Data Article

Data on health risk assessment to the nitrate in drinking water of rural areas in the Khash city, Iran

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ABSTRACT

The main objective of this data was determination of the nitrate concentration and its health risk assessment in the drinking water resources. In the aim of this data article a number of 30 samples of nitrate concentration in drinking water resources were collected from villages of the Khash city, Sistan and Baluchistan province, Iran. The nitrate concentration was measured using a Spectrophotometer accordance standard methods for examination of water and wastewater. Data indicated that nitrate concentration in drinking water ranged from 6 to 35 mg/L (average 16.083 mg/L). The mean EDI values for nitrate in different groups of infants, children, teenagers and adults were 0.1287, 0.9114, 0.6433 and 0.5155 mg/Kg, respectively. The findings of data showed that HQ value was less than 1 in 96% of samples in age groups of infants, children, teenagers and adults.

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**Value of data**

- The data showed that the nitrate concentration in all of water samples was lower than the maximum permissible limits (50 mg/L) according to WHO guideline and Iran standards.
- Rural water sources, due to the lack of sewage collection systems can be one of the sources of nitrate absorption in the body and cause methemoglobinemia (blue baby), especially in children. Also, nitrate is used mainly in inorganic fertilizers. It is also used as an oxidizing agent and in the production of explosives, and purified potassium nitrate is used for glass making, so nitrate can reach both surface water and groundwater (by infiltration of the nitrogen) as a consequence of agricultural activity. Hence its risk assessment can be useful in preventing methemoglobinemia.
- The data indicated that HQ value was more than one for age group of children only in one sampling areas, so should be selected a suitable resource of drinking water for this age group.

1. **Data**

   Table 1 shows the constants used in calculating the nitrate risk assessment in water samples. Nitrate concentration and nitrate estimated daily intake (EDI) and hazard quotient (HQ) of nitrate for the drinking water samples have been indicated in Table 2. Also, location of water sampling in the research area and Geological distribution of nitrate in Khash area has been indicated in Figs. 1 and 2.

### Table 1

| Parameter | Risk exposure factors | Values for groups | Unit |
|-----------|-----------------------|-------------------|------|
|           |                       | Infants | Children | Teenagers | Adults |
| Nitrate   | $C_r$                 | –       | –        | –         | –      |
|           | $C_d$                 | 0.08    | 0.85     | 2         | 2.5    |
|           | $B_w$                 | 10      | 15       | 50        | 78     |
|           | RID                   | 1.6     | 1.6      | 1.6       | 1.6    |

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2. Experimental design, materials and methods

2.1. Description of study area

The Khash city is located in Sistan and Baluchistan Province, Iran in the latitudes of 28°13'N and longitudes of 61°13'E. According to the demographic information of Iran, this city is populated with almost 173,821 with an area 19.376 km². This area has a warm and dry climate and the highest and lowest air temperatures are 37°C and 7°C, respectively [9–11].

2.2. Determination of nitrate concentration in drinking water resources

The samples were collected in the middle of the day and then transferred to chemical laboratory in a cool box immediately. Sampling was done with one-liter polyethylene bottles which were immersed in nitric acid for 24 h, then washed with 10 percent HCL and finally washed with distilled water. It is necessary to be mentioned that before the collection of the samples, sampling containers had been rinsed at least three times with water. In the laboratory the nitrate ions in the samples were measured using the SPADN method at a wavelength of 500 nm by HACH (spectrophotometer DR 5000 Company, USA) [12–24].

| No.s | Nitrate concentration | EDI Adults | Infants | HQ Adults | HQ Teenagers | HQ Children | HQ Infants |
|------|-----------------------|------------|---------|-----------|--------------|-------------|------------|
| 1    | 11.500                | 0.0920     | 0.6517  | 0.4600    | 0.3686       | 0.0575      | 0.4073     |
| 2    | 26.000                | 0.2080     | 1.4733  | 1.0400    | 0.8333       | 0.1300      | 0.9208     |
| 3    | 19.000                | 0.1520     | 1.0767  | 0.7600    | 0.6090       | 0.0950      | 0.6729     |
| 4    | 18.500                | 0.1480     | 1.0483  | 0.7400    | 0.5929       | 0.0925      | 0.6552     |
| 5    | 6.500                 | 0.0520     | 0.3683  | 0.2600    | 0.2083       | 0.0325      | 0.2302     |
| 6    | 8.500                 | 0.0680     | 0.4817  | 0.3400    | 0.2724       | 0.0425      | 0.3010     |
| 7    | 6.000                 | 0.0480     | 0.3400  | 0.2400    | 0.1923       | 0.0300      | 0.2125     |
| 8    | 24.500                | 0.1960     | 1.3883  | 0.9800    | 0.7853       | 0.1225      | 0.8677     |
| 9    | 16.000                | 0.1280     | 0.9067  | 0.6400    | 0.5128       | 0.0800      | 0.5667     |
| 10   | 27.000                | 0.2160     | 1.5300  | 1.0800    | 0.8654       | 0.1350      | 0.9563     |
| 11   | 25.000                | 0.2000     | 1.4167  | 1.0000    | 0.8013       | 0.1250      | 0.8854     |
| 12   | 35.000                | 0.2800     | 1.9833  | 1.4000    | 1.1218       | 0.1750      | 1.2396     |
| 13   | 16.000                | 0.1280     | 0.9067  | 0.6400    | 0.5128       | 0.0800      | 0.5667     |
| 14   | 11.500                | 0.0920     | 0.6517  | 0.4600    | 0.3686       | 0.0575      | 0.4073     |
| 15   | 26.500                | 0.2120     | 1.5017  | 1.0600    | 0.8494       | 0.1325      | 0.9385     |
| 16   | 8.500                 | 0.0680     | 0.4817  | 0.3400    | 0.2724       | 0.0425      | 0.3010     |
| 17   | 11.500                | 0.0920     | 0.6517  | 0.4600    | 0.3686       | 0.0575      | 0.4073     |
| 18   | 11.500                | 0.0920     | 0.6517  | 0.4600    | 0.3686       | 0.0575      | 0.4073     |
| 19   | 9.000                 | 0.0720     | 0.5100  | 0.3600    | 0.2885       | 0.0450      | 0.3188     |
| 20   | 8.000                 | 0.0640     | 0.4533  | 0.3200    | 0.2564       | 0.0400      | 0.2833     |
| 21   | 18.500                | 0.1480     | 1.0483  | 0.7400    | 0.5929       | 0.0925      | 0.6552     |
| 22   | 20.500                | 0.1640     | 1.1617  | 0.8200    | 0.6571       | 0.1025      | 0.7260     |
| 23   | 7.000                 | 0.0560     | 0.3967  | 0.2800    | 0.2244       | 0.0350      | 0.2479     |
| 24   | 10.500                | 0.0840     | 0.5950  | 0.4200    | 0.3365       | 0.0525      | 0.3719     |
| 25   | 11.000                | 0.0880     | 0.6233  | 0.4400    | 0.3526       | 0.0550      | 0.3896     |
| 26   | 25.500                | 0.2040     | 1.4450  | 1.0200    | 0.8173       | 0.1275      | 0.9031     |
| 27   | 15.000                | 0.1200     | 0.8500  | 0.6000    | 0.4808       | 0.0750      | 0.5313     |
| 28   | 14.000                | 0.1120     | 0.7933  | 0.5600    | 0.4487       | 0.0700      | 0.4958     |
| 29   | 25.500                | 0.2040     | 1.4450  | 1.0200    | 0.8173       | 0.1275      | 0.9031     |
| 30   | 9.000                 | 0.0720     | 0.5100  | 0.3600    | 0.2885       | 0.0450      | 0.3188     |
| Mean | 16.083                | 0.1287     | 0.9114  | 0.6433    | 0.3155       | 0.0804      | 0.5696     |
| Max  | 35.000                | 0.2800     | 1.9833  | 1.4000    | 1.1218       | 0.1750      | 1.2396     |
| Min  | 6.000                 | 0.0480     | 0.3400  | 0.2400    | 0.1923       | 0.0300      | 0.2125     |
| SD   | 7.778                 | 0.0622     | 0.4408  | 0.3111    | 0.2493       | 0.0389      | 0.2755     |

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Fig. 1. Location of nitrate sampling points in drinking water resources of the Khash city.

Fig. 2. Geological distribution of nitrate in studied area.
2.3. Risk assessment of nitrate

The most important concern is the health effects of exposure to high concentrations of nitrate due to the occurrence of methemoglobinemia and nitrosamines. Therefore, health effects should be evaluated to prevent undesirable health effects [1–4]. So, the quantitative health risk assessment of nitrate through consumption of drinking water was estimated in rural population of Khash city, Sistan and Baluchistan province. For this aim, water samples were collected from villages of Khash city. Then, population were divided into four age groups based on physiological and behavioral differences as follow: infants (< 2 years), children (2 to < 6 years), teenagers (6 to < 16 years) and adults (≥ 16 years). The daily exposure to nitrate was calculated in these groups using Eq. (1) [2,8]:

\[
EDI = \frac{C_f \times C_d}{B_w}
\]

EDI: Estimation of daily nitrate consumption (mg/kg)
C_f: Nitrate concentration in drinking water (mg/L)
C_d: Average daily drinking water intake
B_w: Body weight (kg)

Then hazard quotient (HQ) was evaluated to predict the non-carcinogenic risk of exposure to nitrate using Eq. (2).

\[
HQ = \frac{EDI}{RFD}
\]

EDI: Estimated daily intake (mg/kg d)
RFD: Reference dose

The reference dose of nitrate (1.6 mg kg\(^{-1}\) d\(^{-1}\)) was according to the integrated Risk Information System, USEPA. A value HQ more than one indicates a significant risk level of non-carcinogenic effects.

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Transparency document. Supporting information

Transparency data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.11.007.

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