

Cadmium Content in Refill Drinking Water in Pariaman City

Azyyati Ridha Alfian*, Fea Firdani, Aria Gusti

Fakultas Kesehatan Masyarakat, Universitas Andalas, Jl. Perintis Kemerdekaan No.94, Padang, Sumatera Barat 25171, Indonesia.

*Corresponding author : azyyatiridhaalfian@ph.unand.ac.id

Info Artikel: Diterima 28 Juli 2022 ; Direvisi 15 Desember 2022 ; Disetujui 30 Januari 2023

Tersedia online : 1 Februari 2023 ; Diterbitkan secara teratur : Februari 2023

Cara sitasi (Vancouver): Alfian AR, Firdani F, Gusti A. Cadmium Content in Refill Drinking Water in Pariaman City. Jurnal Kesehatan Lingkungan Indonesia [Online]. 2023 Feb;22(1):92-95. <https://doi.org/10.14710/jkli.22.1.92-95>.

ABSTRAK

Judul : Kandungan Kadmium pada Air Minum Isi Ulang di Kota Pariaman

Latar belakang: Cadmium bersifat sangat toksik dibandingkan logam berat lainnya, dapat menyebabkan keracunan akut maupun kronis. Badan Pengawas Obat dan Makanan telah menguji mutu produksi dari 95 depot air minum isi ulang di 5 kota. Sebanyak 9 produk mengandung Cadmium yang melebihi ambang batas. Tujuan penelitian ini untuk memberikan informasi mengenai kandungan logam berat Cadmium yang ada di dalam air minum isi ulang di Kota Pariaman.

Metode: Penelitian ini menggunakan desain kuantitatif deskriptif untuk menggambarkan kandungan Cadmium yang terdapat dalam air minum isi ulang di Kota Pariaman. Penelitian ini menggunakan data sekunder. Total DAMIU yang diperiksa selama 3 tahun terakhir sebanyak 91 DAMIU. DAMIU diklasifikasikan menjadi memenuhi atau tidak memenuhi syarat kandungan Cadmium dari hasil uji laboratorium. Analisis data dilakukan secara univariat.

Hasil: Tingginya kadar Cadmium dalam air minum isi ulang diduga karena kualitas air baku dan *catridge filter* yang tidak di maintainance. 50% DAMIU menggunakan sumur gali sebagai air baku dimana cadmium lebih mudah mengendap pada sediman dasar sungai/ke dalam air tanah sehingga dalam menimbulkan tingginya kandungan Cadmium dalam air tanah. DAMIU yang tidak memenuhi baku mutu paling banyak ditemukan di wilayah Pariaman Selatan sebanyak 87% pada tahun 2020-2021

Simpulan: Tingginya kadar Cadmium dalam air minum isi ulang diduga karena kualitas air baku yang tidak memenuhi standar dan tidak dilakukan maintainance peralatan yang digunakan oleh DAMIU khususnya *Catridge filter* sesuai dengan jangka waktu seharusnya.

Kata kunci: Air Minum Isi Ulang; Kadmium; Depot Air Minum Isi Ulang; Kualitas Air Minum.

ABSTRACT

Background: Cadmium is highly toxic compared to other heavy metals, it can cause both acute and chronic poisoning. The Food and Drug Administration has tested the production quality of 95 refillable drinking water depots in 5 cities. A total of 9 products contain Cadmium that exceeds the threshold. The purpose of this study is to provide information about the heavy metal content of Cadmium in refillable drinking water in Pariaman City.

Method: This study used a descriptive quantitative design to describe the cadmium content contained in refillable drinking water in Pariaman City. This study used secondary data. The total refillable drinking water examined over the past 3 years is 91 refillable drinking water. Refillable drinking water is classified as meeting or not meeting the cadmium content requirements from the laboratory test results. Data analysis is carried out univariat.

Result: High levels of Cadmium in refillable drinking water are thought to be due to the quality of raw water and filter cartridges that are not maintained. 50% of refillable drinking water uses dug wells as raw water where cadmium is easier to settle in the sediment riverbeds / into groundwater so as to cause a high content of Cadmium in groundwater. refillable drinking water that does not meet the most quality standards is found in the South Pariaman region as much as 87% in 2020-2021

Conclusion: High levels of Cadmium in refillable drinking water are suspected to be due to raw water quality that does not meet the standards and is not maintained the equipment used by refillable drinking water, especially cartridge filters, is in accordance with the supposed time period.

Keywords: Refillable Drinking Water; Cadmium; Refillable Drinking Water Depot; Drinking Water Quality.

INTRODUCTION

Drinking water is directly related to the body's biological processes so it must meet the drinking water quality requirements set by the Ministry of Health of the Republic of Indonesia. These requirements are regulated in the Minister of Health of the Republic of Indonesia No.492 / MENKES / PER / IV / 2010. Mandatory parameters and additional parameters of drinking water quality requirements include chemical, microbiological, physical and radioactivity requirements. Drinking water should not contain toxic chemical compounds and each solute has a certain limit that is allowed to be contained in water. Drinking water can be healthy, but it can also have the potential to be a medium for disease transmission and the cause of poisoning.^{1,2,3,4}

Some types of heavy metals such as Cadmium (Cd), Lead (Pb), Mercury (Hg) are heavy metals that are very toxic compared to other heavy metals, which can accumulate in the body, so that they can cause acute and chronic poisoning in living things.^{5,6,7} According to the International Agency for Research on Cancer (IARC), Cadmium (Cd) is toxic to the body even in very low levels. The toxic effect of Cd is influenced by the length of exposure and levels during exposure, so if exposed to high levels for a long time will increase the toxic effect greater. A single dose of Cd can cause digestive tract disorders, while exposure to Cd in low doses but repeatedly can cause impaired renal function.^{8,9}

As a result of its easy accumulation in both sediments and organisms, Cadmium (Cd) can result in disruption of biological systems. Organs of the body such as the kidneys and liver are the targets of poisoning Cd. Other diseases such as 'lumbago' and 'itai-itai' that can be caused by Cd poisoning have also occurred in Japan which continues with bone damage due to softening and cracking of bones.¹⁰ In addition, Cd has also been classified as a carcinogenic agent by the International Agency for Research on Cancer (ICRP).¹¹

Refill Drinking Water Depots can be polluted by metal content that exceeds the normal threshold, so not all refillable drinking water is guaranteed safety. The Food and Drug Supervisory Agency of the Republic of Indonesia has tested the production quality of 95 refill drinking water depots in 5 cities. A total of 9 (nine) the product contains Cadmium (Cd)

which exceeds the established limits. Metal levels that exceed this normal threshold can be harmful to consumer health.^{12,13} The purpose of this study is to provide information on the heavy metal content of Cadmium present in refillable drinking water in Pariaman City. Information is needed to keep the refill drinking water safe that is starting to appear a lot.

MATERIALS AND METHODS

This study used a descriptive quantitative design to describe the cadmium content contained in refillable drinking water in Pariaman City. This study used secondary data, namely annual sanitation inspection data on the quality of refillable drinking water obtained from the Pariaman City Environmental Agency, from 2019-2021. The total refillable drinking water examined over the past 3 years is 91 refillable drinking water, but the number is different for each year. In 2019 the number of refillable drinking water inspected was 72 depots, in 2020 it was 68 depots, and in 2021 there were 75 depots. All refillable drinking water are spread across 4 sub-districts in Pariaman City. Each refillable drinking water is classified as eligible or unqualified based on content Cadmium which was found from the results of laboratory tests in refillable drinking water. The classification uses the drinking water quality standard limit for Cadmium content contained in the Minister of Health of the Republic of Indonesia No.492 / MENKES / PER / IV / 2010 which is 0.003 mg / L. Data analysis is carried out univariately and the data is displayed in the form of a graph to describe the quality of Cd content in refillable drinking water in refillable drinking water every year which is grouped based on the area of the District.²

RESULTS AND DISCUSSION

One of the chemical parameters tested in drinking water is the cadmium content. Cadmium is a heavy metal that has a harmful effect on humans if an excessive amount of exposure enters the body. Cadmium poisoning in high amounts of exposure can cause impaired kidney function and bone disorders.¹⁴ Based on the results of research and data analysis of Cadmium content in refillable drinking water, results were obtained as depicted in figure / graph 1.

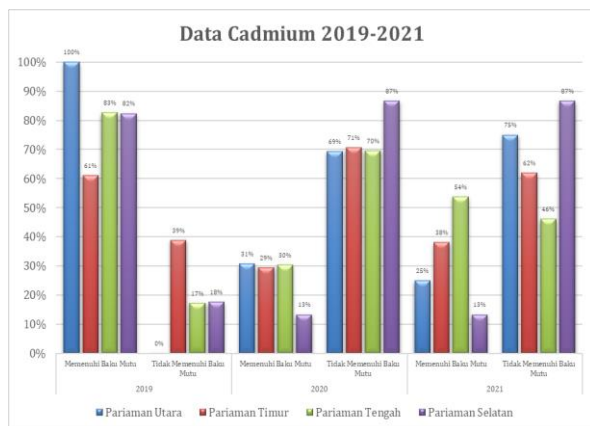


Figure 1. Cadmium Data 2019-2021

Within 3 years, namely 2019-2021, there are still many Refill Drinking Water Depots which are classified as not meeting the quality standards of their Cadmium content. The number of refillable drinking water that are classified as not meeting Quality standards also fluctuate every year in each district. In 2019, refillable drinking water that did not meet the quality standards was found in the East Pariaman area, which was 39%. In 2020-2021 refillable drinking water that did not meet the most quality standards was found in the South Pariaman region as much as 87%. The highest amount of Cadmium found in refillable drinking water processed refill drinking water in the city of Pariaman is 0.099 mg/L

The high level of Cadmium (Cd) in refillable drinking water is thought to be due to the high level of Cadmium in raw water used as a source of drinking water, one of which comes from well water. Based on the data obtained it is known that 50% refillable drinking water using dug wells / drilled wells as a source of raw water. Heavy metal materials, one of which is Cd, is easier to settle on the riverbed or can seep into groundwater so that it causes a high cd content in groundwater / well water. Research conducted by Naseem, et al (2014) shows that high levels of Cadmium in groundwater in Winder City, Pakistan where only 29.16% of water samples are safe which can meet the quality standards of WHO standards.^{15,16,17}

In addition, the quality of drinking water produced by the Refill Drinking Water Depot is also affected by the Catridge Filter used catridge filter must be cleaned or replaced within 3-4 months, while based on research data obtained more than 50% refillable drinking water carry out cleaning for more than 6 months. Filter cartridges have the ability in absorbing particles, chlorine and chemicals contained in water. The condition of the filter cartridge that is not maintained properly results in a high risk of contamination in refillable drinking water.¹⁸

Consumption of Cadmium (Cd) in low concentrations over a long period of time will cause accumulation in the kidneys and cause kidney damage. Cd content of 200 µg (wet weight) in the

renal cortex can result in kidney failure leading to death. Cd build-up in the body increases according to age i.e. half-life in the span of 20-30 years in the body.^{19,20}

Further research to determine the effects of Cadmium (Cd) on health in this settlement north of Winder City suggests that the area located in the redundant Cd boundary zone. As many as 9% of patients with kidney-related diseases were reported in this settlement out of a total of 15% of respondents of patients who had kidney problems in the study area.²¹ The results of the study Arain et al. (2015) also showed a high correlation between cd concentrations in the blood and urine in patients with renal impairment compared to healthy patients. Albuminuria, a state of the presence of albumin in the urine is a clinical biomarker of renal impairment. Research conducted in Australia that cd levels in the urine are associated with albuminuria. The effects of Cd can cause coughing, headaches, and vomiting at low doses whereas at high doses it can cause accumulation in the kidneys, liver, bones. Chronic anemia can also be caused as a result of prolonged exposure to Cd-containing drinking water.^{22,23}

CONCLUSION

In the period 2019-2021, there are still many refillable drinking waters found from refill drinking water depots in pariah city that do not meet the standard standards judging from the indicators of heavy metals, namely Cadmium. In 2019, refillable drinking water depots that did not meet the quality standards were found in the East Pariaman area, which was 39% and in 2020-2021 refillable drinking water which did not meet the quality standards most found in the South Pariaman region by 87%. The high level of Cadmium in refillable drinking water is thought to be due to the quality of raw water that does not meet the standards and is not carried out maintenance of the equipment used by refillable drinking water, especially catridge filters according to the supposed time frame.

ACKNOWLEDGMENTS

A thank you is conveyed to the Dean of the Faculty of Public Health Andalas University, to all lecturers and staff of the Faculty of Public Health of Andalas University, to the Pariaman City Environmental Service and the owners and managers of refillable drinking water who participated and assisted in this research, and all parties who have directly or indirectly helped the author and participated in this research.

REFERENCE

1. Maulana P. Fungsi dan Manfaat Air tersedia <http://Perpustakaan.or.id>; 2012
2. Permenkes RI. Persyaratan Kualitas Air Minum No. 492 492/MENKES/PER/IV/2010. Permenkes RI, Jakarta; 2010.

3. Khaira K. Analisis Kadar Tembaga (Cu) Dan Seng (Zn) Dalam Air Minum Isi Ulang Kemasan Galon Di Kecamatan Lima Kaum Kabupaten Tanah Datar. *J Sainstek IAIN Batusangkar*. 2014, 6(2):116-23 .
4. Asmadi. *Teknologi Pengolahan Air Minum*. Gosyen Publishing. Yogyakarta; 2011
5. Warlina, L . *Pencemaran Air : Sumber, Dampak Dan Penanggulangannya*. Sekolah Pasca Sarjana/ S3 Institut Pertanian Bogor, Bogor; 2004
6. Wardhana, W.A. *Dampak Pencemaran Lingkungan*. Penerbit Andi, Yogyakarta; 2001
7. Akbar AW, Daud A, Mallongi A. Analisis Risiko Lingkungan Logam Berat Cadmium (Cd) Pada Sedimen Air Laut di Wilayah Pesisir Kota Makassar. 2014:1-8.
8. Widowati W, Sastiono A, Jusuf R. *Efek Toksik Logam*. Andi, Yogyakarta; 2008.
9. Malik, Q., & Khan, M. Effect In Human Health Due To Drinking Water Contaminated With Heavy Metals. *Journal of Pollution Effects & Control*. 2016, 5(1):10-11.
10. O'Neill P. *Environmental Chemistry, Second Edition*, Chapman & Hall. London; 1994.
11. Ying Ouyang, John H, Jeanne T, Tim O, Dean C. Characterization And Spatial Distribution Of Heavy Metals In Sediment from Cedar And Ortega Rivers Subbasin. *J Contam Hydrol*. 2002, 54(1-2):19-35. [https://doi.org/10.1016/S0169-7722\(01\)00162-0](https://doi.org/10.1016/S0169-7722(01)00162-0)
12. Rahayu CS, Setiani O, Nurjazuli. Faktor Resiko Pencemaran Mikrobiologi Pada Air Minum Isi Ulang Di Kabupaten Tegal. *J Kesehatan Lingkungan Indonesia*. 2013, 12(1):1-9
13. Lubis H, Putra EDL, Jas A. Pemeriksaan Cemar Bakteri dan Beberapa Logam Berat Pada Air Minum Isi Ulang Yang Beredar Di Kota Medan. *e J usu*, 2005, 38(4)
14. Festri Istarani dan Ellina S. Pandebesie. Studi Dampak Arsen (As) Dan Kadmium (Cd) Terhadap Penurunan Kualitas Lingkungan. *Jurnal Teknik Pomits*, 2014, 3(1):1-6.
15. Naseem, Hamza, Bashir, Pirzada T, Talpur MMA. Trace Element Geochemistry Of Groundwater Of Winder, Balochistan, Pakistan And Its Appraisal For Irrigation Water Quality. *Br J Appl Sci Technol*, 2013,3(1):182-98. <https://doi.org/10.9734/BJAST/2014/2561>
16. Gafur, A., Kartini, A. D., & Rahman. Studi Kualitas Fisik Kimia Dan Biologis Pada Air Minum Dalam Kemasan Berbagai Merek Yang Beredar Di Kota Makassar Tahun 2016. *Jurnal Higiene*, 2017, 3(1):37-46. <http://103.55.216.56/index.php/higiene/article/view/2762>)
17. Rosita, N. Analisis Kualitas Air Minum Isi Ulang Beberapa Depot Air Minum Isi Ulang (DAMIU) di Tangerang Selatan. *Jurnal Kimia VALENSI*. 2014, 4(2):134-141. <https://doi.org/10.15408/jkv.v0i0.3611>)
18. Akmal Indra ,Agus S. Prototipe Alat Pencuci Cartridge Filter Usaha Air Minum Isi Ulang. *Inovtek*. 2016, 6(1):11 - 18.
19. Herman, Danny, Zulkifli. Tinjauan Terhadap Tailing Mengandung Unsur Pencemar Arsen (As), Merkuri (Hg), Timbal (Pb), Dan Kadmium (Cd) Dari Sisa Pengolahan Bijih Logam. *J Geol*. 2006, 1(1):31-6.
20. US Department of Human and Health Services. *Toxicological profile for Cadmium*; 2010.
21. Burke F, Hamza S, Naseem S, Azama SN-HM, Khan I. Impact of Cadmium Polluted Groundwater on Human Health, *J Sagepub,Winder, Balochistan*; 2016. <https://doi.org/10.2139/ssrn.2799397>
22. Arain. Co-Exposure Of Arsenic And Cadmium Through Drinking Water And Tobacco Smoking: Risk Assessment On Kidney Dysfunction. *J Environ Sci Pollut Res*. 2015, 22(1):350-357. <https://doi.org/10.1007/s11356-014-3339-0>
23. Webb. *The Geochemistry, Biochemistry And Biology of Cadmium*. Elsevier. Amsterdam; 1979



©2023. This open-access article is distributed under the terms and conditions of the Creative Commons Attribution-ShareAlike 4.0 International License.