Iodine Nutrition Status and Knowledge, Attitude, and Behavior in Tehranian Women Following 2 Decades Without Public Education

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ABSTRACT

Objective: To evaluate the association of iodine nutrition status and knowledge, attitude, and behavior in Tehranian women after 2 decades without updating public education.

Design: Cross-sectional study.

Setting: Eight health care centers from 4 district areas of Tehran.

Participants: A total of 383 women aged $\geq$ 19 years, randomly selected.

Main Outcome Measures: Iodine concentration of 24-hour urine samples, iodine content of household salts, and knowledge, attitude, and practice scores regarding iodine nutrition and iodized salt.

Analysis: Multiple logistic regression was used to identify the association of knowledge, attitude, and practice scores with urinary iodine concentration (UIC) < 100 μg/L.

Results: The percentages of Tehranian women with high knowledge, attitude, and practice scores were 26%, 26%, and 14%, respectively. Practice score was significantly different between females with UIC < 100 and > 100 μg/L ($P = .001$). Risk of UIC < 100 μg/L in women of childbearing age (19–45 years) after adjustment of education level, region of residence, and iodine content of salt was significantly associated with intermediate practice score (odds ratio = 2.6; 95% confidence interval, 1.3–13.2).

Conclusions and Implications: Marginally suboptimal iodine status in women of childbearing age can be attributed to inappropriate practices, but not to knowledge and attitude.

Key Words: iodine nutrition, knowledge, attitude, behavior, female (*J Nutr Educ Behav*. 2013;45:412–419.)

INTRODUCTION

Iodine deficiency is a public health issue worldwide, especially among pregnant and women of childbearing age, because of the critical role of iodine in the production of thyroid hormones and fetal neurologic development.[1,2] Iodine deficiency during pregnancy can affect both pregnant women and their infants. Consequences of iodine deficiency during pregnancy include prenatal (ie, cretinism, congenital anomalies, abortion, stillbirth, increased prenatal mortality) and postnatal (ie, intellectual impairments, neonatal hypothyroidism and goiter, growth retardation) disorders.[1-4]

Some countries have experienced iodine deficiency recurrence despite serious efforts and interventional strategies during past 2 decades in implementing universal salt iodization programs and mandatory fortification of foodstuffs.[5-8] This failure has been attributed to poor monitoring, reduced iodine content of dairy products, restriction of salt intake, and low levels of public awareness. As seen in India, Ethiopia, and South Africa, failure in public awareness and education has resulted in iodine deficiency.[9-12] Moreover, recurrence of iodine deficiency in Australia, previously considered an iodine-sufficient area, may partly be related to lack of strategies to improve public knowledge and awareness regarding iodine nutrition.[13,14]

The Islamic Republic of Iran has been recognized as a country free of iodine deficiency disorders (IDDs), after implementing universal salt iodization and sustained monitoring of the IDD program.[15,16] In 1968, the prevalence of goiter in various provinces of Iran was between 10% and 60%. However, no preventive measures for the control of IDD were

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undertaken. In 1989, a nationwide survey showed that goiter existed at a rate of 30% to 80% in school children in most provinces, and it was estimated that 20 million people were at risk of iodine deficiency. The production and distribution of iodized salt containing 40 ppm iodine was begun and the education of policy makers, health personnel, and public was initiated in 1990; the first law requiring mandatory iodination of all salts for household use was passed in 1994. Because of the continuous risk of recurrence of iodine deficiency, a surveillance program on sustainability of iodine sufficiency in Iran by assessing goiter prevalence and measuring urinary iodine concentration (UIC) has been conducted every 5 years since 1996. Public education during the earlier years of implementation of salt iodization program resulted in high levels of public awareness in over 95% of homemakers and almost 80% of households consuming iodized salt,[17] and was accompanied by dietary iodine sufficiency in schoolchildren in 1996 and 2001.[15] Since 1990, 4 surveys on sustainability of iodine deficiency prevention have reported great success in IDD control and elimination in Iran; however, compared with previous studies, a recent survey and also a previous study conducted in Tehran showed an increase in the percentage of subjects with UICs < 100,[18] a cutoff point for iodine insufficiency.[19-21]

Since the first few years of implementation of the salt iodization program, there has been a lack of comprehensive community education programs in Iran in this regard. Furthermore, there is no information related to public knowledge, attitude, and practice of iodine nutrition in recent years. Data from several studies indicate that upgrading public knowledge and community education regarding iodine among individuals is 1 of the most important contributors for successfully combating iodine deficiency.[9,22,23] Hence, the present study was conducted to evaluate the relationship between iodine nutrition status and knowledge, attitude, and practice in Tehranian women after 2 decades without updates in public education.

METHODS

Subjects

This cross-sectional study was conducted with the sample of a previous study of Tehranian adults in 2009, further details of which have been published elsewhere.[20] Briefly, from each of 8 health care centers located in 4 distinct areas of Tehran (ie, south, west, east, and north), 48 households were randomly selected. During home visits, the purpose and methodology of the study were clarified and mothers of each household were invited to participate. Of the 383 mothers who had complete data on knowledge, attitude, and practice regarding iodine nutrition and iodized salt, participants who abstained from giving 24-hour urine samples ($n = 7$), pregnant and lactating mothers ($n = 20$), and women with incomplete urine samples ($n = 18$) were excluded; eventually, a total of 338 women remained for the current analysis. Personal information (ie, age, education, occupation, and number of family members), medical history of thyroid diseases, and use of thyroid medications and iodine-containing supplements were self-reported and documented using an interviewer-administered questionnaire. Informed consent was obtained from the mother of each household, and the Ethical Committee of the Research Institute for Endocrine Sciences approved this study.

Salt Sample Collection

During the first home visit, salt samples (2 tablespoons) were collected from each of the 338 households. The samples were kept in lightproof, closed plastic cans and labeled with the code of each household.

Urine Collection

At the first home visit, written instructions and 2.5-L labeled plastic containers were given to the mothers of each household, who were asked to collect all urine passed during a 24-hour period, beginning on Friday (a weekend day in Iran), starting from the second morning urine and ending with the first urine passed the following morning.

At the second visit, on the following Saturday, all samples were collected and sent to the iodine laboratory of the Endocrine Research Center, the reference laboratory of the Eastern Mediterranean region; total volume was measured and urine was transferred into screw-top labeled plastic vials. The aliquots were kept frozen at $-80°C$ until iodine and creatinine were measured.

Laboratory Measurements

Iodine concentration of salt samples was determined using the iodometric titration method with 1 ppm sensitivity and 1% coefficient of variation. The values obtained were shown in parts per million. Iodine concentration in urine samples was analyzed using the Sandell-Kolthoff (acid–digestion) reaction; results are expressed as micrograms of iodine per liter of urine. The intra-assay and inter-assay coefficients of variation were 9.6% and 10.4%, respectively, and the sensitivity was 2 μg/L. Completion of 24-hour urine sample collection was confirmed with creatinine concentration. Urine samples with creatinine levels below 500 mg/d were considered incomplete. Urinary creatinine was measured by the kinetic Jaffé method (creatinine colorimetric kit; Pars Azmoun, Tehran, Iran). The assays were run using an autoanalyzer (Selectra-2, Vitalab, Holliston, The Netherlands).

Conceptual Framework

An emerging field of science recognized as "translational research," which may be better defined as "from bench to bedside and back again" or "from bench to behavior," applies laboratory results to clinical settings and also integrates nutrition education with biomarker(s).[24] For this reason, in the current study, the knowledge–attitude–practice (KAP) model[25] has been included to explain the role of these factors in urinary iodine concentration as an indicator for iodine nutrition sufficiency. The hypothesis of this study was that higher levels of knowledge and positive attitude would improve behaviors regarding iodine nutrition

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