Comparing Heavy Metal Concentrations in Urine and Municipal Drinking Water

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[NOTE: This text fits into a larger research paper. It is in draft form.]

Introduction and context:
This section is part of a larger research review on the possible health benefits and implications of Uropathy. The questions being addressed in this section are: (1) what can be learned from an analysis of a heavy metal (HM) test done on the urine of a Uropathy practitioner[1]; and (2) whether drinking urine is problematic or dangerous because of toxins in urine. The long-held understanding is that all the elements, chemicals and metabolites, that can be detected in urine will be reabsorbed if drunk. However, consumption does not equal absorption, and the elements, chemicals and metabolites, would necessarily be affected by their passage through the body. It is therefore unknown whether urine consumption could increase toxic load in the body.[2,3]

As a first step towards beginning this discussion, the HMs in a urine test performed in October 2024, are compared to HM standards in drinking water. Water is a relevant comparison because urine is 95% water. Acceptable levels of HM concentration in water are highly studied. This basic analysis of the concentrations found in the example urine test will provide a starting point. No conclusions can be drawn from one test. The comparisons are based on the water safety standards for municipal water set in Canada in 2024. As well, values from the US based Environmental Protection Agency (EPA) and World Health Organization (WHO) are used secondarily.

Challenges:
The main challenge to this work and analysis is that no similar supporting studies currently exist. There are many studies that analyze what can be detected in urine. There are no studies on what can be detected in the urine of people who drink their urine. Neither is there a study on the general health of people who drink their urine. This lack of data cannot be redressed without a

[1] The author is providing access to a urine heavy metals test from October 2024 as an example for this paper. For HM testing to provide a holistic picture, it is ideal to perform hair, urine and blood tests, as well as to repeat the tests at set intervals. As hair and blood tests are completed, this example will be added to with those results. These are the first tests the author has since beginning Uropathy protocols in 2013. Two of the largest doubts around Uropathy, from those who do not practice, are about long-term practice and the re-ingestion of toxins. The daily practice of the author, drinking at least 250ml a day since 2013, provides a good example for discussion, until a broader study can be completed. At the very least, showing that daily consumption is not immediately dangerous.
[2] Specifically, when people undergo detox protocols, and the concentrations of toxins increases in the urine, the understanding is that this urine would be counter to promoting health. However, we know as well, that the substances in the body undergo many processes as they pass through the organs and are subjected to bonding, conjugation and other reactions. Another study is indicated to examine urine during detox. In particular, what is the state of any HM as it exists the body, and what is the effect of drinking urine on the heavy metal and toxic loads of the individual?
[3] The heavy metals themselves are of interest, and a detailed breakdown is beyond the scope of this current example. A detailed discussion of heavy metals and their taxonomy is included in the longform of this research.

long-term study. Until such time, this example provides a basic foundation on which to begin the discussion.

This test is the first HM test performed on the subject since beginning daily uropathy practice in 2013. This provides a first look at whether there are any discernable signs of toxic load that might have built up with consistent ingestion and other protocols. Neither the test nor the analysis is conclusive as there is too little data.

There is always the possibility of molecular and ion mimicry which could be interfering with an accurate heavy metal test. This can happen in any individual, and if this is happening, it would only be borne out in repeated studies and interventions to redress mimicry.[4]

The subject

As there is one urine test, on one practitioner, the parameters are limited. Taking into account the details below, we can analyse the test within these parameters.

- The subject has been drinking urine daily since 2013 (other protocols have also been done regularly, but we are restricting this analysis to a water comparison and are therefore focussing on drinking).
- Daily consumption averages 750ml a day (a general range of 250ml to 1500ml a day has been ingested since 2013)
- The subject has drunk filtered water almost exclusively since 2013 (gravity filtration system[5]), and distilled water since 2021.
- The subject has had no signs of heavy metal related illnesses, toxic load increase, nor had any other health issues linked in any way with heavy metals or toxins since starting this practice.
- The general diet and medication history of the subject[6]:
    - Currently takes no medications, and has never taken daily, weekly or monthly pharmaceuticals,
    - does not smoke (linked to higher instances of arsenic (As), cadmium (Cd), chromium (Cr), nickel (Ni), and lead (Pb)),
    - has a diet high in plants, local foods and has been vegetarian since 2018,
    - ingests seafood one to four times a year (frequent intake of fish and seafood linked to higher Cd, mercury (Hg), Pb, As, and Cr.

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[4] Molecular and ion mimicry is a potential line of further inquiry, "Ionic mimicry refers to the ability of a cationic form of a toxic metal to mimic an essential element or cationic species of an element at the site of a transporter of that element. Molecular and ionic mimics can also be sub classified as structural or functional mimics" (p. 274). See - Bridges, Christy C. and Rudolfs K. Zalups, 'Molecular and Ionic Mimicry and the Transport of Toxic Metals', *Toxicology and Applied Pharmacology*, 204.3 (2005), 274-308

[5] The ceramic system used by the subject from Radiant Life guarantees the following specs which would possibly indicate a reduced HM and toxin intake over the last decade: 0.5 Micron absolute, >99.9% Efficiency at 0.2 micron, Meets or Exceeds NSF/ANSI Standards 42 & 53 for the following: >99% Chloramine reduction, >99% Chlorine reduction, >99% Lead reduction, >99% Herbicides and Pesticides reduction, >99% Glyphosate reduction, >98% VOC's reduction, >96% Pharmaceutical reduction, >98% Heavy metals reduction, >98% THM's (Trihalomethanes) reduction, >92% Nitrates reduction, >97% Fluoride reduction, >99% Fluorinated Organic Acids (PFOA & PFOS), >99% Micro plastics

[6] We are not in a position in this analysis to take into account the diet of the subject in terms of testing and monitoring ingestion. However, these points are relevant as we are not expecting to find higher concentrations because of a known source of heavy metals such as seafood consumption.

Methods:
One urine sample was collected and sent to the Medivere lab in Mainz, Germany. The kit provided by Medivere contains the instructions and all materials needed to collect the biospecimen. The sample was collected on 14.10.2024 and the test results published on 23.10.2024.

The lab provided two data sets: Heavy Metal Concentrations in Urine at µg/L Raw Values) and Heavy Metal Concentrations Correlated to Creatinine in Urine at µg/g of Creatinine. The raw values are used as a comparison for municipal drinking water standards at mg/L. As the urinary creatinine concentration was known, the raw values are relevant for comparison to water heavy metal concentrations.

The test returned values for 15 HMs: Aluminium (Al), Antimony (Sb), Arsenic (As), Lead (Pb), Cadmium (Cd), Chrome (Cr), Iron (Fe), Cobalt (Co), Copper (Cu), Nickel (Ni), Palladium (Pd), Platinum (Pt), Mercury (Hg), Silver (Ag), Thallium (Tl), Zinc (Zn), Tin (Sn). Not all of these HMs have standards for water concentrations. The analysis is limited to the shared HMs included in the standards for heavy metals in water provided by the WHO, the EPA, and the Guidelines for Canadian Drinking Water Quality (2024).[7]

The purpose of municipal water standards is to address potential exposure levels in drinking water. The comparison of municipal water standards to urine is therefore to determine whether a practitioner of urine therapy could increase their HM toxic load by drinking urine. We are not seeking to understand the body's exposure to heavy metals, nor the possible heavy metal load of this individual. The focus is strictly on the hypothetical question of what volume of urine would have to be drunk to approximate the acceptable concentrations of HMs set in drinking water standards.

Goals:
The aim of this discussion is to show the promise of further research in this area. Specifically, that consuming urine is not likely to increase toxic load. Eventually, with more subjects, the goal of the research is to demonstrate that urine consumption can help the body to better process and release the HMs and toxins that are present.

Discussion:
Toxicity is not determined by the 'product' but by the dose.[8] Therefore, we are focussed in this example on the hypothetical dose that could be ingested by an individual drinking their own daily urine.

The comparisons in **Table 1** are to the Health Canada guidelines. These are based on municipal water standards. **Table 2** provides the WHO and EPA standards as well. The comparison across the three standards shows some variance. The Canadian standards are used for the majority of the

[7] 'Guidelines for Canadian Drinking Water Quality—Summary Tables (2024).' Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.
[8] A detailed discussion of toxicity is included in the longform of this research.

discussion because they were updated in 2024. As well, the subject of the test was living in Canada throughout most of the eleven years of uropathy practice before the Medivere test.

Table 1

Summary Table of Results. Canadian Municipal Drinking Water Standards (CND)

Metal	***Concentration Norm in urine* µg/L**	***Concentration in Urine sample* µg/L**	**CND Standard mg/L**	**Urine Volume (L) CND**
Aluminium (Al)	*<20.0*	*16.5*	2.9	176
Antimony (Sb)	*< 0.25*	*<0.25*	0.006	24
Arsenic (As)	*< 25.0*	*7.7*	0.01	1.3
Lead (Pb)	*< 4.5*	*0.53*	0.005	9.4
Cadmium (Cd)	*< 0.50*	*0.14*	0.007	50
Chrome (Cr)	*< 1.00*	*<0.04*	0.05	125
Copper (Cu)	*2.0 – 80.0*	*5.0*	2.0	400
Nickel (Ni)	*< 3.30*	*2.54*	0.02	7.9
Mercury (Hg)	*< 2.3*	*0.2*	0.001	5

Table 2

Summary Table of Results. EPA, CND and WHO Water Standards

Metal	***Concentration Norm* µg/L**	***Concentration in Urine sample* µg/L**	**Urine Volume (L) CND**	***Urine Volume (L) EPA***	**Urine Volume (L) WHO**
Aluminium (Al)	*<20.0*	*16.5*	176	*12.1*	NA
Antimony (Sb)	*< 0.25*	*<0.25*	24	*24*	>80
Arsenic (As)	*< 25.0*	*7.7*	1.3	*1.3*	1.3
Lead (Pb)	*< 4.5*	*0.53*	9.4	*28.3*	18.9
Cadmium (Cd)	*< 0.50*	*0.14*	50	*35.7*	21.4
Chrome (Cr)	*< 1.00*	*<0.04*	125	*250*	>125
Copper (Cu)	*2.0 – 80.0*	*5.0*	400	*260*	400
Nickel (Ni)	*< 3.30*	*2.54*	7.9	*NA*	27.6
Mercury (Hg)	*< 2.3*	*0.2*	5	*10*	30

In **Table 1** the columns are from left to right: the chemical element and its symbol; the established concentration norms in urine for each chemical element; the concentration of each chemical element found in the test subject's urine; the Canadian standard for HM concentrations in mg/L in municipal drinking water; the volume in L of urine that would need to be drunk to approach the CND standard.

In **Table 2** the columns are from left to right: the chemical element and its symbol; the established concentration norms in urine for each chemical element; the concentration of each chemical element found in the test subject's urine; the volume in L of urine that would need to be drunk to approach the CND standard; the volume in L of urine that would need to be drunk to approach the EPA standard; the volume in L of urine that would need to be drunk to approach the WHO standard.

Observations:

1. **Nine HMs were compared**:
    - Of the 15 HMs in the urine test, nine are included in Table 2, and seven were part of all three drinking water standards. Al is not part of WHO values. Ni is not part of EPA values. This could be due to the low toxicity or lack of evidence for setting limits within the frameworks of those organizations.
2. **Highest Urine Volumes**:
    - Cu requires the largest urine volume at 400 L (260 EPA) to approach CND's and WHO's standard of 2 mg/L. Cr is the next highest at 125 L (250 EPA). (Al is very high in CND values at 176 L and in a middle range for EPA at 12.1 L)
3. **Middle Volumes:**
    - Sb, Pb, Cd, Ni values are all too high for a person to consume enough urine to increase the toxic load.
4. **Low Volumes for Arsenic**:
    - Arsenic's urine concentration is closest to all three standards of 0.01 mg/L, needing only **1.3 L of urine** to match the standard.
5. **Variance for Mercury:**
    - Hg provides an interesting case. The CND standard returns 5 L , EPA returns 10 L and WHO returns 30 L. This variance is likely based on ALARA or what is considered 'as low as reasonably achievable' – for the larger organizations.
6. **The Big Four**:
    - Arsenic, cadmium, mercury and lead, are referred to as the big four of HMs.
    - Cd, Pb, are low in the subject's sample, compared to norms. It would be impossible to drink enough urine in a short period of time, to approach the standards.
    - Hg is low, and the threshold is also low. As Hg is shown as 5, 10 or 30 L, it depends on the standard referenced. Even at 5 L it would be very hard to approach the standard by drinking urine.
    - As is the outlier as all the standards return 1.3 L as the volume needed. However, As differs greatly from the other Big Four because of the kind of As detected in water, versus As in food, and in urine.[9]

Question 1

We return to our opening questions. What can be learned from an analysis of a heavy metal test done on the urine of a Uropathy practitioner?

Given the results from this test a few pieces of information stand out. The idea that drinking urine is unsafe because of heavy metals and toxins is at the very least put in doubt by this

[9] Arsenic is discussed in depth in the long form of the research.

example. The test subject has been drinking 250ml-1500ml of urine a day since 2013. If urine was an efficient delivery system for the re-uptake of toxins and HMs we would assume higher levels of toxins and HMs than this sample contains. At the very least, a higher level of As might be posited as it requires much less liquid intake to approach the CND, EPA and WHO standards.

With this information we could question whether HMs in urine behave differently than HMs in water. Are HMs in urine in an altered state because of the chemical processes in the body?

Question 2

Is drinking urine problematic or dangerous because of the toxins in urine and the potential to increase toxic load in the body?

Taken in light of the test subject's years of daily practice, the simple answer would be, no. However, this information needs to be tested against other samples from urine therapy practitioners. Tests would ideally be run on those who have been practicing for many years, as well as on those who are undergoing HM detox or have specific known toxic loads.[10]

To deepen the understanding of the implications of drinking urine extensive testing is called for to establish the effects and affects of urine. In particular, how is it similar and how is it different from water.

For the purposes of this urine test we have assumed that 1 L of water is similar enough to 1 L of urine to run the example. However, to be more exact tests would need to be run on the electrical charge in water and in urine, the chemical makeup of both, the blueprint, if you will of both substances would need to be take into account.

The answer to question 2 is no, insofar as for most of the HMs tested, it would be impossible to drink enough liquid to reach the volume in L listed in the tables. Research into water toxemia, or water poisoning, which is excessive water intake, indicates that the kidneys can filter 800ml to 1000ml of water per hour. Anything above this disturbs the electrolyte balance and can lead to problems in brain function and ultimately, death. An example from Scientific American reports on a case where a woman drank six litres in three hours and died later that day.[11] The main issue is the shift in sodium levels in the blood.[12] There is no known example of someone consuming

[10] Many anecdotal examples exist of people who were in a toxic state and used their own daily urine to achieve better health while the known toxic load was still high. There is no study on such examples to date.
[11] There are specific cases of marathon runners drinking more than the kidneys can filter while under the stress of running. On an average day 800ml to 1000ml per hour is the maximum, and this cannot be maintained for many hours per day. A major campaign has been led most people to assume that they should be drinking 1500ml to 2000ml of water per day (or six to eight cups). This does not include liquids with caffeine, high amounts of sugar or other ingredients, which many people will consume while at work. Ballantyne, Coco, 'Strange but True Drinking too Much Water can Kill You', *Scientific American*, 21 June 2007, https://www.scientificamerican.com/article/strange-but-true-drinking-too-much-water-can-kill/ [Accessed Nov 17, 2024]
[12] "Hyponatremia, a word cobbled together from Latin and Greek roots, translates as "insufficient salt in the blood." Quantitatively speaking, it means having a blood sodium concentration below 135 millimoles per liter, or approximately 0.4 ounces per gallon, the normal concentration lying somewhere between 135 and 145 millimoles per liter." Ballantyne, Coco, 'Strange but True Drinking too Much Water can Kill You', *Scientific American*, 21

enough urine to create urine toxemia. Perhaps the volume would be similar to water, but perhaps it is different.

Keeping to the assumption that water and urine would be similar when drunk in large volumes, by the time a person had drunk enough urine to approach these standards (As not included), the volume of liquid consumed would have led to water poisoning.[13,14] While it is useful to compare water and urine simply based on volumes of liquid, they cannot be compared in terms of chemical makeup and possible absorption in the human body, without further study.

Conclusion:
This is one example based on one test of an individual's urine. What is promising is the potential that drinking urine over many years does not increase the HM load in the human organism. This short example will serve as a starting point to further examination, discussion and research into the effects and affects of urine practices.

June 2007, https://www.scientificamerican.com/article/strange-but-true-drinking-too-much-water-can-kill/ [Accessed Nov 17, 2024]

[13] However, we don't know that drinking high volumes of urine results in water toxemia at the same rate as with water. The electrolyte balance in urine is different, indeed given the information in the Human Metabolome Database urine could be seen as nutrition with its complex chemical makeup. The Human Metabolome Database is discussed at length in the long form of the research.

[14] For our purposes we are comparing HM concentrations in two different liquids. We are making a jump in this comparison, because water, in general, contains a very different list of contents than urine. According to the Environmental Working Group in the US, "found a total of 316 contaminants in water supplied to the public between 2004 and 2009." "9 Common Chemicals in Tap Water", *Primo Water Blog*, March 12, 2018, https://primowater.com/blog/9-common-chemicals-in-tap-water/ [Accessed 18 Nov 2024]