

Editorial

Drinking Water Safety and Health Effects

Dede C¹, Cinar N^{2*} and Pekşen S³¹Vocational School of Health Sciences, Sakarya University, Turkey²Sakarya University, School of Health Sciences, Turkey³Zekai Tahir Burak Maternity Teaching Hospital, Turkey***Corresponding author:** Cinar Nursan, Sakarya University, School of Health Sciences, Esentepe Campus, 54187 Sakarya, Turkey, Tel: 264 295 66 21; Fax: 2642956602; Email: ndede@sakarya.edu.tr**Received:** September 10, 2014; **Accepted:** September 11, 2014; **Published:** September 11, 2014

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Access to safe-drinking water is essential to health, a basic human right and a component of effective policy for health protection [1]. Water is an essential requirement for cellular homeostasis and life. Without water, humans can survive only for days. Water comprises from 75% body weight in infants to 55% in elderly [2]. A daily water intake of 3.7 L for adult men and 2.7 L for adult women meets the needs of the vast majority of persons. However, strenuous physical exercise and heat stress can greatly increase daily water needs [3].

However, besides of quantity, quality of water is also important for human health. Unsafe drinking water can cause to serious acute, chronic, or sometimes fatal health consequences. Drinking water can contain various risky materials that naturally occurring or stems from human activities. Microorganisms, radionuclides, nitrates and nitrites, heavy metals and, fluoride can be occur naturally in drinking water. Also, as a result of human activities; bacteria and nitrates, heavy metals, fertilizers and pesticides, industrial products and wastes, house hold wastes, lead and copper, water treatment chemicals can contaminate drinking water [4].

Many classes of microorganisms including enteric and aquatic bacteria, viruses, helminthes and enteric protozoa which are strongly resistant in the water environment and to most disinfectants are able to initiate water borne infections [5]. The main contamination source is from swage causing serious digestive tract diseases [6]. The most predominant waterborne disease, diarrhoea, has an estimated annual incidence of 4.6 billion episodes and causes 2.2 million deaths every year [7].

When the chemical disinfectants such as chlorine, ozone, chlorine dioxide, or chloramines are used to eliminate the pathogens, Disinfection By-Products (DBPs) are formed due to the reaction of disinfectans with naturally occurring organic matter, anthropogenic pollutants, bromide, and iodide [8,9]. Bladder cancer, early-term miscarriage and birth defects are the potential health risks of DBPs [8].

Drinking water may contain radiation due to nuclides dissolved

in the water from natural sources in the earth or releasing from laboratories or nuclear power plants [10,11]. Environmental Protection Agency (EPA) regulates the radionuclides in drinking water as gross alpha emitters, beta particle and photon (gamma) radio activity, Radium 226 and Radium 228 and Uranium. Exposing radionuclides via drinking water may increase risk of getting cancer. Meanwhile, exposure to uranium in drinking water may also result in toxic effects to the kidney [12].

Nitrates and nitrites are also important for drinking water quality. The major health risk related with high level of nitrate/nitrite is to under 6 months of age infants. Nitrate in the body is transformed to nitrite and react with hemoglobin which is the oxygen carrier in the blood. In this case, oxygen carrying ability of blood is inhibited and oxygen supply to the body is decreased. This is called blue baby syndrome or methemoglobinemia and the risk increases when the nitrate concentration rises above 50 mg/L [13]. The risk related with this syndrom for adults is low but pregnant and nursing mothers and adults having chronic health problems may be at higher risk. Although the connection between drinking water nitrate/nitrite level and certain types of cancer is not well understood, there have been a few studies suggesting high nitrate/nitrite may cause certain types of cancer [6,14,15].

Drinking water can contain heavy metals as pollutants including Arsenic (As), Boron (B), Cadmium (Cd), Cyanide (Cn), Chromium (Cr), Copper (Cu), Fluorine (F), free Chlorine (Cl), mercury (Hg), Nickel (Ni), lead (Pb), Selenium (Se), and antimony (Sn) [6]. Among this heavy metals the main reported health threats are related with exposure to lead, cadmium, mercury and arsenic [16].

Lead in drinking water can cause various health problems for all ages. These problems may include delays in physical and mental development, slight deficits in attention span and learning abilities for babies and children and increase in blood pressure and kidney problems for some adults [17]. Long time intake cadmium and mercury above the Maximum Contaminant Level (MCL) in drinking water can cause kidney damage [18,19]. Especially skin cancer risk increase with long term exposure to arsenic via drinking water. Meanwhile, the risk of some other cancers and skin lesions like hyperkeratosis and pigmentation changes can also increase [16].

Excessive consumption of fluoride over a life time may cause tooth and skeletal damages such as increased bone fracture risk, pain and tenderness for adults. In children, pits and cosmetic problems in the tooth enamel can be occur due to the excessive fluoride in drinking water [20].

Drinking water can cause exposure of millions of people to different contaminants. Some people especially including infants, children, elderly, pregnant women and their fetuses, immuno compromised persons such as transplant, HIV/AIDS or under going chemotherapy patients, are susceptible to the contaminants in drinking water. Additional precautions are needed to reduce the

drinking water related risks in this weaker population and to improve public health [4,5].

References

1. World Health Organization. Guidelines for drinking-water Quality. First addendum to 3rd edition. Recommendations. 2006; 1.
2. Popkin BM, D Anci KE, Rosenberg IH. Water, hydration, and health. *Nutr Rev.* 2010; 68: 439-458.
3. Sawka MN, Cheuvront SN, Carter R. Human water needs. *Nutr Rev.* 2005; 63: 30-39.
4. United States Environmental Protection Agency. Water on tap what you need to know. 2009.
5. Leclerc H, Schwartzbrod L, Dei-Cas E. Microbial agents associated with water borne diseases. *Crit Rev Microbiol.* 2002; 28: 371-409.
6. Caylak, E, Tokar M. Investigating chemical and microbiological contaminants in drinking water of Cankiri Province, Turkey. *Environmental Earth Sciences.* 2012; 67: 2015–2025.
7. World Health Organization. WHO Guidelines for Drinking-water Quality. 2010.
8. Richardsan SD, Postigo C. Drinking water disinfection by-products; Emerging Organic Contaminants and Human Health. Barcelo´ D, Kostianoy AG, editors. *The Handbook of environmental Chemistry.* 2012: 93-137.
9. Richardson SD, Plewa MJ, Wagner ED, Schoeny R, Demarini DM. Occurrence, genotoxicity, and carcinogenicity of regulated and emerging disinfection by-products in drinking water: a review and roadmap for research. *Mutat Res.* 2007; 636: 178-242.
10. Basic Information about Radionuclides in Drinking Water.
11. United States Environmental Protection Agency. Office of Air and Radiation, Office of Radiation and Indoor Air. Radiation: Facts, Risks and Realities. 2012.
12. United States Environmental Protection Agency. Basic Information about Radionuclides in Drinking Water.
13. Thompson T, Fawell J, Kunikane S, Jackson D, Appleyard S, Callan P, et al. Chemical safety of drinking-water: Assessing priorities for risk management. World Health Organization. 2007.
14. Sigler A, Bauder J. Nitrate/nitrite fact sheet.
15. Ward MH, DeKok TM, Levallois P, Brender J, Gulis G, Nolan BT, et al. International Society for Environmental Epidemiology. Workgroup report: Drinking-water nitrate and health—recent findings and research needs. *Environ Health Perspect.* 2005; 113: 1607-1614.
16. Jarup L. Hazards of heavy metal contamination. *Br Med Bull.* 2003; 68: 167-182.
17. United States Environmental Protection Agency. Lead in Drinking Water.
18. United States Environmental Protection Agency. Basic Information about Cadmium in Drinking Water.
19. United States Environmental Protection Agency. Basic Information about Mercury (inorganic) in Drinking Water.
20. United States Environmental Protection Agency. Basic Information about Fluoride in Drinking Water Review of Fluoride Drinking Water Standard.