EU [4] and India [5] are as follows (Table1).

Constitutes of Mineral Water	Maximum Limits allowed in (mg/Liter)	
Element	EU	India
Antimony	0.0050	0.0050
Arsenic	0.0100	0.0500
Barium	1.0000	1.0000
Cadmium	0.0030	0.0030
Chromium	0.0500	0.0500
Copper	1.0000	1.0000
Cyanide	0.0700	Should be absent
Fluorides	5.0000	1.0000
Lead	0.0100	0.0100
Manganese	0.5000	2.0000
Mercury	0.0010	0.0010
Nickel	0.0200	0.0200
Nitrates	50.000	50.000
Nitrites	0.1000	0.0200
Selenium	0.0100	0.0500

Table 1: Maximum limits of Mineral Water constituents allowed in EU and India respectively.

FSS Act of India is more stringent on concentrations of cyanide, fluoride and nitrite in mineral water than the EFSA (European Food Safety Act) perhaps due to serious health hazard consequences of these constituents. On the other hand, the latter is more stringent on arsenic, manganese and selenium probably due to the same hypothetical reason. However, there is a long profile of elements in water, found in traces, essential in balanced amounts for public health and biosphere existence. It is said that 72 out of the total 92 naturally occurring elements in the periodic table are required for proper human body maintenance; these elements can be suitably absorbed from food and water belonging to conserved soils waters. United States' Utah lake water is one of such excellent examples [6]. The question arises, what may happen when minimum concentration limit for constituent minerals in drinking water is not legally ascertained.

Possibility of mineral water fabrication

There is a chance; the mineral water might be fabricated if the lower limits of constituents of water are not mentioned in regulation. For example, the TDS requirement for natural mineral water, as per FSSR, is 150-700 mg/Liter with no lower limits for mineral constituents. In such a situation, the minimum TDS requirement might be easily met out by dissolving just 150 mg of sodium chloride or anhydrous calcium sulfate in one liter of rain water or distilled water. However, addition of a few minerals of zinc, magnesium and copper appears to be essential due

to organoleptic requirement. To eliminate the possibility of fabrication of mineral water, legal provisions for setting up minimum levels for entire profile of minerals naturally occurring in water are perhaps direly required.

The syrup based Channa sweet samples show presence of copper in 0.26 mg per liter concentration. In this case presence of copper is expected mainly due to water used in processing provided packaging container material is perfect. The syrup of such a product normally exhibits 50° brix. It means the syrup contains 50 per cent water. That means the copper concentration in water used is around 0.52 mg per kg, almost half of the maximum legal requirement of copper for natural mineral water. Perhaps water used in this case is not fabricated. But if water used in food processing contains copper much less, say one tenth of this concentration that is 0.05 mg/Kg that would be the maximum copper requirement of packaged drinking water. And the law has not set up any minimum level for packaged drinking water too. The legal TDS requirement as per FSSR is 500 mg/Liter maximum with no provision of minimum parameter in the case of packaged drinking water. Obviously, there are ample opportunities for food frauds, and use of fabricated mineral water may make people suffer from several serious diseases due to mineral deficiency.

WHO guideline for dissolved solids in water

The background document for development of World Health Organizations Guidelines for Drinking Water Quality (WHO GDWQ) scientifically edited by Ms Marla Sheffer of Ottawa, Canada, dated 3rd April 2016 [7], clearly refers the studies regarding effects of TDS on humans. It concludes: results of early epidemiological studies suggest that low concentrations of TDS in drinking water may have beneficial effects, although adverse effects have been reported in two limited investigations. According to Document, water containing TDS concentrations below 1000 mg/Liter is usually acceptable to consumers, although acceptability may vary according to circumstances. It further states that water with extremely low concentrations of TDS may be unacceptable to consumers because of its flat, insipid taste; high levels of TDS in water may also be objectionable to consumers owing to resulting taste (not suiting). Although this document does not decide the maximum and minimum levels of TDS in water, but perhaps persuades to accept around 500 ppm as average contents. Therefore, the author of this article agrees with US FDA which classifies mineral water as water containing at least 250 ppm TDS originating from a geologically and physically protected underground water source to which no minerals may be added.

Discussion

In the light of current legal provisions of low lower TDS limits and no lower limits of constituents for natural mineral water, it would be relevant to consider the concerned analytical reports of potable water, agricultural products and processed food articles which often indicate the low concentrations of cadmium, arsenic, mercury and tin less than 0.10 ppm, not exactly determined (better to say detected) by normal test procedures. Dieticians and nutritionists normally advise restriction on intakes of sodium (while its deficiency may cause severe edema, vomiting and diarrhoea) and a few minerals like antimony, arsenic, barium, cadmium, chromium, copper, cyanide, fluorides, lead, manganese, mercury, nickel, nitrates, nitrites and selenium which are legally considered as metal contaminants. But copper is highly concerned with well-functioning of human body. Copper is necessary for the activity of cytochromes and its deficiency can cause a fatal anemia (of course on the other side high copper intake, more than 2.5 mg per day, may result in its increased absorption from intestines and damage kidneys) [8]. In fact, foods, including water, are the vital sources of calcium, phosphorus magnesium, sulfur, iron, copper, iodides, manganese, cobalt, zinc, fluorides, molybdenum and selenium, essentially (better to say direly) required for well-functioning of human and animal bodies [8]. It seems that body demands almost all the minerals, which are not synthesized in body but exist due to food and water intake, in quite balanced amounts. Obviously, setting up of minimum levels of constituent ions in natural mineral water is a prominent legal issue. It is perhaps also necessary to eliminate the possibility of mineral water fabrication.

The phenomenon of natural mineral water is not limited up to the food processing level. In fact, the human activity of deforestation leading to soil erosion (degradation) could be considered as etiology (origin or cause) of mineral water fabrication at source (wells or rivers) level. The mineral constituents of natural mineral water (groundwater) can't remain conserved unless dense forestation is seriously followed in countries, like India, where forests and pastures on large scale have been destroyed. Hence both the legal setting up of minimum limits of natural mineral water and the dense forestation are required for prevention of mineral water fabrication.

Conclusion

In order to eliminate the possibility of fabrication of mineral water and strengthen the mineral profile of groundwater reserves, author wants to suggest (i) TDS limit 250-750 mg/Kg for natural mineral water (current limit in FSSR is 150-750 mg/Kg) (ii) TDS limit 200-500 mg/Kg for packaged drinking water (currently no minimum limit for TDS in packed drinking water has been ascertained by FSSR) (iii) minimum limit for entire mineral constituents be established (perhaps not ascertained world over) (iv) dense forestation for soil and water conservation where deforestation has been a routine phenomenon, for example India.

References

1. Ramesh KS, Salvatore P (2017) Toxins and Contaminants in Indian Food Products. Mineral Deficient Foods – The Indian Scenario, pp: 44-45.
2. Analytical Report (2017) Eurofins Analytical Services. Gurugram, India.
3. Food Safety and Standards Authority of India (2015) Order to M/s Nestle India Ltd - May 2015. Available from: http://old.fssai.gov.in/Portals/0/Pdf/Order_Nestle.pdf (Accessed on: June 05, 2015).
4. Commission Directive 2003/40/EC (2003) Official Journal of European Union 126: 34-39.
5. Food Safety and Standards Regulations (2011) Regulation 3 - August 2011. Available from: http://fsdaup.gov.in/writereaddata/images/pdf/act-and-rules/fss-regulation/Food-safety-and-standards-Prohibition-and-Restrction-on-sales-regulation-2011.pdf
6. Minerals for All (2012) Mineral Resource International. Available from www.mineralsforall.com
7. World Health Organization (1996) Guidelines for drinking-water quality. Available from: http://www.who.int/water_sanitation_health/dwq/2edvol2p1.pdf
8. Rama Rao AVSS, Suryalakshmi A (1994) Metabolism of Inorganic Substances. A Textbook of Biochemistry. UBS Publishers Distribution Pvt. Ltd., New Delhi, India, pp: 441-457.