

1 **Implication of nitrate in drinking water in Kawauchi village,**
2 **Fukushima**

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3 **Dear Editor:**

4 Four years has passed since the accident at Fukushima Daiichi nuclear power plant
5 (FDNPP). The thyroid ultrasound examination within the framework of the Fukushima
6 Health Survey being conducted in Fukushima Prefecture has targeted all prefectural
7 inhabitants who were less than 18 years of age at the accident (approximately 360,000
8 inhabitants). The first cycle of screening, which took place between October 2011 and
9 March 2014, showed that amongst 297,046 screened individuals, 112 had confirmed or
10 suspected malignancies. Nevertheless, the causal relationship between radiation
11 exposure and thyroid cancer in this cycle should be carefully evaluated since the
12 radiation dose to the thyroid gland in Fukushima was quite low when compared to that
13 in Chernobyl (the maximum thyroid radiation dose in Fukushima was 35 mSv, whereas
14 the mean dose in Chernobyl was 240 mSv) (1,2), and the ages of children with thyroid
15 cancer were less than 10 years old at the time of the accident in Chernobyl, whereas in
16 Fukushima, so far, no children were less than 5 years and only a few cases were less
17 than 10 years old at the time of the accident (1).

18 Besides ionizing radiation exposure, nitrate is considered as a risk factor for thyroid

1 cancers. Nitrate and nitrite are precursors in the endogenous formation of N-nitroso
2 compounds, which are potent animal carcinogens that cause thyroid and many other
3 tumors in animal models (3). An epidemiological study in older women in Iowa showed
4 an increased risk of thyroid cancer with higher average nitrate levels in public water
5 supplies and with longer consumption of water exceeding 5 mg/L nitrate-N (3). The
6 possibility of a similar relationship between the incidence of thyroid cancer in
7 Fukushima and consumption of nitrate-containing water has not been evaluated. In this
8 report, we conducted a preliminary evaluation of nitrate concentrations in drinking
9 water in Kawauchi village, Fukushima Prefecture, located within 30km of the FDNPP.
10 We investigated nitrate nitrogen concentrations in the drinking water of Kawauchi
11 village (Total population; 2,700 and total households; 1,100) (4), where all inhabitants
12 use their own private wells as the main source of drinking water. We collected water
13 from 104 household wells in the village (Figure 1) and analyzed the nitrate/nitrite
14 nitrogen concentrations by the naphthylethylene-diamine method (Pack Test, Kyoritsu
15 Chemical-Check Lab., Corp, Tokyo, Japan). The median (25th–75th) nitrate nitrogen
16 level was 0.62mg/L (0.20–2.51 mg/L), which did not exceed the recommended
17 maximum contamination levels (MCL) of 10 mg/L for nitrate nitrogen in water samples
18 in Japan. The nitrite nitrogen concentrations in any well also did not also exceed

1 0.005mg/L, the recommended MCL in Japan. Our preliminary results suggested that
2 nitrate in drinking water does not contribute significantly to thyroid disorders in
3 Kawauchi village of Fukushima. In Fukushima Prefecture, many inhabitants usually use
4 tap water. Since tap water is more regulated than private wells, nitrate nitrogen exposure
5 from drinking water is considered to be limited in inhabitants of Fukushima.
6 In addition to investigations including the evaluation of dietary nitrate intake, further
7 epidemiological studies are needed to clarify the factors contributing to the incidence of
8 thyroid diseases, including malignancies, in Fukushima.

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14 **Author Disclosure Statement**

15 No competing financial interests exist.

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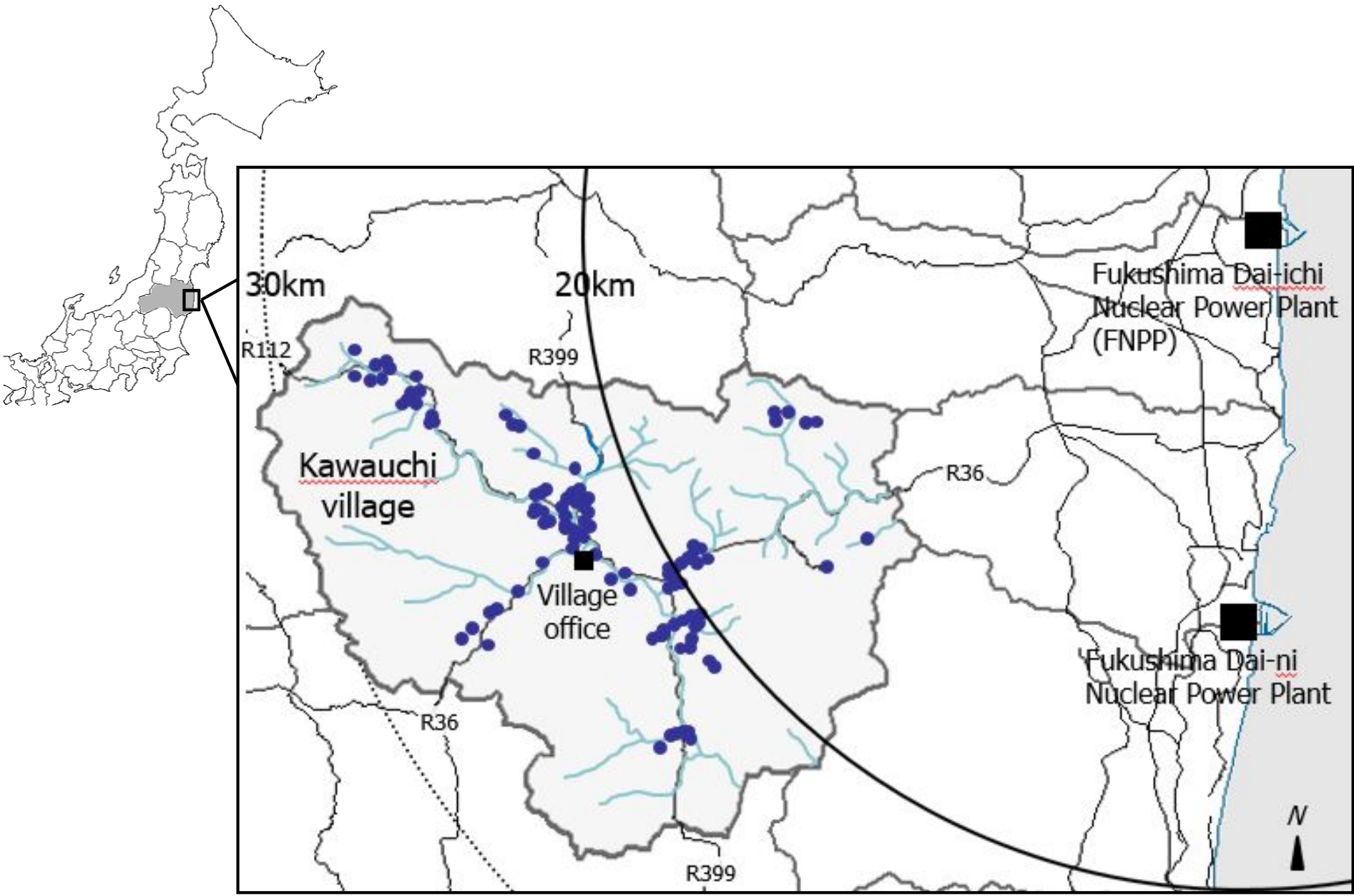


FIG. 1.

Sampling points of water for the measurement of nitrate/nitrite nitrogen concentrations in Kawauchi village.