

Introduction of iodized salt in the 1920's linked to increased IQ and growth in the U.S. and Switzerland

The U.S. and Switzerland were the first countries to introduce iodized salt to their populations. Two historical studies looking at 100-year old army conscription data suggest this public health measure sharply improved growth and cognition in the 1920s.

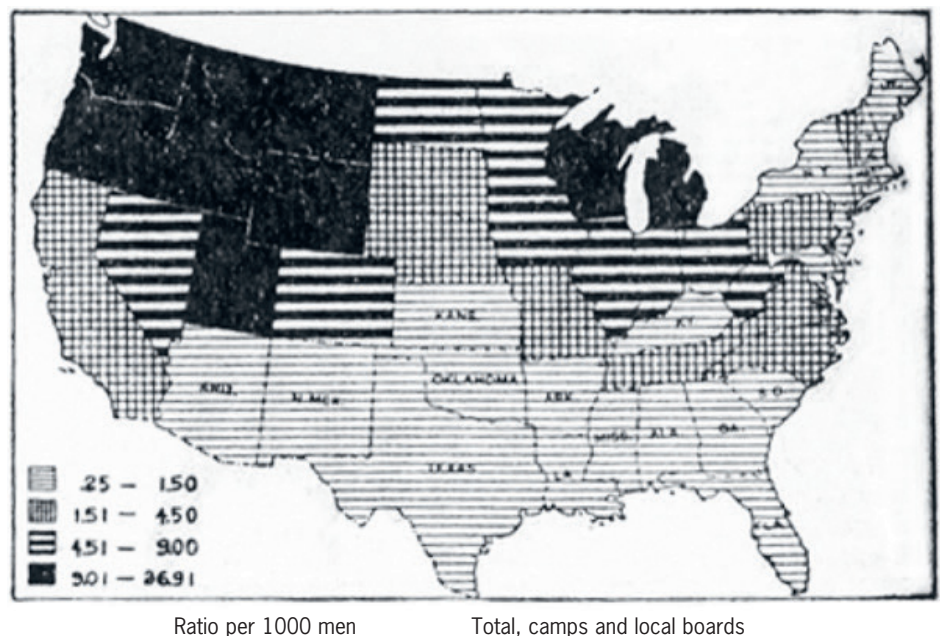
I. Correction of iodine deficiency and increased IQ in U.S. males

Excerpted from: J Feyrer, et al. *The Cognitive Effects of Micronutrient Deficiency: Evidence from Salt Iodization in the United States*. U.S. National Bureau of Economic Research Working Paper No. 19233, July 2013

Iodine deficiency is the leading cause of preventable mental retardation in the world today. In this paper, the authors study the long-term effects of iodine fortification in the United States. Because iodine deficiency affects mental development, the elimination of this deficiency is a candidate explanation for part of the Flynn Effect, the gradual rise in measured IQ over many decades that has been observed in developed countries.

Prior to salt iodization, endemic goiter and other iodine deficiency disorders were present in certain regions of the US and absent from others, depending on the iodine content of the soil and water. *Figure 1* illustrates the geographic distribution of goiter in the US as measured among World War I recruits. In 1924, iodized salt was introduced in the United States to reduce the goiter rate. This intervention rapidly reduced the incidence of iodine deficiency. The authors investigated whether there was a significant difference between those born before and

Figure 1: Goiter prevalence in young U.S. men, by state, in 1920.



after the introduction of iodized salt in locations with low levels of environmental iodine. Those living in high iodine regions provide a control group.

Military data collected during WWI and WWII was used to compare outcomes of cohorts born before and after iodization, in localities that were naturally poor and rich in

iodine. Two data sources were used to look at the effects of iodine deficiency eradication on cognitive ability. After World War I, statistics from draft physicals were compiled by geographic location. From this source, the incidence of goiter for 151 geographic regions before the introduction of iodized salt is known. This provides the measure of iodine deficiency prior to treatment.

The outcome measure was provided by an extensive data set of men who enlisted in the Army during World War II. The timing of the war generates a large sample of men born in the years 1920–1927, neatly covering the introduction of iodized salt. Upon enlistment, each recruit took an intelligence/aptitude test. Test scores were not available, but the authors made crude inferences about the test scores by examining which army branch the enlistees were assigned to.

Using information about average scores of recruits the authors infer that **for the one quarter of the population most deficient in iodine this intervention raised IQ by approximately 10 points.** The results can explain roughly one decade's worth of the upward trend in IQ in the US (the Flynn Effect). The average level of iodine deficiency in the US was significantly lower than in the highest regions, so the overall effect in the US was much more modest.

II. Correction of iodine deficiency and increased height of Swiss young men

Excerpted from: Staub K, et al. 'From growth in height to growth in breadth': The changing body shape of Swiss conscripts since the late 19th century and possible endocrine explanations. General and Comparative Endocrinology 188 (2013) 9–15

Because Swiss army conscription has been mandatory and standardized since 1875 and measurement procedures for height and weight have not changed, recruitment data provide a solid measure of height changes of young men at 19 years of age in Switzerland over the past 140 years.

Prior to 1922, when a national iodized salt program was introduced, parts of the Swiss population was severely deficient in iodine, particularly in alpine areas and the foothills of the Alps, in cantons such as Appenzell. In contrast, the western part of the country (e.g., Geneva) was relatively iodine sufficient. The percentage of young men found unfit for service because of large goiters was smaller in the western cantons (Geneva), occurring in less than 4% of the conscripts, whereas they were very prevalent (15% and

more) in those of the Alps, the foothills, and the midlands stretching from the southwest to the northeast (Figure 2, left map). At the same time, conscripts from iodine-deficient areas were significantly smaller than the national average (Figure 2, right map). Around 1920, iodine prophylaxis was introduced in Zurich's and Bern's schools (where 60% of children had visible goiter) (Figure 3). The first iodized salt program in the Europe was introduced Appenzell in 1922, resulting in a decrease in goiter and elimination of cretinism. The difference in average height between very tall, iodine sufficient (e.g., Geneva) and very short, iodine deficient cantons (Appenzell) decreased with the Appenzell conscripts catching up, heightwise, with the national average during the 1920s (Figure 4). The average Swiss male body height increased markedly by 15 cm between the 1870s and the 1970s (from 163 cm to 178 cm). The positive trend started during the birth years of the 1870s, lost some of its momentum during World War I, was particularly strong during the interwar period, during the introduction of iodine prophylaxis (Figure 4).

Figure 2: Percentage of Swiss conscripts exempted from military service due to large goiter (left map) compared to average height of the same conscripts (right map) by district, 1884-1891

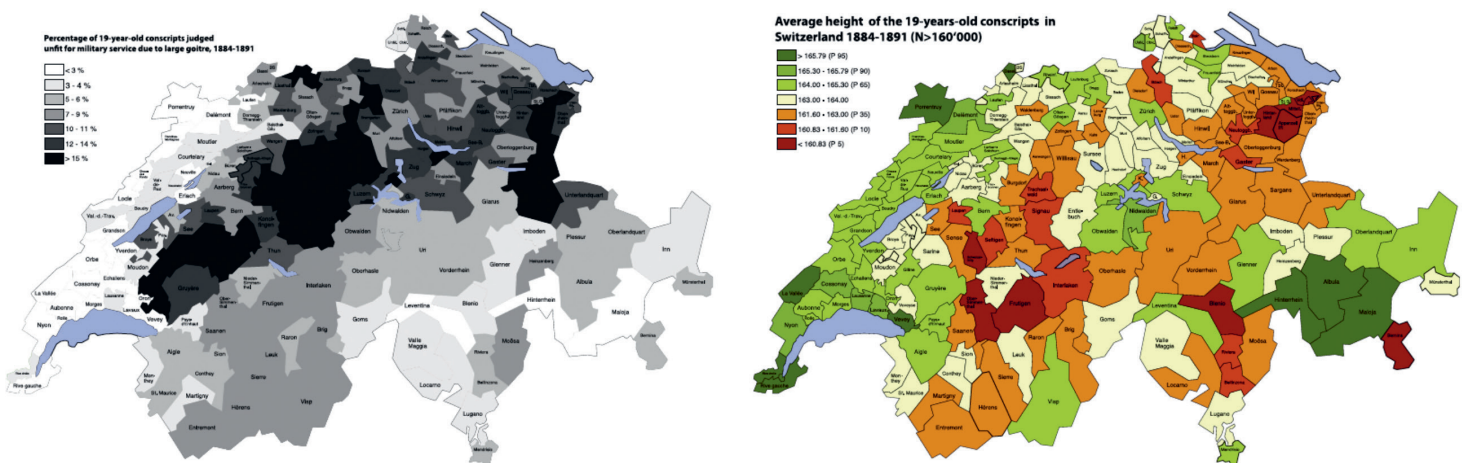
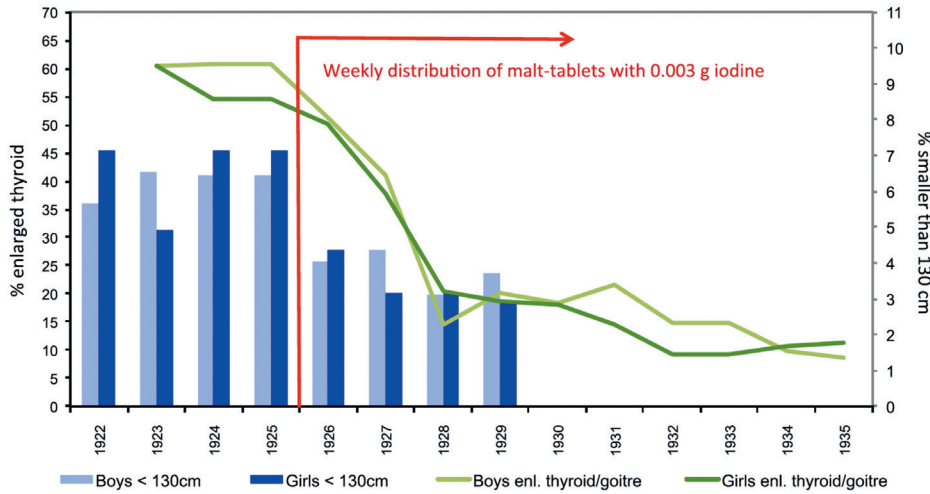


Figure 3: Medical examination of schoolchildren in the city of Bern: iodine prophylaxis, enlarged thyroid gland (goiter) and growth in all 5th graders (aged 10 to 11 years)



In conclusion, widespread iodine deficiency at the end of the 19th century helps to account for an overrepresentation of very short conscripts, for the low level of average height in Switzerland in general as well as for the tremendous regional variation in average height. **Public-health measures, such as the iodine-deficiency prophylaxis via weekly iodine tablets for schoolchildren and via iodized table salt, introduced in the 1920s, were likely to have been largely responsible for the dramatic increase in height during the interwar period.**

Figure 4: Published average height (cm) of 19 years-old conscripts in Switzerland and in the cantons Geneva and Appenzell Ausserrhoden, complete conscription years

