



Thyroid function parameters in normal pregnancies in an iodine sufficient population



Roy Moncayo ^{a,*}, Birgit Zanon ^b, Kurt Heim ^c, Karina Ortner ^d, Helga Moncayo ^e

^a Department of Nuclear Medicine, Medical University of Innsbruck, Anichstrasse 35, 6020 Innsbruck, Austria

^b Kreisklinik Ebersberg, Abtlg. Gynäkologie, Pfarrer-Guggetzerstrasse 3, D-85560 Ebersberg, Germany

^c LKH Kirchdorf, 4560 Kirchdorf, Austria

^d Department of Nuclear Medicine, Medical University of Innsbruck, Austria

^e WOMED, Karl-Kapferer-Strasse 5, 6020 Innsbruck, Austria

ARTICLE INFO

Article history:

Received 22 October 2014

Received in revised form 27 December 2014

Accepted 29 December 2014

Available online 2 January 2015

Keywords:

Thyroid function

TSH

fT4

fT3

Pregnancy

ABSTRACT

Background: The aim of this retrospective observational study was to describe thyroid function parameters (fT3, fT4 and TSH) in the course of normal pregnancies.

Methods: Data were obtained between 2006 and 2007 at the University Hospital in Innsbruck, Austria. The starting point was the identification of women who had had a normal birth as recorded in the birth registry of Tyrol. Thyroid function parameters were determined using methods implemented at the Department of Nuclear Medicine in Innsbruck.

Results: The fT3 and fT4 values were normally distributed. Grouping the results by trimester revealed the following values: 4.93 ± 0.59 , 4.54 ± 0.48 , and 4.27 ± 0.45 pmol/l for fT3; and 15.23 ± 2.43 , 13.79 ± 1.99 , and 13.32 ± 0.201 pmol/l for fT4, respectively. The values corresponding to the 10th-percentile were 3.9 pmol/l for fT3 and 11.3 pmol/l for fT4, respectively. TSH values showed a typical left skewed distribution, thus the mean values were calculated after log transformation of the data. The corresponding mean trimestral values for TSH were 1.46 ± 1.29 , 1.68 ± 1.23 , and 1.70 ± 2.22 mIU/l, respectively.

Conclusion: In an iodine sufficient population, thyroid function parameters in normal pregnancies do not differ from those in non-pregnant women. Our previously defined reference range for TSH of 0.3 to 3.5 mIU/l is equally valid for normal pregnancies.

General significance: The question of cognition and IQ development of children has been proposed to be associated with thyroid function. The addition of data regarding normal thyroid function during pregnancy will contribute to this research.

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1. Introduction

The role of thyroid function during pregnancy has been observed and described since many centuries [1]. Modern studies describe thyroid disease as the second most frequent endocrine disorder that can affect women in their reproductive age. When thyroid disease remains untreated in a pregnant woman some disorders can appear. These include risk of miscarriage, hypertension, growth restriction, and placental abruption [2]. One fundamental cause of thyroid dysfunction is iodine deficiency which will lead to the development of goiter [3].

Abbreviations: TSH, thyroid stimulating hormone; fT3, free triiodothyronine; fT4, free thyroxine; hCG, human chorionic gonadotropin

* Corresponding author at: Department of Nuclear Medicine, Medical University of Innsbruck, Anichstrasse 35, AT-6020 Innsbruck, Austria. Tel.: +43 512 504 22661.

E-mail addresses: Roy.Moncayo@i-med.ac.at (R. Moncayo), birgit.zanon@klinik-ebe.de (B. Zanon), heim_kurt@yahoo.com (K. Heim), Karina.Ortner@student.i-med.ac.at (K. Ortner), anmeldung@womed.at (H. Moncayo).

When iodine deficiency is present together with obstetrical pathology the cognitive development of the offspring can be endangered [4]. Fierro-Benítez et al. added the factor of protein-caloric malnutrition in regulating mental development [5]. The putative negative effect of thyroid function on cognitive development, however, has not been confirmed in a recent study [6].

The regulation of thyroid function has been analyzed from a historical point of view by Toni [7]. Current descriptions place thyroid hormone action and regulation in the context of regulation of metabolism [8]. The cellular processes leading to thyroid hormone action require selenoproteins, the deiodinases [9], in order to convert the pro-hormone T4 to the active form T3 [10].

In the clinical setting the evaluation of thyroid function relies on morphological and laboratory methods. In the past years we have been involved in applying improved thyroid ultrasound techniques [11] as well as in evaluating thyroid hormone reference levels in children and adults [12,13] under conditions of sufficient iodine supply.

The aim of the present study was to analyze thyroid function parameters in normal pregnancies.

2. Materials and methods

2.1. Patients

This study was carried out at the University Hospital in Innsbruck, Austria between 2006 and 2007. The study was conceived by KH who had previously designed and implemented the Tyrolean Birth Registry (Registry). The investigation was conducted as a retrospective case study of women that had a normal pregnancy. The data regarding the uneventful course of the pregnancy were obtained from the Registry. Inclusion criteria were that all babies born were healthy with no obstetrical pathology (data not shown). After identifying the subjects, thyroid function parameters as well as pregnancy variables were retrieved from the hospital clinical database. The study was approved by the local Ethics Committee.

2.2. Laboratory methods

Thyroid function parameters were determined using routine methods implemented at the Department of Nuclear Medicine as described previously [14]. Reference values for TSH have been described by us before [12] and served as a control group. A total of 2028 data sets were available for TSH evaluation and 1822 for fT3 and fT4. Laboratory determinations were performed on an ADVIA Centaur XP Immunoassay System (Siemens, Erlangen, Germany). Assay performance characteristics are similar to those reported by Reix et al. [15].

2.3. Statistical methods

The same subject was studied up to 3 times during pregnancy. Data was grouped according to the week of pregnancy. At each week of pregnancy a descriptive data analysis for fT3, fT4, and TSH was done. Presentation of the results for fT3 and fT4 was done by depicting the confidence intervals. TSH values are shown in percentiles. Statistical analysis was done with IBM SPSS 22.

3. Results

The mean age of the subjects was 27.6 ± 6.2 years. Among the subjects studied, we observed 5 cases of hypothyroidism, 10 cases of hyperthyroidism, and 159 cases of latent hyperthyroidism. In 83 cases a latent hypothyroidism was detected having 95% CI values of TSH between 4.5 and 5.3 mIU/l. These cases were subsequently excluded from the analysis. In spite of thyroid dysfunction these women had a normal pregnancy and delivery.

The results of the study are presented in Table 1 showing the mean and S.D. for each parameter according to pregnancy week. These results are extracted giving the mean values for 3 periods of time: up to week 12, weeks 13 to 24, and weeks 25 to 36. The corresponding trimestral values for fT3 were 4.93 ± 0.59 , 4.54 ± 0.48 , and 4.27 ± 0.45 pmol/l, respectively. The corresponding trimestral values for fT4 were 15.23 ± 2.43 , 13.79 ± 1.99 , and 13.32 ± 2.01 pmol/l, respectively. Both parameters showed a continuous decline. The fT3 to fT4 ratio had a mean value of 0.32. The values corresponding to the 10th-percentile were 3.9 pmol/l for fT3 and 11.3 pmol/l for fT4, respectively. Figs. 1 and 2 show the histograms depicting the normal distribution of fT3 and fT4; Figs. 3 and 4 show the course of fT3 and fT4 during pregnancy.

TSH values showed a typical left skewed distribution. The mean values were calculated after log transformation of the data. The corresponding mean trimestral values for TSH were 1.46 ± 1.29 , 1.68 ± 1.23 , and 1.70 ± 2.22 mIU/l, respectively. The maximal values reached levels of 3.5 mIU/l. Fig. 5 shows the TSH values at the percentile levels

Table 1
Thyroid function reference values for fT3, fT4, TSH and fT3/fT4 ratio across pregnancy.

Pregnancy Week	fT3 pmol/l		fT4 pmol/l		TSH mIU/l		fT3/fT4
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean
6	4.55	0.35	14.45	0.35	1.57	0.63	0.31
7	5.06	0.68	15.30	2.63	2.22	1.45	0.33
8	5.08	0.64	16.03	2.99	1.33	0.97	0.32
9	5.04	0.57	15.35	3.32	1.48	2.33	0.33
10	5.03	0.75	15.75	2.67	0.96	0.76	0.32
11	4.89	0.59	14.89	2.79	1.21	1.12	0.33
12	4.89	0.56	14.84	2.26	1.41	1.75	0.33
13	4.78	0.64	14.72	2.58	1.65	1.96	0.32
14	4.75	0.56	14.02	1.88	1.52	1.23	0.34
15	4.69	0.45	14.02	2.04	1.57	1.01	0.33
16	4.66	0.54	14.02	1.89	1.67	1.58	0.33
17	4.54	0.44	14.03	2.19	1.61	0.89	0.32
18	4.55	0.45	13.23	1.66	1.91	2.28	0.34
19	4.61	0.50	13.86	2.19	1.90	1.06	0.33
20	4.39	0.40	13.19	1.83	1.83	1.26	0.33
21	4.52	0.46	13.83	1.91	1.63	0.94	0.33
22	4.38	0.48	13.69	2.16	1.70	0.98	0.32
23	4.31	0.45	13.43	1.96	1.70	0.86	0.32
24	4.33	0.45	13.39	1.62	1.41	0.79	0.32
25	4.31	0.48	13.17	2.07	1.77	1.32	0.33
26	4.21	0.54	13.29	2.32	2.77	10.97	0.32
27	4.30	0.43	13.07	2.47	1.49	0.92	0.33
28	4.25	0.40	13.33	1.80	1.44	0.98	0.32
29	4.28	0.42	13.33	1.93	1.72	1.56	0.32
30	4.26	0.41	13.90	1.78	1.32	0.65	0.31
31	4.34	0.48	12.97	2.04	1.44	0.92	0.33
32	4.35	0.46	13.32	1.93	1.60	0.95	0.33
33	4.23	0.41	13.63	2.25	1.55	1.16	0.31
34	4.27	0.55	13.14	1.86	2.10	5.36	0.32
35	4.23	0.44	13.24	1.86	1.58	0.82	0.32
36	4.24	0.40	13.46	1.87	1.57	1.03	0.31
37	4.25	0.43	13.12	2.32	1.56	0.96	0.32
38	4.29	0.39	12.82	1.43	1.68	0.93	0.33
39	4.18	0.42	13.60	1.78	1.89	1.03	0.31
40	4.04	0.32	12.56	2.70	1.74	1.04	0.32
41	3.97	0.49	13.23	0.76	2.29	0.58	0.30
Total mean	4.47	0.48	13.81	2.06	1.66	1.53	0.32

of 2.5, 5.0, 50.0, 95, and 97.5 across pregnancy. While TSH levels showed little variation, only those corresponding to the 2.5 and 5.0 percentiles decreased between weeks 6 and 8 of pregnancy.

4. Discussion

This clinical observational study demonstrates that under conditions of sufficient iodine supply women that have a normal pregnancy

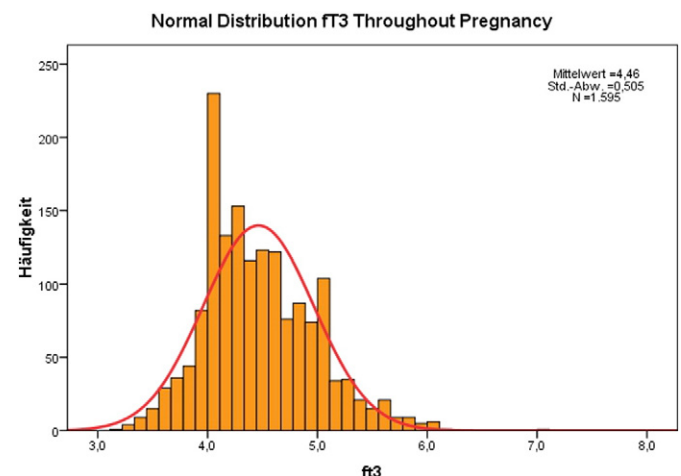


Fig. 1. Normal distribution of fT3 values in normal pregnancies.

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