In Montenegro, historically, goiter was present mainly in the north and north-eastern part of the country, particularly along the Lim River. A survey, done by Prof Gušić et al. in 1955, showed goiter to be the most prevalent in inhabitants residing along the river, more than in those from higher altitudes within the same area.

National iodine prophylaxis was introduced in 1951, and a legal statute defining the program was achieved in 1953. The results were positive: in 1981, surveys in the north showed less endemic goiter among women of all age groups, with only rare cases of severe goiter, and no cases of endemic cretinism. In 1991, 23% of children aged 7–15 years were goitrous, with a median urinary iodine concentration (UIC) of 47 ± 34 μg/L. In 2001, the median UIC increased to 82 μg/L, but still indicated mild iodine deficiency. Salt in households, both at production and retail levels, was not iodized according to standards. In 2002, a survey in the north-eastern part of the country reported a median UIC of 100 μg/L. Inadequate salt iodization was noted in 35% of household salt samples.

The first nationally representative iodine survey was conducted in Montenegro in 2007. Results from Bijelo Polje, Pljevlja, Rožaje and Berane, the once endemic area in the northern region of Montenegro, were compared with those from the central and southern regions, in Podgorica, Bar, Budva and Kotor. Salt samples were collected from the households of all women included in the survey. The analysis was done using a standard volumetric-titration method to measure quantities of potassium iodide (KI) or iodine (I).

Pregnant women in Montenegro are mildly iodine-deficient

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Household iodized salt

Potassium iodide (KI) concentration in household salt samples (n=302) ranged between 1.4 and 48.9 mg/kg. The mean concentration was 18.3 mg of KI per kg. 20% of samples contained <16 mg/kg of KI, while 74% were adequately iodized according to the national standard (2). Overall, the salt was iodized homogeneously, and none of the households in the survey used non-iodized salt.

Survey design

The survey estimated iodine status of pregnant women visiting obstetric clinics in all three regions of Montenegro. Results from Bijelo Polje, Pljevlja, Rožaje and Berane, the once endemic area in the northern region of Montenegro, were compared with those from the central and southern regions, in Podgorica, Bar, Budva and Kotor. Salt samples were collected from the households of all women included in the survey. The analysis was done using a standard volumetric-titration method to measure quantities of potassium iodide (KI) or iodine (I).

Pregnant women in Montenegro could benefit from awareness campaigns and education programs to improve their iodine intake.
Pregnant women are mildly iodine deficient

The median (range) UIC in pregnant women (n=307) was 123 (13.1–440.4) μg/L. There was no significant difference in median UIC between trimesters. The median UIC was similar across all regions (Figure 1).

The lowest median UICs were recorded in Bijelo Polje and Rožaje, and highest in Berane (Table 1).

Estimating iodine intake using a Food Frequency Questionnaire (FFQ)

An FFQ was completed by 300 pregnant women; 163 women reported taking supplements, including 147 who reported using supplements designed for pregnancy. Pregnant women consuming supplements containing iodine either 4–6 a week, daily, or as prescribed had significantly higher iodine intakes than women who took no supplements or who took them 1–3 times per week. Taking supplements 4–6 a week or as prescribed was associated with a median UIC in the adequate range. Self-reported fish consumption was not significantly associated with iodine intake. A majority of women were aware of the importance of iodized salt, reporting that they chose iodized salt while shopping. Women who reported buying non-iodized salt had a significantly lower UIC (76 μg/L vs. 126 μg/L in women who bought iodized salt). Dairy was consumed by a large proportion of women, who had a higher median UIC (126 μg/L) than the women who did not include dairy in their diet (105 μg/L).

Conclusions and recommendations

The new survey results show no improvement in iodine intake in pregnant women compared with the 2007 survey. The most relevant iodine sources for pregnant women are iodized salt and iodine-based supplements.

In 2016, UNICEF and IGN convened in Sarajevo a sub-regional workshop on Sustainable Prevention of Iodine Deficiency and Achieving Optimal Iodine Intake through Nutrition. Roadmaps were developed for all participating countries, including Montenegro, which gave recommendations for improving USI strategies in line with globally accepted guidelines and practices, and using major lessons learned from the experiences of countries in the sub-region. Taking these into account together with the findings of the survey, the following actions are proposed:

- Re-establish the Commission for USI and IDD Prevention to report regularly to the Ministry of Health (MoH);
- Develop a plan of action for monitoring iodine intake in pregnancy and consider the introduction of iodine supplements to prevent adverse effects of IDD on maternal health, and growth and development of the fetus;
- Estimate iodine intakes in pregnancy at least once a year;
- Improve legislation, increase the amount of iodine added to salt (currently 12–18 mg/kg) to align it with the WHO recommendations and population salt intake levels. Follow the WHO requirement of having more than 95% of salt available in the market adequately iodized, and reaching more than 90% of households;
- Continuous monitoring of retail iodized salt is needed to ensure homogenous iodization. In cooperation with the MoH and the Food Safety, Veterinary and Phytosanitary Policy Administration, develop a plan for monitoring salt and iodization quality;
- In consultation with the MoH, improve monitoring and routine collection of biomarkers of iodine status and salt intake, and indicators of quality of salt in the market;
- Align the program for reducing salt intake with the USI strategy;
- Foster sustainability of IDD/USI program through assistance in planning, surveys and monitoring, building capacities of national staff, and financial assistance;
- Raise awareness of IDD among producers and consumers focusing on pregnant women, and awareness of the need to reduce salt intakes while maintaining optimal iodine intake;
- In collaboration with obstetric clinics, develop education programs encouraging better nutrition and iodine intake in pregnancy;
- Hold ongoing education campaigns in schools and via media to improve awareness of iodine deficiency, but also of excessive salt intake;
- Indicate practical steps on how to reduce the loss of iodine in household salt.

References

2. Rulebook on Quality and Other Requirements for Salt for Human Consumption and Food Production, Official Gazette of Serbia and Montenegro, No 31/05.

**FIGURE 1** Median urinary iodine concentration (UIC) in pregnant women (n=307) in Montenegro by region. Horizontal line represents a median threshold below which iodine intake is insufficient (1).

**TABLE 1** Median urinary iodine concentration (UIC) in pregnant women (n=307) in Montenegro by municipality. Values expressed in μg/L.

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar</td>
<td>122.6</td>
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<td>385.2</td>
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<tr>
<td>Berane</td>
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<tr>
<td>Rožaje</td>
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