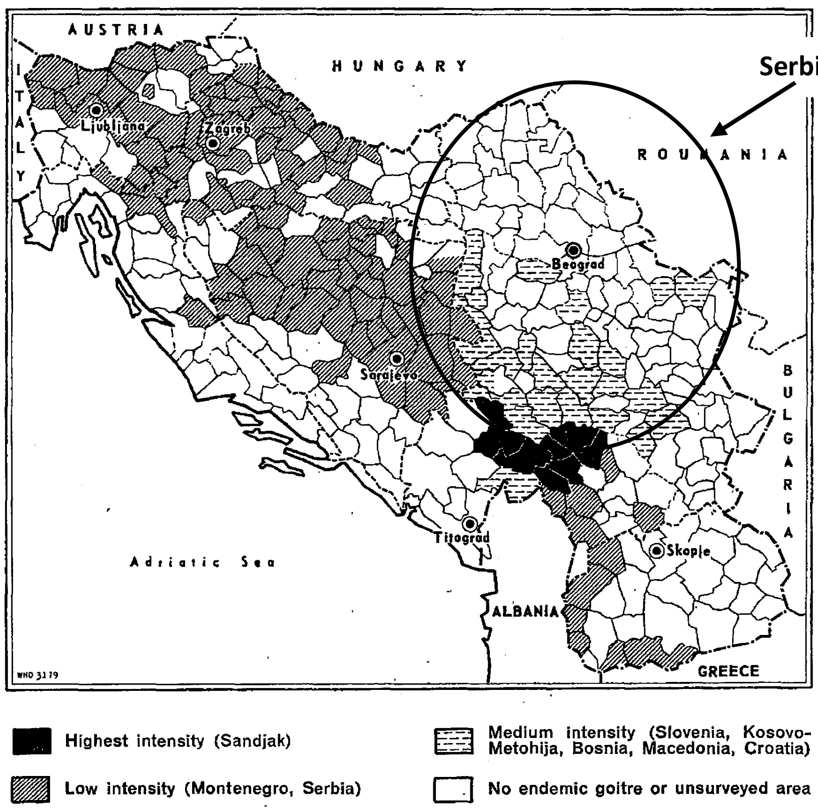
Serbia

Historically, goiter and cretinism were significant public health problems in Yugoslavia. The earliest studies by Sahovic and coworkers identified endemic areas in Serbia and marked Badovinci, Josanica and Novi Pazar as the most affect locales with goiter prevalence 86-90% and numerous cases of mental impairment, deaf-mutism and cretenism. The Sandžak region, which straddles the border area of Serbia and Montenegro, was notorious for the large goiters of its population (1).

Map of endemic goiter in former Yugoslavia (*Bull World Hlth Org* 1953)



The exact range of intensity represented by the various degrees of shading cannot be given as the figures, obtained from several different surveys, are not directly comparable. The map is intended to show only the relative importance of the goitre problem in various parts of Yugoslavia.

The first regulations on salt iodization were introduced in 1937, initially at a low level of 5mg KI/kg for only household salt directed to high goiter areas. Upon full review of the situation during a Congress of Preventive Medicine in 1950, the iodization level was increased to 10mg KI/kg in 1954 and expanded to all the salt for human and animal consumption. Ten years later, epidemiological surveys confirmed a fourfold reduction of goiter prevalence among school-age children (2). Nevertheless, studies during the 1980s suggested that goiter, although in milder form, persisted in schoolchildren surveys. This was confirmed to be due to low iodine status since non-goitrous patients persisted having fairly high uptake of radioactive iodine in the thyroid gland (3). The present legislation in Serbia mandates that all the edible salt should be iodized at 12-18 mg iodine per kg salt, while both KI and KIO_3 are permitted.

In 1992, the two remaining republics of Yugoslavia, Serbia and Montenegro, formed a federation named Federal Republic of Yugoslavia, which in 2003 was transformed into the State Union of Serbia and Montenegro. Upon peaceful separation, Serbia became a sovereign state in 2006. However, due to the turmoil during the Balkan conflict and its aftermath of political instability, the National Commission for IDD (formerly, Goiter Control) seized functioning for most of the present decade.

Since there are no natural deposits of salt, all the salt requirements in Serbia are imported. Two firms dominate the national salt supply situation, namely 'Interkomerc' a general food and household goods trading company located in Belgrade and 'So Product' a salt processing and packing company 30km outside of Belgrade. The variety of salt brands in the market shows active competition among the salt suppliers. So Product imports the basic salt mostly from Israel, Belarus, Austria and Ukraine. The firm has a number of modern iodization and packaging lines, with an internal quality assurance system based on quantitative salt iodine analysis on regular 2-hourly basis. Interkomerc imports iodized salt mostly from Solana Tuzla (Bosnia-Herzegovina) but also from other sources in Romania, Greece and Ukraine.

Studies of school-age children during 1998-2000 by the National Institute of Public Health in Belgrade showed a median urinary iodine (UI) concentration of 158µg/L and a decrease in goiter prevalence to 2.35% (4). According to the MICSII report (5), adequately iodized salt was being used in 73% of the households in 2000. These findings confirmed the quantum improvement of iodine nutrition that had taken place during the preceding period of half a century.

To assess whether USI still endures, the Institute of Public Health of Serbia (IPHS) carried out a national iodine survey during September-December 2007 (6), using the standard design of 30 clusters (primary schools), selected proportionate to school population size. In each cluster, 60 Grade 1-6 children were selected at random for thyroid volume measurements and among them, 30 children were giving casual urine samples and salt samples brought from home for iodine analysis in the IPHS laboratory. Also, 12 pregnant women were sampled in prenatal health clinics, located nearby each of the 30 schools, for casual urine and salt samples brought from home. The IPHS laboratory participates successfully in EQUIP, and internal quality control demonstrated a precision of ±5% for the urinary iodine assay.

No differences were found in the iodine content of 950 salt samples obtained from school children and 347 salt samples from pregnant women. The results are therefore combined in Figure 1. Notably, all the household salt samples obtained in the survey were iodized. The median salt iodine content was 13.9mg/kg; 32.2% of the salt samples had ≥15mg/kg, and 76.1% of the measurements fell within the range of 12–18mg iodine/kg mandated for import and wholesale.

The median UI *concentration* in school children was 195µg/L; 9.4% of the children had UI<100µg/L, the UI was 100-199µg/L in 42.3%, and the UI was ≥200µg/L in 48.2% of the children. The thyroid ultrasound measurements (ref 6) found elevated thyroid volume among 3.2% of children (BSA reference).

The UI measurements of the children were converted to iodine consumption estimates using the Institute of Medicine formula (7). The median iodine *consumption* estimate among all the children was 185µg/d (95% CI: 176-192). Children in urban areas (median 192µg/d) had higher consumption ($p<0.01$) than in rural areas (171µg/d), and the intake was also higher ($p<0.05$) in boys (192µg/d) than in girls

(175μg/d). As expected, the iodine consumption of the children increased with age (Figure 2). Compared to the recommended dietary allowance, the Serbian children were consuming a diet typically providing 158% of their RDA, with an increase from ±125% of RDA at 6-8y to ±190% of RDA at 12-14y of age.

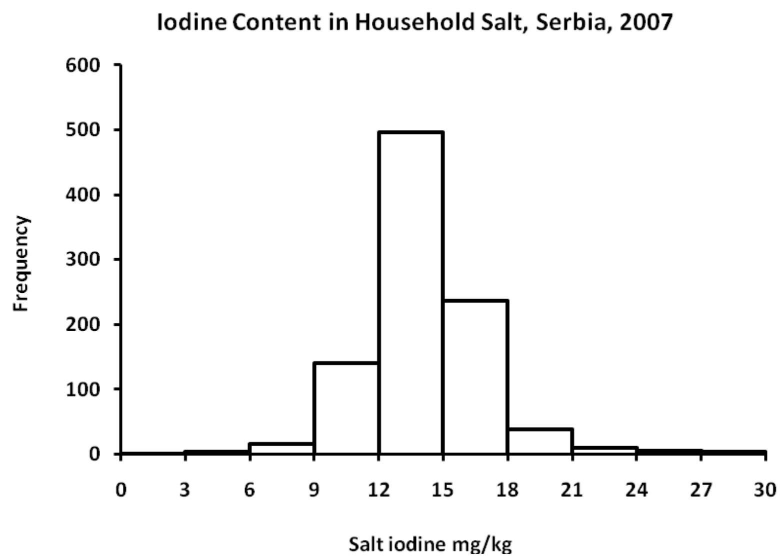


Figure 1: Histogram of iodine content in household salt, Serbia, 2007

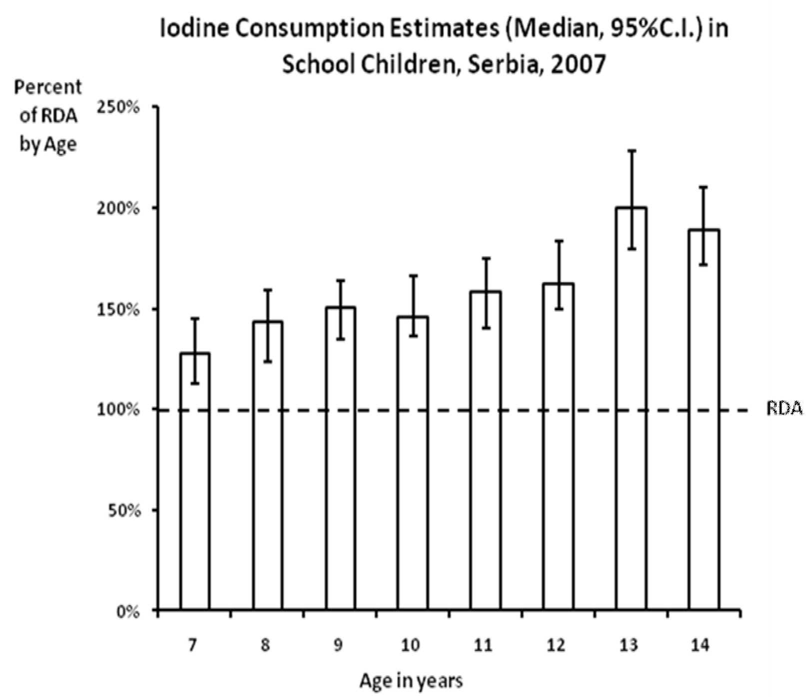


Figure 2: Relationship of iodine consumption with age, Serbia, 2007

The histogram of UI concentrations in pregnant women (Figure 3) had a median of 158μg/L. The UI was <150μg/L in 45.2% of the women, 32.0% had UI in the range 150-249μg/L and the UI of the pregnant women was ≥250μg/L in 21.8%. UI≥500μg/L occurred in 4.9%.

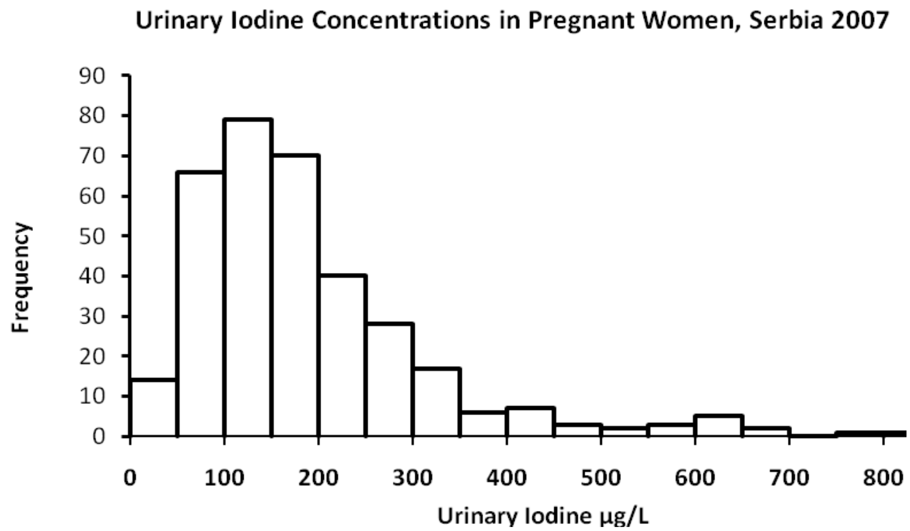


Figure 3: Histogram of UI concentrations in pregnant women, Serbia, 2007

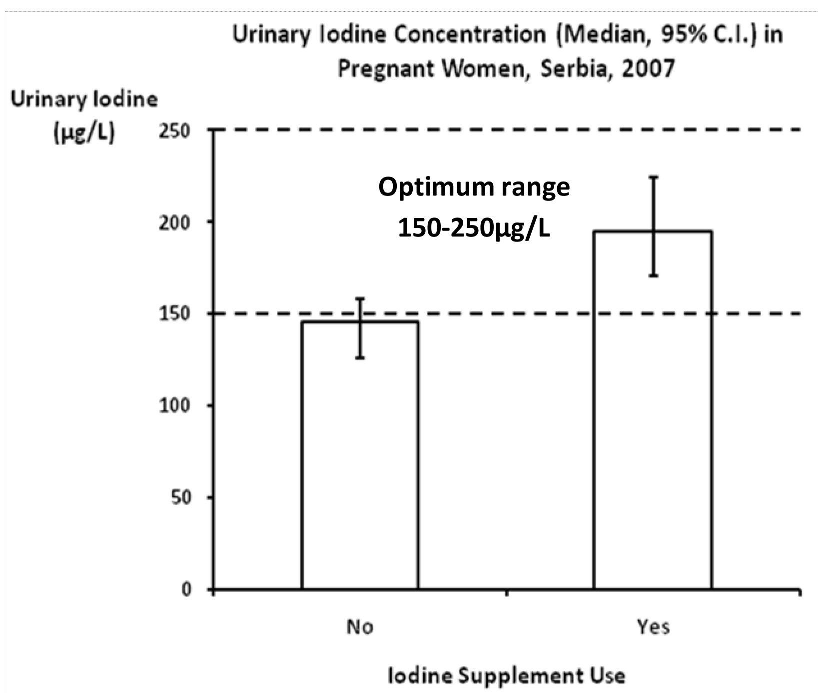


Figure 4: UI concentrations in pregnant women by iodine supplement use, Serbia, 2007

Physicians commonly recommend dietary supplements to pregnant women in Serbia, and 33.9% of the women in this survey reported using an iodine supplement. Figure 4 shows that the UI concentration in pregnant women who used a supplement (median 195μg/L) was significantly (p<0.001) higher than those who reported not to use a dietary supplement (146μg/L). Notably, the median UI in the non-supplement users fell below the range of sufficient UI recommended by WHO/UNICEF/ICCIDD.

Further in-depth analysis did not find a relationship between the iodine levels in household salt and the UI concentrations in either the school children or the pregnant women (non-supplement users). The UI levels in pregnant women **not** using a dietary supplement (median 146μg/L) were sizably lower than those in school-age children (195μg/L), even though the iodine content in the salt from their households did not differ, thus suggesting starkly different dietary practices between these groups.

As was the case in 1999-2000 (2, 4), the results of the latest survey indicate that the population in Serbia enjoys optimum iodine nutrition, even with the low mandatory iodization levels by international standards. The absence of a direct relationship between the iodine content in household salt and the iodine status of either the children or the women indicates that the consumption of household salt contributes only a small part of the overall iodine intake. Thus, the use of iodized salt in the food industry is the major factor in improving the dietary iodine consumption in Serbia.

Overall, the iodine nutrition status of pregnant women was just sufficient due the use of supplements by half of the women. Pregnant women who were not using iodine supplements had only borderline iodine status, however. This gives reason to recommend a modest upward revision of the mandated iodine range for iodization, and to suggest that only potassium iodate should be used as fortificant.

Inspectors of Sanitary Surveillance conduct regular sampling in the salt markets and food industry, and submit the samples to IPHS for analysis to ensure continued quality iodized salt supply of the population. The salt iodine measurements indicate that quality assurance of the iodized salt supplies is functioning well. The IPHS functions *de facto* as the coordinating entity on behalf of the Government, but it receives no specific budget allocation for this purpose. Knowledge of IDD and USI is part of the public history of Serbia and has been included in the regular educational curriculums of primary and secondary schools, as well as various professional training. The Ministry of Health has recently re-established a National IDD Commission, which is expected to review the latest information and give guidance on future policy.

Participation of national officers in UNICEF-supported regional iodine meetings:

- Workshop on Strengthening Strategies for the Elimination of Micronutrient Malnutrition. Antalya, 4-8 April 2005

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