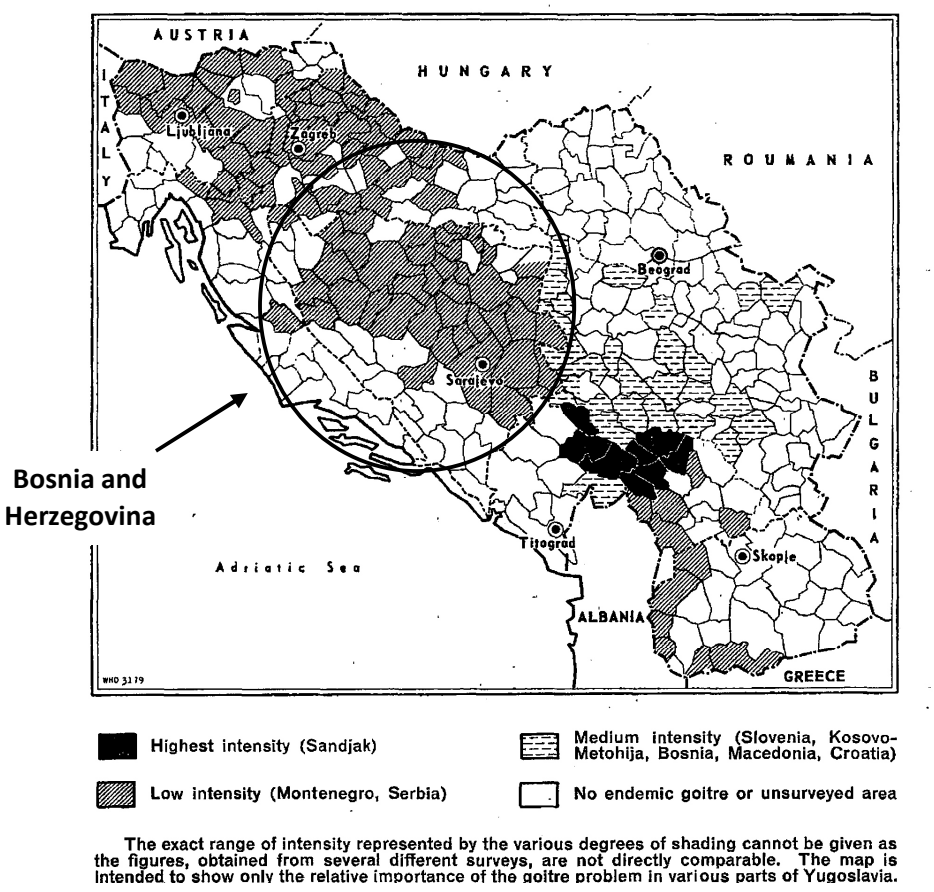
# Bosnia and Herzegovina

Iodine deficiency has historically been a significant problem in the State of Bosnia and Herzegovina (BiH), with evidence of high goiter accompanied by cretinism in many central locales. Salt iodization was made mandatory in 1954 throughout former Yugoslavia, leading to a substantial reduction in goiter prevalence also in BiH (1).

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




During 1999, researchers of Tuzla University performed extensive canton-based studies (2) in the Federation Bosnia-Herzegovina (FBH), collecting measurements of goiter prevalence, UI concentration and household salt iodine content of >5,500 school children aged 7-15y. The mean iodine content in household salt samples was 14mg/kg, the total goiter prevalence was 27% and the median UI level 78µg/L, thus providing evidence that iodine deficiency persisted despite the salt iodization policy. To examine the role of the iodine levels in salt, the data of this study were divided into cantons where >90% of the salt was produced in the Tuzla plant at 5-15mg/kg, and cantons where >80% of the salt originated from the Pag plant in Croatia, iodized at 20-30mg/kg (3). The iodine content in household salt of the Tuzla group (Table below) was significantly ($p<0.001$) lower than in the Pag salt group, and this contrast in salt iodine supply between groups corresponded with significant ($p<0.001$ in each case) *lower* UI concentrations

and *higher* goiter prevalence among the children in the Tuzla as compared to the Pag group (Table 1). The analysis underscored the key importance of the iodine levels in the salt supplies for determining the iodine nutritional status and the impact on functional IDD indicators.

| Iodine Assessment in School-age Children, Federation Bosnia-Herzegovina, 1999 | | |
|---|---|---|
| Parameter | Grouping of Cantons based on the origin of household salt | |
| | Predominantly salt from Tuzla factory | Predominantly salt from the Pag factory |
| Median salt iodine | 11.4mg/kg | 18.9mg/kg |
| Median UI | 75.2µg/L | 82.6µg/L |
| Goiter prevalence | 32.6 % | 19.7 % |

Table 1: Iodine status in FBH in relation to the origin and iodine level of salt supplies

At Independence in 1992, BiH was left with one poorly equipped salt factory in Tuzla. During 2000-2002, UNICEF provided iodization equipment and automatic salt packaging machines. The Tuzla Salt laboratory was also assisted with equipment for salt quality measurements, thus completing the full capacity to supply quality iodized salt that meets the needs for BiH, as well as for export to Croatia, Montenegro, Macedonia, Serbia, Kosovo and Slovenia.

Iodization machinery, Tuzla Salt plant, BiH


Attractive packaging of household salt

A small survey on the level of iodine in salt on the market in 2000 showed complete iodization of all domestically produced salt. However, imported salt from mainly Poland and Romania remained accessible in local markets and was not iodized to the nationally mandated levels. Consequently, about 80 per cent of the household salt in markets of did not supply adequate iodine and did not have proper labeling (Federal Sanitary Control Commission report). A UNICEF report mentioned that sanitary inspectors did not have authority to enforce sanctions on traders and retailers selling salt that was in violation of the mandated iodization levels at that time.

During 2000-2002, approximately 400 health professionals and sanitary inspectors throughout BiH received two-day practical training on IDD prevention, including inspection needs and procedures. Educational materials on the prevention of iodine deficiency disorders were also produced and provided to health professionals and sanitary personnel. A small formative research study in FBH in 2002 (4) revealed that the majority of adult citizens were aware of the threat of iodine deficiency and knew the relationship with goiter (78%), mental retardation (33%) and stillbirths/abortions (35%). Nevertheless, about half of the respondents purchased iodized salt only, in small packages and short intervals. Among the reasons for not buying iodized salt was that it was not available. Using these results, UNICEF supported the salt industry to devise improved packaging, and collaborated with officials and professional social marketers to devise key messages for public awareness communications, with emphasis on the proper use of iodized salt in the households. A comprehensive campaign was conducted during 2002-2003, using multiple channels including mass media (TV, radio, newspapers, etc), advertisements and billboards (streets, mass transport, etc), mass mailings, round tables, etc.

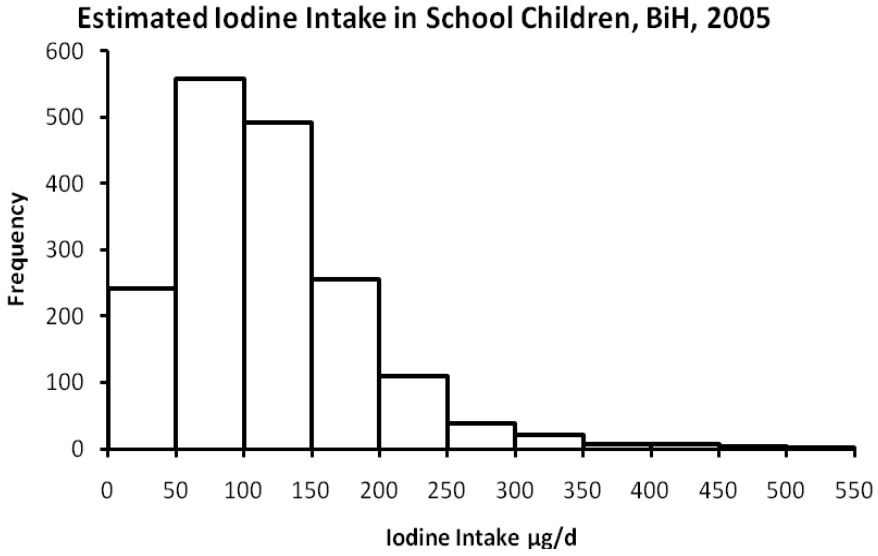
Cognizant of the key importance of salt iodization, UNICEF also supported the governments in FBH and Republica Srpska (RS) to stimulate the IDD Committees to update existing legislation, revise policies and undertake quality monitoring of the salt supplies from local production (Tuzla) and from import. The Parliament of FBH passed a law in January 2001 that mandates the iodization of all salt for household and food industry at 20-30mg iodine/kg, permitting both KI and $KIO_3$. The RS enacted a regulation in 2005 that makes iodization of household and food industry salt obligatory at 20-30mg iodine/kg, permitting $KIO_3$ only.

Researchers of Tuzla University conducted a follow-up study during 2004 (5), enrolling 962 school children (equal numbers in rural and urban areas) of 11-14y in the 10 Cantons of FBH. The non-weighted mean salt iodine content was 21.4mg/kg and the median UI 139.5µg/L, confirming the progress that had been made since enactment of the salt iodization law in FBH. The publication suggested that neonatal TSH screening would be a useful source of information for monitoring the situation.

In June-October 2005, an iodine survey of BiH was fielded (6) under overall auspices of the public health authorities with technical assistance by the Institute for Patho-physiology and Nuclear Medicine (IPNM), Skopje, Macedonia. In view of the political reality, the survey design was stratified into three geographical areas: (a) FBH, estimated population 2.5million, (b) RS, 1.5million and (c) Brcko District, 80 thousand. Grade 2-3 children of primary schools were the

target group. The design of the survey started out with PPS selection of 3 schools in Brcko, and 30 schools in FBH and RS each. Within each school, the school enrolment list was used for randomized systematic selection of 40 children, half from each Grade. The authorities in Tuzla Canton of FBH (estimated population 500 thousand) did not give permission for the survey, thus limiting the FBH stratum to 23 schools. In Brcko District, 2 more schools were added during fieldwork to improve on precision. Trained survey teams visited the schools, examined the children by palpation and ultrasound measurement of the thyroid gland, and collected a sample of household salt and casual urine of each child. The salt was analyzed for iodine content by titration at the local Institutes of Health Protection and the urine samples were shipped for analysis of the iodine concentration in the laboratory of the IPNM which holds a certificate of successful participation in the CDC-provided EQUIP program.

For the entire cohort of children, the un-weighted median UI concentration was 157µg/L, demonstrating that iodine deficiency had significantly abated in BiH. Elevated thyroid volume (BSA-reference) by ultrasound was found among 7.8% of the children. Of all the salt samples from the households, 31% was iodized with $KIO_3$ and the overall iodine content was 23.1mg/kg. An in-depth analysis (6) did not find significant associations between the iodine levels in household salt and the UI levels of the children, indicating that iodized salt was also used in food industry, which rendered the portion of total iodine intake from household salt less influential.




Histogram of iodine intake estimates, BiH, 2005

The Figure above illustrates the iodine intake estimate of the children, calculated by the IOM formula (8). The data illustrated that diet of the children in BiH typically supplied 105µg iodine/day, or 103% of the RDA. Classified by stratum, these estimates were 128% in Brcko, 99% in FBH and 102% in RS. The estimated iodine intake was below EAR in 22.8% of the children, with no significant difference between stratums. The report concludes that the iodine situation

in the population is sufficient notwithstanding the remaining goiter prevalence, which is known to be attributable to the remaining effect of previous iodine deficiency.

A stratified iodine survey in 2007-8 assessed the iodine situation among pregnant women in BiH (9). Of the 20 maternal health centers in BiH invited, 18 agreed to participate and in each center, 70 pregnant women and 30 breastfeeding women were enrolled for collection of demographic data, and salt and urine iodine measurements. The age range of the 1,222 pregnant women and 522 breastfeeding women was 16-45y with a median of 27y. The salt iodine measurements were performed in BiH and the urine iodines were managed in the Institute for Patho-physiology and Nuclear Medicine (IPNM), Skopje, Macedonia.

Salt iodized with $KIO_3$ constituted 76% of all the household samples collected, which is twice the proportion of the 2005 survey in children. The median salt iodine content was 26.5mg/kg (27.5 in FBH and 25.7 in RS), with 65% of the samples in the mandated range of 20-30mg/kg, similar to the situation in 2005. Among the 757 pregnant women in FBH, the median UI concentration was 157µg/L and the median UI among the 484 pregnant women in RS was 160µg/L. Therefore, in both administrative regions the UI was within the recommended range for pregnancy of 150-250µg/L. The median UI of all the women was 168µg/L in the 1$^{st}$ semester and 155µg/L in the 3$^{rd}$ semester ($p<0.05$). Since early pregnancy is the period of highest vulnerability, these findings are encouraging despite the small decrease with the duration of pregnancy. The respective UI levels of breastfeeding women were 179µg/L in FBH and 159µg/L in RS, showing adequate iodine status in both areas. Unfortunately the survey did not analyze whether the women had enlarged thyroid volume, nor did the data collection include the origin of the salt (e.g. salt brand or company name) or the use of iodine supplements by the women.

The importance of collecting additional information about specific habits (such as the use of supplements and iodized salt) during pregnancy became apparent from a study by researchers of Tuzla University in 2007 (10), which examined UI and household salt iodine levels of 300 pregnant women sampled from Tuzla (urban and rural), FBH. The overall median UI level in the pregnant women was 142µg/L, while those women who were <u>not</u> restricting their salt intake had significantly higher UI levels compared to women who restricted their salt intake.

To conclude, iodine deficiency in the State of Bosnia and Herzegovina, which was a significant problem historically, has been addressed successfully despite the factious political situation and the different statutory approach in the various regions. Recent local and regional assessments suggest that the iodine nutrition situation of children and pregnant women is adequate, although the evidence that this is fully attributable to the USI policy is not complete. There is active interest among the research community but a joint multi-sector oversight arrangement is not obvious. Household salt assessments indicate that the iodine content in BiH corresponds to the mandated levels, but the evidence that iodized salt is used throughout the food industries is indirect. The Tuzla salt factory has fully established capacity for quality iodization of edible salt, and the enterprise remains an important source of the salt supplies for neighboring countries.

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