

Nitrate concentration and human health risk assessment in different age groups of population

Sonila Duka^{1,2*}, Loreta Vallja^{1,2}, Majlinda Vasjari^{1,2}, Alma Shehu¹, Nevila Broli^{1,2}, Sadik Cenolli^{1,2}

¹Department of Chemistry, Faculty of Natural Sciences, Blv "Zogu I", 1001, Tirana, Albania

²Nano-Alb, Academy of Sciences of Albania, Sheshi "Fan Noli", No7, 1001, Tirana, Albania

e-mail: soniladuka@fshn.edu.al

Abstract

A Human health risk assessment was proposed by United States Environmental Protection Agency (USEPA) such as hazard identification, dose response assessment, exposure assessment, and risk characterization [1, 2]. Estimation daily intake (EDI: mg/kg day) was computed to determine the doses of NO₃ - received through individual ingestion pathway. The drinking water pathway is computed by using EDI, which indicates the measure of chemical substance ingested through drinking per kilogram of body weight per day [3, 4]. Adopted methodology to assess the human health risk goes through these elements: **i.** Hazard identification [non-carcinogenic risk] **ii.** Dose response assessment [Oral intake - Rdf] **iii.** Exposure assessment [Chronic daily intake by drinking water] **iv.** Risk characterization in children, teenagers, adults – [Oral hazard quotient *evaluated* by Hazard Quotient HQ].

The results of the study indicated that the nitrate concentration in many brands of bottled water is lower than the standard limit, therefore, the consumption of bottled water does not create a threat to the health of consumers.

Based on risk assessment and data analysis, the highest value HQ was associated with the age group of children, thus the sensitivity should be applied to the selection of drinking water brands for this age group. The mean HQ values for nitrate in different groups of children, teenagers and adults were 0.3737, 0.2638 and 0.2114, respectively. The hazard quotient for the population consuming bottled water, appropriate strategies should be considered in order to reduce the concentration of nitrate in bottled water.

Key words: Nitrates levels, Bottled drinking water, Human health risk, IBA, FDA

Tab. 1 The statistical summary of EDI and HQ – values for different age groups

Age Groups	EDI - Daily nitrate consumption			HQ - the risk of non-carcinogenic substances		
	Children	Teenagers	Adults	Children	Teenagers	Adults
EDI & HQ						
Mean	0.35	0.10	0.07	0.30	0.09	0.06
Min	0.07	0.02	0.02	0.06	0.02	0.01
Max	1.05	0.32	0.22	0.91	0.27	0.19

References

1. The United States Environmental Protection Agency, US EPA. Edition of the Drinking Water Standards and Health Advisories Tables; Environmental Protection Agency: Washing, DC, USA, 2018. Available online: <https://www.epa.gov/sites/production/files/2018-03/documents/dwtable2018.pdf> (accessed on 21 May 2021).
2. USEPA (US Environmental Protection Agency). 2001. Baseline human health risk assessment Vasquez Boulevard and I-70 superfund site, Denver CO. <http://www.epa.gov/region8/superfund/sites/VB-170-Risk.pdf>. (Accessed 20 January 2011).
3. World Health Organization. Guidelines for Drinking-Water Quality, 4th ed.; WHO: Geneva, Switzerland, 2006. ISBN:92-4-154696-4. Available online: <http://helid.digicollection.org/en/d/Js8578e/> (accessed on 23 May 2021).
4. European Communities, Directive 80/777/EEC, Council Directive of 15 July 1980 on the Approximation of the Laws of the Member States Relating to the Exploitation and Marketing of Natural Mineral Water, L229/1–L229/10. Available online: <https://eurlex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A31980L0777> (accessed on 24 May 2021).
5. Guidelines for Drinking-Water Quality, 4th ed, WHO, Geneva incorporating the 1st Addendum. Available online: <https://www.who.int/publications/i/item/9789241549950> (accessed on 7 May 2021).
6. Essential guide to nutrients [Login | The National Academies Press](https://nap.nationalacademies.org/login.php?record_id=11537#:~:text=The%20Essential%20Guide%20to%20Nutrient%20Requirements)
https://nap.nationalacademies.org/login.php?record_id=11537#:~:text=The%20Essential%20Guide%20to%20Nutrient%20Requirements