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Iodine nutrition and thyroid function assessment in childbearing age women from Queretaro, Mexico

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Abstract

Objective: **To assess iodine nutrition and thyroid function in Mexican childbearing age women.**

Methods: **101 childbearing age women (21.7 ± 3.5 years) randomly selected from the university student population participated in this cross-sectional study. TSH, thyroid hormones, anti-thyroid antibodies, thyroid volume, iodine intake, and urinary iodine concentration (UIC) were assessed. The knowledge about the importance of iodine in nutrition was also evaluated by using questionnaires.**

Results: **TSH median (interquartile range) value was 1.9 (1.4-2.5) mIU/L, while FT4 median value was 9.0 (8.3-9.6) µg/dL. The median FT3 and total rT3 values were 3.3 pg/mL and 40.1 ng/dL, respectively. The prevalence of subclinical hypothyroidism (serum TSH >4.5 mIU/L) and of positive anti-thyroid antibodies were 2.9% and <5.9%, respectively. Median thyroid volume was 5.6 mL and none of the subjects were diagnosed with goiter. Median urinary iodine concentration was 146 (104-180) µg/L. As for the knowledge of iodine nutrition, only 37.6% considered that a pregnant woman needs more dietary iodine than a non pregnant woman, while 43.6% recognized that the lack of iodine can cause mental retardation in children.**

Conclusions: **Prevalence of thyroid test function abnormalities was low in this population and the median UIC indicates adequate iodine intake. We also found a poor knowledge about the importance iodine nutrition in the studied population.**

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Key words: *Iodine nutrition. Thyroid hormones. Childbearing age women. Urinary iodine concentration.*

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ESTADO NUTRICIO EN YODO Y FUNCIÓN TIROIDEA EN MUJERES EN EDAD REPRODUCTIVA DE QUERÉTARO, MÉXICO

Resumen

Objetivo: **Evaluar el estado nutricional en yodo y la función tiroidea en mujeres mexicanas en edad reproductiva.**

Métodos: **101 mujeres universitarias en edad reproductiva (21,7 ± 3,5 años) fueron seleccionadas al azar para participar en este estudio transversal. Se evaluaron los niveles séricos de tirotropina, hormonas tiroideas, anticuerpos anti-tiroideos, volumen tiroideo, consumo de yodo y yoduria. También se evaluó el conocimiento sobre la importancia del yodo en la nutrición.**

Resultados: **La mediana (rango intercuartilar) de tirotropina fue de 1,9 (1,4-2,5) mIU/L, mientras que para T4 libre fue de 9,0 (8,3-9,6) µg/dL. Los valores de la mediana de T3 libre y T3 reversa fueron de 3,3 pg/mL y 40,1 ng/dL, respectivamente. La prevalencia de hipotiroidismo subclínico fue 2,9% (tirotropina sérica >4,5 mUI/L). La prevalencia de anticuerpos antitiroideos positivos fue <5,9%. La mediana del volumen tiroideo fue de 5,6 mL y no se diagnosticaron mujeres con bocio. La mediana (rango intercuartilar) de la yoduria fue de 146 (104-180) µg/L. En cuanto al conocimiento de la importancia del yodo en la nutrición, el 37,6% consideró que las mujeres gestantes requieren más yodo en la dieta que las no gestantes, mientras que el 43,6% reconoció que la deficiencia de yodo puede causar retraso mental en los infantes.**

Conclusiones: **Se encontró una baja prevalencia de alteraciones en las pruebas de función tiroidea, mientras que la mediana de la yoduria indicó un adecuado consumo de yodo. También se encontró un conocimiento bajo acerca de la importancia del yodo en la nutrición.**

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Palabras clave: *Estado nutritio de yodo. Hormonas tiroideas. Mujeres en edad reproductiva. Yoduria.*

Abbreviations

Ab: Antibodies.
Anti-thyroid peroxidase antibodies (anti-TPO Ab).
Anti-thyroglobulin antibodies (anti-TPO Ab).
BMI: Body mass index.
D1: Deiodinase type I.
DIQ: Dietary iodine questionnaire.
ICCIDD: International Council for Control of Iodine Deficiency Disorders.
FT3: Free triiodothyronine.
FT4: Free thyroxine.
HNNS: Health and Nutrition National Survey.
rT3: Reverse triiodothyronine.
TT3: Total triiodothyronine.
TT4: Total thyroxine.
TSH: Thyroid stimulating hormone.
TVol: Thyroid volume.
UAQ: Universidad Autónoma de Querétaro.
UIC: Urinary iodine concentration.
UNICEF: United Nations Children s Fund.
USI: Universal salt iodization.
WHO: World Health Organization.

Introduction

Iodine deficiency is still a significant global public health problem and affects both developed and developing countries[1]. It is estimated that iodine intake is insufficient in about 2 billion people worldwide[2]. An adequate iodine nutrition is required for an appropriate thyroid function and maternal euthyroidism is essential for a physiological gestation.[3] Iodine deficiency during gestation can cause neurological and cognitive impairments in children and increased pregnancy loss and infant mortality[3].

According to World Health Organization (WHO), United Nations Children s Fund (UNICEF) and the International Council for Control of Iodine Deficiency Disorders (ICCIDD), two major strategies to control iodine deficiency exist: universal salt iodization (USI) and periodical monitoring of iodine intake[4]. On one hand, USI is considered a safe, cost-effective, and a sustainable strategy to ensure sufficient intake of iodine by all individuals. In Mexico USI has been implemented for 60 years and is required by law[5,6]. Data from 2008 showed that approximately 80% of commercial salt in Mexico contained between 20 and 40 ppm of iodine, and 94% contained ≥ 15 ppm of iodine[7]; which is in accordance to WHO/UNICEF/ICCIDD criteria where a concentration between 15-40 ppm of iodine in table salt at a house level must be guaranteed[4].

The best indicator of iodine intake in a population is the median urinary iodine concentration (UIC)[4]. On this regard, in Mexico there has not been a periodical monitoring of iodine intake. Currently iodine sufficiency in a population is defined by a median UIC of 100-299 µmg/L in schoolchildren, and in pregnant women ≥150-499 µg/L[1,4]. Monitoring UIC is essential to face global emerging issues related to iodine nutrition, such as: a) discrepancies between urinary iodine status in pregnant women compared to schoolchildren; b) the problem of re-emerging iodine deficiency in some developed countries; c) the use of iodized salt in the food industry; d) excessive iodine intake; e) the potential effects of initiatives regarding the reduction of sodium and table salt consumption[1].

In addition, there is no current data about iodine nutrition in childbearing age women in Mexico. This group of population could be a potential target to evaluate dietary sources of iodine, the impact of the reduction in table salt consumption, and their current knowledge about iodine nutrition. This latter could play a crucial role in the sustainability of salt iodization programs[8]. Finally, thyroid function can be affected by iodine nutrition; iodine deficiency impairs thyroid hormone synthesis and excessive iodine intake is associated with an increased risk for chronic autoimmune thyroiditis and hypo and hyperthyroidism[9]. Data about prevalence of thyroid function test abnormalities in Mexico and Latin America is also scarce.

The aim of this study was to assess thyroid function and iodine nutrition in Mexican childbearing women, as well as to evaluate the general knowledge about iodine as a nutrient.

Materials and methods

This is a cross-sectional survey carried out in female students from the Universidad Autónoma de Querétaro (UAQ), México, between October-November 2011. Women between 18 and 40 years old, without an energy-restricted diet history, and non-pregnant or breastfeeding during the previous year were included in the study. Sample size was calculated using the Epi-Info 6.0 software (CDC, Atlanta, GA) based on an expected 7.4% prevalence of UIC <100 µg/L[10]; a 1.9% worst acceptable result; a 95% confidence of interval, and considering a total population of 9,292 subjects. The calculated sample size was of 86, and a total sample size of 101 women was randomly selected. This study was approved by the Bioethical Committee of the Medical School of the UAQ, and conducted according to Declaration of Helsinki. All participants gave informed written consent before being admitted into the study.

Anthropometric variables were measured following standardized procedures[11]. Weight (kg) and height (m) were taken using a calibrated scale and stadimeter (SECA, Germany), waist circumference was measured midway between the lower rib margin and the iliac crest in the horizontal plane with the patient standing. Both body mass index (BMI in kg/m^2), and conicity index were estimated. Overweight and obesity were defined by a BMI ≥ 25 and ≥ 30 kg/m^2, respectively[12]. Abdominal obesity was defined by a waist circumference ≥ 80 cm[13]. Conicity index is used to asses obesity and body fat distribution, and it was determined by weight, height and waist circumference with the following equation: waist circumference (cm)/0.109 √weight (kg)/height (m)[14].

To estimate iodine intake a modified version of Leung's dietary iodine questionnaire (DIQ), a self-administrated questionnaire, was applied[15]. Major modifications of Leung's DIQ were done considering dietary habits and availability of food, and multivitamins and food supplements available in Mexican markets. Leung's DIQ recorded socio-demographic characteristics, smoking, thyroid medical history, general understanding about dietary iodine and sources of dietary iodine. After Leung's DIQ a dietary 24 h recall was also applied to estimate iodine intake. Iodine values from the Spanish Food Composition tables were employed in the estimation of iodine intake[16].

Thyroid gland volume (TVol) was assessed by using a high-resolution ultrasound (Voluson 730 GE, KPI Ultrasound; Riverside, CA) with a 7.5 MHz lineal array transducer. Thyroid ultrasounds were performed in supine position with extended cervical spine by a pillow under the shoulders and the maximal craneo-caudal (length), medio-lateral (width) and antero-posterior (depth) distances were measured by a single expert radiologist. Total volume of the thyroid gland was estimated according to Henjum et al (2010)[17] by adding the volume of each lobe (right and left) and calculated as follows: length (mm) × width (mm) × depth (mm) × 0.479, without considering the isthmus volume. In addition, and in accordance to these authors, goiter was defined by ultrasound as a thyroid volume >18 mL[17].

Fasting peripheral blood samples were collected and serum aliquots were stored at -70°C until being used for hormones and antibodies quantification. Serum total triiodothyronine (TT3), free triiodothyronine (FT3), total thyroxine (TT4), free thyroxine (FT_4), thyroid-stimulating hormone (TSH) and anti-thyroid peroxidase (anti-TPO) antibodies (Ab) were measured by the immune-chemiluminescense-assay method (ADVIA Centaur® CP immunoassay System; Siemens AG, Erlangen, Germany). Anti-thyroglobulin Ab (anti-Tg Ab) was determined by the Immulite® 1,000 Systems method (Siemens AG, Erlangen, Germany). Reverse T3 (rT3) serum concentration was measured by a modification of the radioimmunoassay (RIA) previously described by Wiersinga and Chopra (1982)[18]. Inter- and intra-assay coefficients of variation were 4.0 % and 3.9 %, respectively. The assay buffer used was Tris-HCl (0.05M; pH 8.6). The incubation mixture contained assay buffer and a working dilution (1:1,000) of anti-rT3 serum (Invitrogen™, Carlsbad, CA), the radioactive solution (10 pg/100 µL of the labeled rT3 plus 10 mg/10mL of 8-anilino-1-naphthalene sulfonic acid, Sigma), and standard (standard curve, 5.8-3,000 pg/dL of rT3 [Sigma; St. Louis, MO], plus 50 µL of iodothyronine-free serum), or 50 µL of the experimental sample. Free and antibody-bound radioactive rT3 were separated using 0.5% activated charcoal/dextran suspension (Sigma; St. Louis, MO). Thyroid function definitions were taken from Surks et al. (2004)[19]. Euthyroidism was defined as an FT4 level between 10 and 25 pmol/L with a TSH level between 0.25 to 4.5 mIU/L. Subclinical hypothyroidism was defined as a TSH level of 4.5 to 10 mIU/L, with an FT4 level between 10 to 25 pmol/L. Overt hypothyroidism was defined as a TSH level ≥10 mIU/L independently of the FT4 value. Subclinical hyperthyroidism was defined as TSH levels between 0.1 to 0.4 mIU/L and normal FT4 levels and overt hyperthyroidism was diagnosed with TSH levels <0.1 mIU/L and elevated FT4. Positive thyroid antibodies were considered when anti-TPO antibodies values were >35 IU/mL and/or anti-Tg antibodies values were >40 IU/mL.

Spot urine samples were obtained from all women in a 40 mL plastic sterile urine sample container. Samples were placed in polyethylene tubes and kept at 4°C until being stored at -20°C for further analysis. UIC determinations were performed by the Sandell-Kolthoff method after sample digestion with ammonium persulfate, according to Pino et al. (1996).[20] Intra- and interassay coefficients of variation were 6% and 8%; respectively. The median UIC was expressed as micrograms per liter (µg/L). UIC analyses were carried out by, Laboratorio de Micronutrientes (LM) of the Universidad Peruana Cayetano Heredia (UPCH). LM-UPCH is a member of the Regional Resource Laboratory for the International Resource Laboratories for Iodine Network, and follows the "Ensuring the Quality of Iodine Procedures" of the Centers for Disease Control and Prevention. Iodine nutrition status in women was determined according to the recommended WHO/UNICEF/ICCIDD criteria[4]. Insufficient iodine intake was defined as a population median UIC <100 µg/L; adequate intake of iodine as UIC 100-199 µg/L; iodine intake above the requirements as UIC 200-299 µg/L; and excessive intake of iodine as UIC ≥300 µg/L.

Statistical analyses were performed by using the Statistical Package for the Social Sciences (SPSS) version 15.0 (SPSS Inc., Chicago, IL) and GraphPad Prism (GraphPad Sofware Inc. La Jolla, CA). Data on quantitative characteristics are expressed as mean and standard deviation, or median and inter-quartile range. Qualitative variables were expressed as percentages. Spearman correlation analyses were performed with variables with non-Gaussian distribution. Fisher exact test was used to analyze association between variables and the odds ratio was estimated. Statistical significance was defined as a p value <0.05.

Results and discussion

A total of 101 women were included in the study. The average age was 21.7 ± 3.5 years; 60 (59.4%)

subjects studied a health and life science related career, while 41 (40.6%) studied an economical and social science related career. General characteristics of the women that participated in this study are depicted in table I. Frequency of the distribution of TSH, FT4, FT3 serum levels, TVol, iodine intake, and UIC are shown in figure 1. According to their BMI, 16.8% were overweight and 5.9% were obese. These values are lower compared with the Mexican Health and Nutrition National Survey (HNNS) 2012[21], where the prevalence of overweight and obesity nationwide in women between 20 to 29 years was of 30.6 and 24.0%, respectively. When using the criteria of ³80 cm of waist circumference as abdominal obesity, the prevalence in our study population was 49.5% whereas in HNNS 2012 was of 63.6%. The thyroid ultrasound to estimate TVol was evaluated only in 68 women; median (interquartile range) of TVol was 5.6 (4.4-7.1) mL and nobody was diagnosed with goiter. Median (interquartile range) serum levels of TSH, FT4, and FT3 were 1.9 (1.4-2.5) mIU/L, 1.3 (1.15-1.5) ng/dL, 3.3 (3.0-3.7) pg/mL, respectively. Subclinical hypothyroidism prevalence was 2.9% and the prevalence of positive anti-TPO Ab and anti-Tg was of 5.9 and 5.0%, respectively. There are a few studies in Mexican population about prevalence of thyroid function test abnormalities. Hurtado-López et al., (2011)[22] in an open population study (from 18 to 90 years of age) in the Valley of Mexico (n = 2,401), showed a prevalence of high TSH values (> 4.5 mIU/L) of 21.5%, and a prevalence of low TSH levels (< 0.5 mUI/L) of 11.1%. In the same study the reported a prevalence of palpable thyroid nodule of 1.4%, whereas the prevalence of thyroid nodules detected by ultrasound was 19.6%. In a second study published in 2010[23], 3,033 patients of five states from the central region of Mexico, with a mean age of 42.3 ± 10 years, without overt thyroid disease or diabetes, the prevalence of subclinical hypothyroidism was 8.3% (7.1% and 10.1% for men and women, respectively). In a previous study performed by our research group in two cities from the state of Queretaro (n = 164), the prevalence of subclinical hypothyroidism in women with a mean age of 36.8 ± 11.8 years, was 4.2%, additionally the prevalence of thyroid function abnormalities was 12%. In this same study, the prevalence of positive anti-TPO and anti-Tg Ab was 11.6 and 8.5%, respectively (Robles-Osorio et al. 2013. *Unpublished data*). The differences in the prevalence of thyroid function test abnormalities between these studies and the present work could be due mainly by age and sampling methods[24,25].

Table I
General characteristics of the population studied and TSH, TH and UIC levels

Variable	*All women (n = 101)*
Age (years)	21.7 ± 3.5
Health and life sciences students (%)	59.4
Social science students (%)	40.6
Weight (kg)	59.0 ± 9.8
BMI (Kg/m^2)	23.2 ± 3.3
Waist (cm)	80.2 ± 9.2
Conicity index	0.69 ± 0.05
Overweight (%)	16.8
Obesity (%)	5.9
Abdominal obesity (%)	49.5
Smoking (%)	28.7
Thyroid volume (mL)*	5.6 (4.4-7.1)
Goiter (%)	0.0
TSH (µUI/mL)	1.9 (1.4-2.5)
TT4 (µg/dL)	9.0 (8.3-9.6)
FT4 (ng/dL)	1.3 (1.15-1.5)
TT3 (ng/mL)	1.5 (3.1-3.7)
FT3 (pg/mL)	3.3 (3.0-3.7)
Reverse T3 (ng/dL)**	40.1 (27.2-55.0)
Anti-TPO Ab (IU/mL)	12.0 (6.5-22.7)
Subclinical hypothyroidism (%)	2.9
Anti-TPO Ab positive (%)	5.9
Anti-Tg Ab positive (%)	5.0
Anti-TPO Ab and anti-Tg Ab positive (%)	2.0
Subclinical hypothyroidism and either anti-TPO or anti-Tg Ab positive (%)	2.0
Iodine intake (µg) 24 h recall	74 (50-103)
Iodine intake (µg) dietary iodine questionnaire	52 (34-68)
UIC (mg/L)	141 (104-180)

It is shown the mean ± standard deviation, percentage (%) or median and interquartile range in parentheses.
*Thyroid volume was measured to 68 women.
** Reverse T3 was measured to 98 women.

On the other hand, Women on this stutdy had adequate iodine intake probably due to the USI program in Mexico. These results agree with previous data published. In the National Nutrition Survey of 1999, median UIC was 312 µg/L in childbearing age women (12-49 years of age)[10], and recently we found a median UIC of 260 µg/L in pregnant women[26]. According to the DIQ, 77% used iodized salt in their foods and 6% consumed seaweed (*v. gr*. Wakame, nori, kombu, etc.) in the last 24 h. In addition, 61% of the subjects consumed milk, 64% cheese, 36% yogurt, 9% ice cream, 44% sliced bread, 42% other kind of not home-made bread (*v. gr*. Bagels, white rolls, sweet pastries, etc.) and 11% fish in the last 24 h. No subjects used iodine-containing vaginal douches or antiseptic skin cleaners in the previous week (data not shown), and only 1% reported the use of iodine-containing multivitamins. There was no correlation between UIC levels and daily iodine intake estimated by dietary 24 h recall ($r = -0.09$; $p = 0.19$) and DIQ ($r = 0.02$; $p = 0.43$). Besides, a positive but not significant correlation between the iodine intake estimated by dietary 24 h recall and DIQ was found ($r = 0.17$; $p = 0.051$) (data not shown). Unfortunately, the lack of information about iodine contents in Mexican food does not allow us to perform an accurate estimation of iodine intake using dietary evaluation tools.

Due to the high prevalence of abdominal obesity found in the population studied, we explored its relation with thyroid function. Several studies showed that

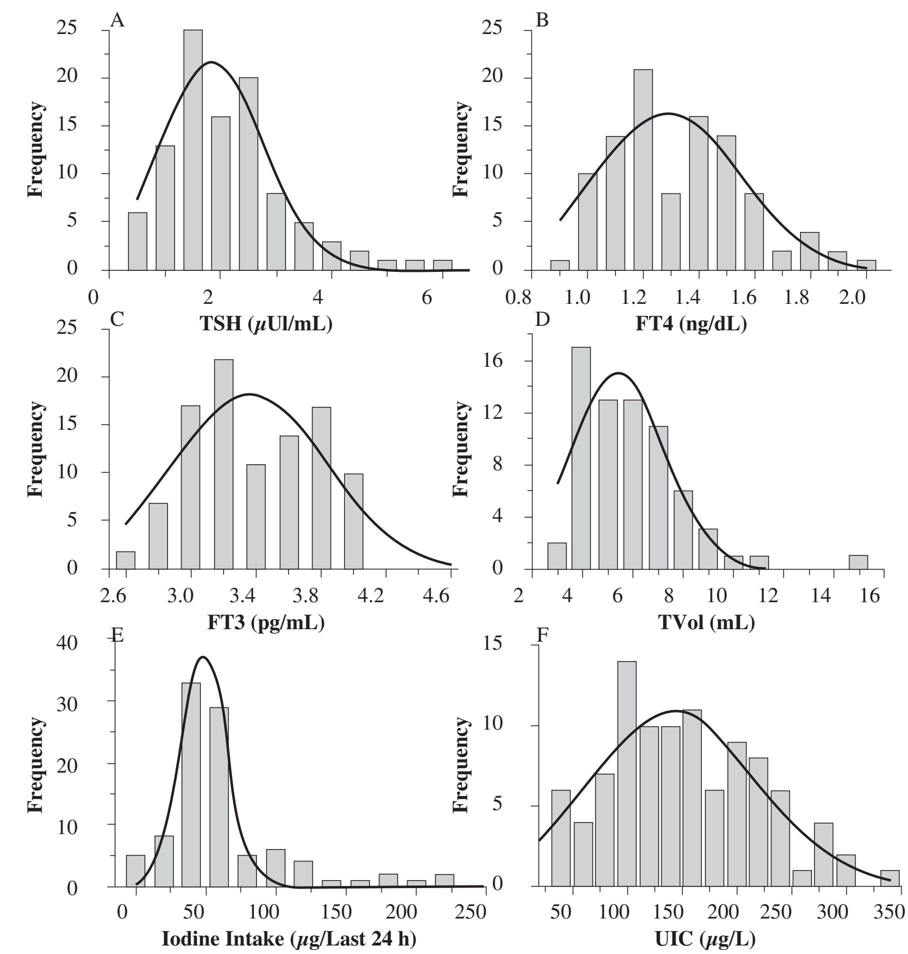

Fig. 1.—Distribution of serum concentration of TSH (A), FT4 (B), FT3 (C), TVol (D), Iodine intake in last 24 h (E) and UIC (F) in childbearing age women from Mexico.

overweight and obesity are associated with an increase in TSH levels, but there are contradictory data regarding FT4, FT3, TVol and autoimmune thyroid disease[27-31]. Our results show a significant positive correlation between TSH levels and some adiposity indicators such as BMI and waist circumference (table II). Also, TVol was positive and significantly correlated with weight, waist and conicity index. We also found a significant positive correlation between FT4 and BMI (r = 0.17; $p = 0.05$) (data not show). This could be due to the effect of leptin, an adipose tissue hormone that has been described to stimulate TSH and the hypothalamus-pituitary-thyroid axis[27,32]. Experimental data obtained from rat fed with high fat diet is in accordance with these observations. Rats fed with high fat diet showed increased TRH mRNA and TSH levels without changes in T3 and T4 serum levels, but with a significant increase in circulating rT3[33]. This change in rT3 is related with an increase in hepatic type 1 deiodinase activity (D1), which can deiodinate both inner and outer ring, and thus activate or inactivate thyroid hormones. In contrast, in the present study, no correlation between rT3 and BMI, waist circumference or conicity index (data not shown) was found. Furthermore, it has been recently reported in humans that serum leptin levels and D1 adipocyte expression were increased in obese subjects compared to normal controls[34]. Clearly more research is needed to clarify the role of deiodinases in obesity.

Table I
Spearman correlations between serum TSH levels and TVol with anthropometric data and UIC

	TSH		*TVol*	
	r	*p*	*r*	*p*
Weight	0.08	0.23	0.28	*0.01*
Height	0.10	0.20	-0.07	0.25
BMI	0.24	*0.03*	0.15	0.07
Waist	0.19	*0.03*	0.31	*<0.01*
Conicity index	0.17	0.44	0.22	*0.03*
UIC	0.16	0.44	-0.17	0.09

Significant *p* values are shown in italics.

In spite of the USI program in Mexico, and the relevance of health consequences from iodine deficiency, we found a low knowledge of iodine nutrition in the University's student population. table III shows the knowledge and opinions regarding iodine nutrition in the studied women. 67% of the subjects considered that iodine deficiency is an important public health problem worldwide, while 64.4% acknowledged that iodine deficiency is an important health problem in Mexico. Fifty four percent of subjects considered that iodine deficiency can cause goiter, and only 43.6% of the subjects declared that iodine deficiency could cause mental retardation in children. In contrast, more than 40% of the subjects had no opinion about the effects of iodine deficiency, goiter and mental retardation. According to Dunn (1996)[35] an inadequate education is one of the biggest obstacles in iodine deficiency control programs. All affected players (health authorities, health providers, industry, marketing, and consumers) must understand the importance of iodine deficiency, its consequences, and the means for its correction. Regrettably, in Mexico, there is not a massive educational program regarding the relevance of iodine in nutrition.

Finally, considering that we studied a university student population, we performed an association analysis between the category of career, health and life sciences (medicine, nursing, dentistry, veterinary medicine, etc.) and economical and social sciences (accounting, law, linguistics, etc) and their knowledge and opinions about iodine nutrition (table IV). 46% health and life science students *versus* 24.4% of economical and social sciences students considered that a pregnant women needs more iodine intake than a non pregnant women (OR = 2.7; 95% IC = 1.13-6.51) and 70% of health and life science students versus 41% of social sciences students knew that iodine deficiency cause goiter (OR = 5.03; 95% IC = 2.13-11.9). We did not find a significant difference while comparing the opinions between students from health and life sciences and economical and social sciences regarding the importance of iodine deficiency worldwide and in Mexico, salt addition to food and the relation of iodine deficiency and mental retardation. These results could

Table III
Opinions regarding iodine nutrition in Mexican childbearing age women

Variable	*All women* *n*	*%*
Iodine deficiency is an important public health problem worldwide		
Strongly agree	15	14.9
Agree	53	52.5
No opinion	30	29.7
Disagree	3	3.0
Iodine deficiency is an important public health problem in Mexico		
Strongly agree	14	13.9
Agree	51	50.5
No opinion	31	30.7
Disagree	5	5.0
In your opinion, do pregnancy women need		
Less dietary iodine than women who are not pregnant	6	5.9
About the same dietary iodine as women who are not pregnant	13	12.9
More dietary iodine than women who are not pregnant	38	37.6
I don't know	44	43.6
It is not healthy to add salt to food		
Strongly agree	16	15.8
Agree	33	32.7
No opinion	19	18.8
Disagree	29	28.7
Strongly disagree	4	4.0
Lack of iodine can cause goiter		
Strongly agree	22	21.8
Agree	33	32.7
No opinion	43	42.5
Disagree	2	2.0
Strongly disagree	1	1.0
Lack of iodine can cause mental retardation in children		
Strongly agree	15	14.9
Agree	29	28.7
No opinion	48	47.5
Disagree	9.0	8.9

Table IV
Opinions regarding iodine nutrition in Mexican childbearing age women

Variable	*Kind of career* — *Economical and Social sciences n (%)*	*Kind of career* — *Health and life sciences n (%)*	*p*	*Odds ratio*	*95% IC*
Iodine deficiency is an important public health problem worldwide			0.14	1.9	0.8-4.5
Disagree or no opinion	17 (41.5)	16 (26.7)			
Strongly agree and agree	24 (58.5)	44 (73.3)			
Iodine deficiency is an important public health problem in Mexico			0.09	2.2	0.9-5.2
Disagree or no opinion	19 (46.3)	17 (28.3)			
Strongly agree and agree	22 (53.7)	43 (71.7)			
Dietary Iodine pregnancy women needs			0.04	2.7	1.1-6.5
Less, about same than women who are not pregnant	31 (75.6)	32 (53.3)			
More than women who are not pregnant	10 (24.4)	28 (46.7)			
It is not healthy to add salt to food			0.84	1.1	0.7-1.8
Disagree and no opinion	22 (53.7)	30 (50.0)			
Strongly agree and agree	19 (46.3)	30 (50.0)			
Lack of iodine can cause goiter			0.00	5.0	2.1-11.9
Disagree or no opinion	28 (68.3)	18 (30.0)			
Strongly agree and agree	13 (31.7)	42 (70.0)			
Lack of iodine can cause mental retardation in children			0.31	1.6	0.7-3.6
Disagree or no opinion	26 (63.4)	31(51.7)			
Strongly agree and agree	15 (36.6)	29 (48.3)			

IC: Interval confidence.

be explained considering that often during the training of medical doctors and health providers the emphasis is usually on a clinical approach to diagnosis and treatment to thyroid abnormalities, but not in public health aspects of iodine deficiency such as brain damage[8].

Conclusion

A low prevalence of thyroid function test abnormalities, as well as an adequate iodine intake was found among childbearing age women in Mexico. Moreover, a low knowledge regarding the importance of iodine nutrition was found. Furthermore, and in addition to a USI program, it is necessary a to develop a national educational program about iodine nutrition and especially about its importance for neurodevelopment during gestation.

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Author Disclosure Statement

Authors declare that no competing financial interests exist.

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