

## 4 Minerals in tap water

Water is indispensable for human life and health maintenance. In healthy humans, the total amount of water in the body is maintained at a constant level. Although the daily water intake of adults differs according to atmospheric temperature, humidity, activity strength, and other factors, the normal intake of drinking water - about 1.2 L, of water contained in food - about 1 L, and of water yielded by the metabolism of nutrients (metabolic water) - about 0.3 L<sup>1)</sup>.

Drinking water in Japan is mainly sourced from tap water whose water quality is regulated by the Waterworks Law. Tap water contains trace amounts of minerals, the levels of which differ according to the geographical region and raw water<sup>2)</sup>. By clarifying the composition of the minerals contained in daily-taken water and adding this to a nutrient calculation, the intake of minerals can be tracked more accurately.

In this section, the median, maximum, and minimum values of several minerals in tap water are tabulated by collecting the data of each water purification plant based on the 2013 Tap Water Statistics Water Quality Edition<sup>3)</sup> and categorizing the data according to the region and raw water. Median values were used as the representative values because the levels of minerals in supplied water from each water purification plant are not of an even distribution, but are assumed to be of an asymmetrical distribution where only a few purification plants provide water with higher mineral contents. Table 26 shows the contents per 100 g of tap water whose minerals are listed in the Composition Tables by region, and Table 27 shows that by raw water.

### Points to note in data aggregation

- 1 Data of average values of water suppliers, etc. testing the seven items, i.e., sodium, iron, zinc, copper, manganese, selenium content in water, and water hardness were aggregated. (Taking 1 L tap water=1000 g, calculated the values per 100g tap water.)
- 2 Data of average values were taken to be 0 in the aggregation when the values were below the limit of the quantitation.
- 3 Calcium and magnesium are estimated values<sup>\*2</sup> calculated from disclosed hardness<sup>\*1</sup>, and are not test values (analytical values).

\*1 Hardness is the value obtained by converting the content of calcium and magnesium dissolved in water to calcium carbonate (CaCO<sub>3</sub>). When measuring calcium and magnesium, the notification of the Ministry of Health, Labor, and Welfare<sup>4)</sup> prescribes that hardness can be calculated by:

$$\text{Hardness} <\text{mg/L}> = \text{calcium concentration} <\text{mg/L}> \times 2.497 + \text{magnesium concentration} <\text{mg/L}> \times 4.118.$$

\*2 Here, the calcium and magnesium levels per 100g tap water are estimated to be as follows.

$$\text{Calcium content} <\text{mg}/100 \text{ g}> = \text{hardness} <\text{mg}/100 \text{ g}> \div 2.497 \times 0.72$$

$$\text{Magnesium content} <\text{mg}/100 \text{ g}> = \text{hardness} <\text{mg}/100 \text{ g}> \div 4.118 \times 0.28$$

The percentage of calcium hardness and magnesium hardness making up hardness (calcium : 0.72, magnesium : 0.28) is the average of the values calculated from the total hardness and measured calcium and magnesium values in 12 regions all over the country. These percentages differ according to the geological features of the water shed and route to the water purification

facility (river or ground water, reach time). It should be noted that it is difficult to collectively estimate the mineral contents in extensive regions and water sources.

- 4 The minerals are measured by the methods conforming to the Composition Table Analysis Manual (inductively coupled plasma mass spectrometry, and other methods). Hardness is calculated from the measured calcium and magnesium contents or analytical values by the titration method.
- 5 In the aggregation of Table 27 (by raw water types), in plants using multiple raw water sources, plants using raw waters of different raw water types, and plants whose raw water type is unknown were excluded.

Regarding the minimum values for sodium and hardness (including calcium and magnesium), the difference in the minimum determination limits of water suppliers etc. is large and thus they are not shown. Given that the mineral levels in tap water differ according to the water purification plant, if more detailed data is required, the concerned tap water supplier should be contacted to request the data.

Table 26 Minerals in tap water by region

Region		Sodium	*Calcium	*Magnesium	Iron	Zinc	Copper	Manganese	Selenium	Hardness
		mg/100 g								µg/100 g
Throughout Japan (No. of facilities: 5835)	Median value	<b>0.87</b>	<b>1.27</b>	<b>0.30</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>44</b>
	Max. value	9.72	8.48	2.00	0.024	0.028	0.020	0.0050	1.0	294
	Min. value	—	—	—	0	0	0	0	0	—
Hokkaido (No. of facilities: 198)	Median value	<b>0.81</b>	<b>0.84</b>	<b>0.20</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>29</b>
	Max. value	4.88	6.83	1.61	0.007	0.019	0.005	0.0011	0.1	237
	Min. value	—	—	—	0	0	0	0	0	—
Tohoku (No. of facilities: 685)	Median value	<b>0.85</b>	<b>0.87</b>	<b>0.20</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>30</b>
	Max. value	6.70	6.55	1.54	0.015	0.028	0.020	0.0018	0.1	227
	Min. value	—	—	—	0	0	0	0	0	—
Kanto (No. of facilities: 1056)	Median value	<b>1.18</b>	<b>1.93</b>	<b>0.46</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>67</b>
	Max. value	6.88	5.94	1.40	0.024	0.013	0.020	0.0022	0.1	206
	Min. value	—	—	—	0	0	0	0	0	—
Chubu (No. of facilities: 1554)	Median value	<b>0.66</b>	<b>1.10</b>	<b>0.26</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>38</b>
	Max. value	5.84	6.57	1.55	0.023	0.019	0.013	0.0017	1.0	228
	Min. value	—	—	—	0	0	0	0	0	—
Kinki (No. of facilities: 765)	Median value	<b>0.93</b>	<b>1.21</b>	<b>0.29</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>42</b>
	Max. value	8.10	3.60	0.85	0.015	0.006	0.016	0.0013	0.1	125
	Min. value	—	—	—	0	0	0	0	0	—
Chugoku (No. of facilities: 356)	Median value	<b>0.87</b>	<b>1.01</b>	<b>0.24</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>35</b>
	Max. value	4.90	4.79	1.13	0.005	0.010	0.010	0.0005	0.1	166
	Min. value	—	—	—	0	0	0	0	0	—
Shikoku (No. of facilities: 359)	Median value	<b>0.70</b>	<b>1.38</b>	<b>0.33</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>48</b>
	Max. value	5.50	5.68	1.34	0.008	0.005	0.008	0.0012	0.1	197
	Min. value	—	—	—	0	0	0	0	0	—

Kyushu (No. of facilities: 807)	Median value	<b>1.02</b>	<b>1.36</b>	<b>0.32</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>47</b>
	Max. value	6.26	8.48	2.00	0.012	0.027	0.010	0.0050	0.1	294
	Min. value	—	—	—	0	0	0	0	0	—
Okinawa (No. of facilities: 55)	Median value	<b>2.02</b>	<b>1.44</b>	<b>0.34</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>50</b>
	Max. value	9.72	6.20	1.46	0.016	0.008	0.002	0.0001	0.1	215
	Min. value	—	—	—	0	0	0	0	0	—

\*Estimate value calculated from hardness

Table 27 Minerals in tap water by raw water types

Raw water		Sodium	*Calcium	*Magnesium	Iron	Zinc	Copper	Manganese	Selenium	Hardness
		mg/100 g							µg/100 g	
Surface water (No. of facilities: 929)	Median value	<b>0.73</b>	<b>0.89</b>	<b>0.21</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>31</b>
	Max. value	5.30	6.55	1.54	0.015	0.010	0.010	0.0050	0.1	227
	Min. value	—	—	—	0	0	0	0	0	—
Dam/lake water (No. of facilities: 208)	Median value	<b>0.89</b>	<b>0.89</b>	<b>0.21</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>31</b>
	Max. value	6.23	6.55	1.54	0.006	0.007	0.003	0.0010	0.1	227
	Min. value	—	—	—	0	0	0	0	0	—
Ground water (No. of facilities: 2814)	Median value	<b>0.91</b>	<b>1.47</b>	<b>0.35</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>51</b>
	Max. value	8.10	7.84	1.85	0.023	0.028	0.020	0.0022	1.0	272
	Min. value	—	—	—	0	0	0	0	0	—
Received water/spring water, etc. (No. of facilities: 1176)	Median value	<b>0.70</b>	<b>1.01</b>	<b>0.24</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>35</b>
	Max. value	5.45	6.57	1.55	0.024	0.013	0.010	0.0010	0.1	228
	Min. value	—	—	—	0	0	0	0	0	—

\*Estimate values calculated from hardness

## References

- 1) Japan Society of Nutrition and Food Science : Nutrition and Food Science Data Handbook, Dobunshoin (2006)

- 2) Ayuho Suzuki, Tomoko Watanabe: The mineral content of tap water in Japan. Abstract book, 12th Asian Congress of Nutrition. p.198 (2015)
- 3) Japan Water Works Association: 2013 Tapwater Statistics Water Quality Edition
- 4) Methods prescribed by Minister of Health, Labour and Welfare based on ministerial ordinances related to water quality standards (July 22, 2003 MHLW Notification No. 261, MHLW Notification No. 56 (most recent revision March 12, 2015).