Longitudinal study on goiter prevalence and goitrogen factors in northeastern Sicily

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ABSTRACT. A longitudinal study was carried out in an area of endemic goiter of north-eastern Sicily. Three different surveys (in 1977, 1983 and 1994) evaluated the epidemiological prevalence of goiter in schoolchildren of the endemic area (towns of Bronte, Troina and Maniaci) in comparison to an iodine sufficient control area (Catania). Biochemical studies were also performed on urinary iodine and thiocyanate (SCN) excretion and $^{131}\text{T}$ thyroid uptake. In the town of Troina an experimental program of active iodine prophylaxis was carried out from 1979 to 1987 by iodinating the municipal water supply. The aim of this study was to evaluate the effect of an active iodine prophylaxis program in comparison to the "silent iodoprophylaxis" due to improved economic conditions and widespread introduction of industrially produced food. In the 1977-94 period a significant decrease of goiter prevalence in schoolchildren was observed in all areas where no active iodoprophylaxis had been introduced. An abnormal prevalence of goiter, however, was still present in Bronte (12.1%) and Maniaci (25.9%) schoolchildren in respect to Catania (0.7%). In Troina, goiter prevalence decreased from 52.2 to 6.1% after only five years of active iodine prophylaxis (1983). It increased to 8.4% seven years after the program was discontinued (1994). In all areas studied average urinary iodine excretion increased by 70-100 µg/day except in the more rural area at Maniaci. During the same period urinary SCN values decreased by 30-40% and were lower in Troina (non volcanic soil) than in other towns studied. The balance between iodine and SCN intake appears relevant in the etiology of endemic goiter in these areas and the iodine/SCN ratio inversely correlated with goiter prevalence. The persistence of endemic goiter in spite of the important changes in life style and socio-economic conditions if compared to the dramatic amelioration obtained by an active iodine prophylaxis program, confirms the inadequacy of the silent iodine prophylaxis, and further supports the need of an immediate introduction of active iodine prophylaxis in the areas of endemic goiter in Sicily. (J. Endocrinol. Invest. 19: 638-645, 1996)

INTRODUCTION

Twenty years ago we described, in the highlands of North-Eastern Sicily, an area of goiter endemia where more than 200,000 people live, mostly in 3-20,000 inhabitant towns and the rest in small villages and rural areas (1). In this area a high prevalence of goiter in schoolchildren and increased serum TSH levels in the newborns (2) were observed. Furthermore, a higher prevalence of toxic nodular goiter (3) and follicular thyroid cancer (4) was also found in this iodine deficiency area when compared to an adjacent iodine sufficient area. Finally, inside this endemic goiter area, a small rural area where goiter endemia is more severe and endemic cretinism is present was also identified (5). Biochemical studies have proven that in this area endemic goiter is associated to variable degrees of iodine deficiency and, in some places, also to an increased thiocyanate urine excretion (1). Thiocyanate inhibits thyroid iodine uptake and organification and, therefore, potentiates the effects of the alimentary iodine deficiency (6). The iodine/thiocyanate ratio, in fact, better correlated to the severity of goiter endemia than iodine deficiency alone (7-9). In the last sixteen years, in spite of several formal communications to Health Authorities on the severity of the sanitary and social problems related to iodine deficiency, no systematic intervention of iodine prophylaxis in order to prevent iodine deficiency related diseases was carried out except for

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the town of Troina, with a moderate iodine deficiency, where an experimental program of iodine prophylaxis was carried out in the years 1979-87 by iodinating the municipal water supply (10).

We have now repeated, after 16 years, the epidemiological and biochemical studies in order to evaluate the severity of goiter endemia after environmental conditions in the studied areas (such as industrialized food distribution and connecting transportation improvement) have significantly changed. The data collected in the endemic area have been compared to those obtained in the control area and also to those obtained in Troina, in order to analyze the effects of an active iodine prophylaxis program, even transient, in comparison to what is called “silent prophylaxis”, which is due to changes in life style that occur independently of any intervention aimed to specifically ameliorate the prevalence of iodine deficiency related diseases in the population.

MATERIALS AND METHODS

Area studied

Our study was carried out in an area of iodine deficiency in northeastern Sicily and in a control area (the city of Catania and the surrounding coastal area) where iodine intake is sufficient and no endemic goiter is present. Inside the endemic area 3 different towns and their respective surrounding municipal rural territories were studied: a) Bronte (22,000 inhabitants, 760 m over the sea level); b) Troina (13,000 inhabitants, 1,120 m over the sea level); and c) Maniaci (3,000 inhabitants, 750 m over sea level). Both Bronte and Maniaci are located on volcanic soil, on the northwestern side of the volcano Etna, approximately 15 km away from its top. Troina, in contrast, is not placed on volcanic soil, and is located approximately 35 km from the central crater. The city of Catania (at the sea level, 400,000 inhabitants in the city, 700,000 in the metropolitan area) in the Eastern coast of Sicily, is also located on volcanic soil, approximately 29 km from the top of the Etna. In Bronte and Troina a mixed economy (rural, commercial, small family run industries) is present and the socio-economic level is comparable to the average Sicilian level. In Maniaci, a predominant rural economy and a socio-economic level slightly lower than the average Sicilian standard is present. Connecting transportation with the city of Catania were already good in 1977 and have improved therewith, with a network of roads and public transportation system that allows to cover the distance in 60-90 minutes. In 1977, when the endemic goiter was first studied in this area, a moderate goiter endemia was observed in Bronte and Troina and a severe goiter endemia and endemic cretinism was observed in Maniaci (5).

In the town of Troina an experimental program of iodoprophylaxis was started in 1979 by the elemental iodine supplementation to the municipal water central supply at 50-75 μg iodine/liter. In 1983 further epidemiological surveys and biochemical studies were carried out in this town in order to evaluate the efficacy of the iodoprophylaxis program and data were compared to those collected with parallel studies in Maniaci and Catania (10). In 1987 the iodoprophylaxis program in Troina was discontinued because of the lack of financial support from the Public Health Authorities.

Epidemiological surveys

The present epidemiological study was started at the end of 1993, approximately 6 years after iodine water supplementation had been discontinued in Troina. Overall epidemiological survey was carried out in 13,464 schoolchildren (7,415 from the endemic area and 6,049 from the control area, aged 5-18 years). In each studied center, we either investigated all schoolchildren (Bronte, Troina and Maniaci) or selected the same schools and classes that were studied in the previous surveys (Catania) in order to obtain a statistically comparable sample as far as age, sex and socioeconomic conditions are concerned. In all children, the thyroid size and the goiter score was assessed according to the method of Perez et al. (11) as modified by Querido et al. (12), the same method that had been used in prior investigations. The epidemiological survey was carried out by trained specialists that had undergone comparative evaluation for their thyroid examination procedures and results.

Biochemical studies

In the same towns where epidemiological surveys were carried out in schoolchildren, biochemical measurements of iodine and thiocyanate were also carried out in a limited number of adult, euthyroid, non goitrous subjects.

1) Evaluation of iodine intake: iodine intake was evaluated by two different methods:

a) 24-hour urinary iodine excretion in 408 subjects, 283 from the endemic area and 125 from the control area. Groups from the 4 different centers investigated had comparable sex and age distribution. Urinary iodine was measured by the ceric/arsenite reaction, as already reported (13).

b) Radiiodine thyroid uptake measurement 24 hours after oral administration of 10-15 μCi of 131I using a SELO DC 3A equipment (SELO, Milan, Italy). 263 adult volunteers (all over 40 year old)