Investigating the Relationship between Maternal Iodine Intake in Pregnancy and Iodine Status or Thyroid Function of Mothers and Infants

A Prospective Cohort Study

Dominique Condo

This thesis is submitted for the degree of Doctor of Philosophy

The University of Adelaide

School of Paediatric and Reproductive Health

Faculty of Health Science

June 2015
## Table of Contents

Table of Contents ........................................................................................................ i

List of Tables................................................................................................................ v

List of Figures ................................................................................................................ vi

Abstract ......................................................................................................................... .............................. ix

Declaration ...................................................................................................................... xii

Acknowledgements ...................................................................................................... xiv

List of Abbreviations .................................................................................................. xvii

### Chapter 1 : Introduction ......................................................................................... 1

### Chapter 2 : Literature Review ................................................................................. 5

2.1 Overview of literature review .................................................................................. 5

2.2 Iodine and thyroid hormone .................................................................................. 5

2.2.1 Sources of iodine ................................................................................................. 5

2.2.2 Iodine and thyroid hormone metabolism .............................................................. 6

2.2.3 Normal changes in thyroid function in pregnancy ................................................. 8

2.2.4 Transplacental transfer of thyroid hormone .......................................................... 10

2.2.5 Thyroid function in the postpartum period .......................................................... 10

2.2.6 Thyroid dysfunction in pregnancy and in the postpartum period ....................... 11

2.3 Assessment of iodine intake and status ................................................................ 12

2.3.1 Dietary assessment ............................................................................................... 12

2.3.2 Urinary iodine concentration ............................................................................... 13

2.3.3 Blood biomarkers ............................................................................................... 15

2.4 Iodine requirements in pregnancy and lactation ..................................................... 18

2.5. Iodine intake and status of Australian pregnant women and infants ................... 19

2.5.1 Iodine intake of Australian pregnant women ....................................................... 19

2.5.2 Iodine status of Australian pregnant women ....................................................... 19

2.5.3 Thyroid function of Australian pregnant women ............................................... 21

2.5.4 Newborn TSH .................................................................................................... 24

2.5.5 Summary of the findings ..................................................................................... 24
2.6 Review of the literature

2.7 The relationship between maternal iodine intake/maternal UIC and markers of maternal iodine status/thyroid function

2.7.1 The relationship between maternal iodine intake and markers of maternal iodine status/thyroid function

2.7.1.1 Studies in pregnancy

2.7.1.2 Studies in the postpartum period

2.7.1.3 Summary

2.7.2 The relationship between maternal UIC and markers of maternal thyroid function

2.7.2.1 Studies in pregnancy

2.7.2.2 Summary

2.7.3 The relationship between maternal UIC and maternal BMIC

2.7.3.1 Studies in the postpartum period

2.7.3.2 Summary

2.7.4 Overall Summary

2.8 The relationship between markers of maternal iodine intake/ iodine status thyroid function and markers of infant iodine status/thyroid function

2.8.1 The relationship between maternal iodine intake and markers of infant UIC/thyroid function

2.8.2 The relationship between maternal UIC and infant UIC

2.8.2.2 Studies in the postpartum period

2.8.2.3 Summary

2.8.3 The relationship between maternal UIC and markers of infant thyroid function

2.8.3.2 Studies in the postpartum period

2.8.3.3 Summary

2.8.4 The relationship between markers of maternal thyroid function and markers of infant thyroid function

2.8.4.2 Summary

2.8.5 The relationship between maternal BMIC and infant UIC/markers of thyroid function

2.8.5.1 Summary

2.8.6 Overall Summary
2.9. The relationship between maternal iodine intake/markers of thyroid function and clinical outcomes (pregnancy/birth outcomes, infant growth and the health/wellbeing in pregnant or postnatal women) ......................................................................................................................... 104
  2.9.1 The relationship between maternal iodine intake in pregnancy and pregnancy/birth outcomes ........................................................................................................................................................................ 105
  2.9.2 The relationship between markers of maternal thyroid function in pregnancy and pregnancy/birth outcomes ................................................................................................................................................ 105
  2.9.3 The relationship between maternal iodine intake and infant growth outcomes ............................................................. 107
  2.9.4 The relationship between markers of maternal thyroid function and infant growth outcomes .................................................................................................................................................................. 108
  2.9.5 The relationship between maternal iodine intake and the health/wellbeing of pregnant and postnatal women ................................................................................................................................. 110
  2.9.6 The relationship between markers of maternal thyroid function and the health/wellbeing of pregnant and postnatal women .................................................................................................. 110
  2.9.7 Summary ......................................................................................................................................................................................... 130

2.10. The effect of iodine supplementation in pregnancy on maternal and infant iodine status/thyroid function and clinical outcomes .................................................................................................. 130
  2.10.1 The effect of iodine supplementation in pregnancy on maternal iodine status and thyroid function ................................................................................................................................................................ 132
  2.10.2 The effect of iodine supplementation in pregnancy on infant UIC and thyroid function .................................................................................................................................................................. 133
  2.10.3 The effect of iodine supplementation in pregnancy on pregnancy outcomes ................................................................. 133
  2.10.4 The effect of iodine supplementation in pregnancy on infant growth outcomes .................................................................................................................. 134
  2.10.5 Summary ......................................................................................................................................................................................... 144

2.11. Rationale for this thesis ......................................................................................................................................................................................... 144

Chapter 3 : General Methods ......................................................................................................................................................................................... 146

3.1 Introduction ......................................................................................................................................................................................... 146
3.2 Study design ......................................................................................................................................................................................... 146
3.3 Study participants ................................................................................................................................................................................ 147
3.4 Recruitment ......................................................................................................................................................................................... 147
3.5 Data management ................................................................................................................................................................................ 148
3.6 Assessments ......................................................................................................................................................................................... 149
  3.6.1 Assessment of maternal dietary iodine intake .................................................................................................................................................................. 149
3.6.2 Assessment of maternal iodine status and thyroid function ........................................ 152
  3.6.2.1 Urine iodine concentration .................................................................................. 152
  3.6.2.2 Thyroid function ................................................................................................. 153
  3.6.2.3 Breast milk iodine concentration ....................................................................... 154
3.6.3 Assessment of infant iodine status and thyroid function ........................................ 155
  3.6.3.1 Newborn TSH ....................................................................................................... 155
  3.6.3.2 Urine iodine concentration .................................................................................. 155
  3.6.3.3 Thyroid function ................................................................................................. 156
3.6.4 Assessment of pregnancy and birth outcomes ......................................................... 156
3.6.5 Assessment of infant anthropometrics .................................................................... 156
3.6.6 Assessment of the general health and wellbeing of pregnant and postnatal women .......................................................................................................................... 157
3.7 Sample size estimation ............................................................................................... 159
3.8 Statistical analysis ...................................................................................................... 160
  3.8.1 Subgroup analysis .................................................................................................. 164

Chapter 4: The relationship between maternal total iodine intake in pregnancy and
markers of maternal iodine status/thyroid function in pregnancy and in the postpartum
period ................................................................................................................................ 166

4.1 Introduction ................................................................................................................ 166
4.2 Subjects and methods ............................................................................................... 167
4.3 Statistical analysis ...................................................................................................... 168
4.4 Results ........................................................................................................................ 170
  4.4.1 Maternal total iodine intake .................................................................................. 174
  4.4.2 Maternal urine iodine concentration .................................................................... 177
  4.4.3 Maternal thyroid function ...................................................................................... 178
  4.4.4 Breast milk iodine concentration ........................................................................ 180
  4.4.5 The relationship between maternal total iodine intake in pregnancy and maternal
UIC .................................................................................................................................. 186
  4.4.6 The relationship between maternal total iodine intake in pregnancy and markers of
maternal thyroid function ................................................................................................. 187
  4.4.7 The relationship between maternal total iodine intake in pregnancy and BMIC ... 190
  4.4.8 The relationship between maternal UIC at 28 weeks’ gestation and markers of
maternal thyroid function at 28 weeks’ gestation .............................................................. 190
6.4 Results ........................................................................................................................................246
  6.4.1 Pregnancy and birth outcomes ...............................................................................................246
  6.4.2 Infant growth measurements ................................................................................................246
  6.4.3 General health and wellbeing of women ...............................................................................248
  6.4.4 The relationship between maternal total iodine intake/thyroid function in pregnancy and pregnancy/birth outcomes ..............................................................251
  6.4.5 The relationship between maternal total iodine intake/thyroid function in pregnancy and infant growth ...........................................................................................................253
  6.4.6 The relationship between maternal total iodine intake/thyroid function in pregnancy and the general health and wellbeing of pregnant and postnatal women .................257
  6.4.7 The relationship between maternal thyroid function at 28 weeks’ gestation and the general health and wellbeing of pregnant and postnatal women ............................................258
  6.4.8 Subgroup analysis ................................................................................................................263
  6.5 Discussion ..................................................................................................................................265
  6.6 Conclusion .................................................................................................................................269

Chapter 7: General Discussion ..................................................................................................271
  7.1 Conclusion ............................................................................................................................277

References ......................................................................................................................................280

Appendix .........................................................................................................................................298
  Appendix 1: Screening and eligibility forms ..............................................................................299
  Appendix 2: Information sheet ....................................................................................................301
  Appendix 3: Consent form: .........................................................................................................305
  Appendix 4: Consent form ...........................................................................................................307
  Appendix 5: Summary of assessments ........................................................................................349
  Appendix 6: Development and validation of an iodine specific FFQ to estimate iodine intake in Australian pregnant women ..........................................................350
  Appendix 7: Iodine food frequency questionnaire .......................................................................359
  Appendix 8: SF-36 questionnaire ..................................................................................................364
  Appendix 9: DASS questionnaire ................................................................................................369
List of Tables

Table 2.1 Criteria from the WHO for the assessment of iodine nutrition in a population based on median UIC
.......................................................... 16
Table 2.2 Thyroid function of Australian pregnant women .................................................. 22
Table 2.3: Studies assessing the relationship between maternal iodine intake and markers of maternal iodine status/thyroid function ............................................................. 33
Table 2.4 Studies assessing the relationship between maternal UIC and markers of maternal thyroid function /BMIC .......................................................... 48
Table 2.5: Studies assessing the relationship between markers of maternal iodine status/thyroid function and infant UIC/markers of thyroid function .......................... 80
Table 2.6: Studies assessing the relationship between maternal iodine status/markers of thyroid function and pregnancy/birth outcomes, infant growth and/or the general health/wellbeing of pregnant/postnatal women .............................................................. 113
Table 2.7: Effects of iodine supplementation in pregnancy on iodine status and thyroid function (adapted from Zhou et al 2014) .................................................. 135
Table 4.1: Baseline characteristics of pregnant women ................................................................ 173
Table 4.2: Dietary iodine intake of pregnant women ............................................................. 175
Table 4.3: Iodine status and thyroid function of pregnant and postnatal women ...................... 179
Table 4.4: Iodine status and thyroid function of pregnant and postnatal women: comparison of women using iodine supplements ≥150µg/day vs. women using iodine supplements <150µg/day in pregnancy .................................................................................. 182
Table 4.5: Iodine status and thyroid function of pregnant and postnatal women: comparison of women with iodine intake in pregnancy below the RDI (<220µg/day) vs. iodine intake in pregnancy above the RDI (≥220µg/day) ................................................................................. 183
Table 4.6: Thyroid function and BMIC of women according to categories of median UIC in pregnancy............................................................................................... 184
Table 4.7: Thyroid function of pregnant and postnatal women according to categories of BMI (<25kg/m² and ≥25kg/m²) at pre-pregnancy, baseline (<20 weeks' gestation) and 3 months postpartum: Exploratory analysis .................................................................................. 185
Table 4.8: The relationship between maternal total iodine intake in pregnancy and maternal UIC (log scale) at 28 weeks’ gestation and 3 months postpartum .................................................................................. 187
Table 4.9: The relationship between maternal total iodine intake in pregnancy and maternal thyroid function at 28 weeks’ gestation and 3 months postpartum .................................................................................. 189
Table 4.10: The relationship between maternal total dietary iodine intake in pregnancy and BMIC (log scale) at birth and 3 months postpartum .................................................................................. 192
Table 4.11: The relationship between maternal UIC at 28 weeks’ gestation and maternal thyroid function at 28 weeks’ gestation........................................................................................................... 192
Table 5.1: Baseline characteristics of infants at birth................................................................. 216
Table 5.2: Infant UIC and thyroid function at 3 months of age: comparison of women using iodine supplements ≥150µg/day vs. women using iodine supplements <150µg/day in pregnancy .................................................................................. 218
Table 5.3: Infant UIC and thyroid function at 3 months of age: comparison of women with iodine intake in pregnancy below the RDI (<220µg/day) vs. women with iodine intake in pregnancy above the RDI (≥220µg/day) ........................................................................................................ 219
Table 5.4: Infant UIC and thyroid function according to feeding mode at 3 months of age........ 219
Table 5.5: The relationship between maternal total iodine intake in pregnancy (baseline at 28 weeks’ gestation) and infant UIC/thyroid function (log scale)...................................................... 221
Table 5.6: The relationship between maternal UIC/thyroid function at 28 weeks’ gestation and infant thyroid function (log scale) ........................................................................................................ 221
Table 5.7: The relationship between maternal BMIC at birth and infant UIC/thyroid function in breastfed infants (log scale) .................................................................................................................. 223
Table 5.8: The relationship between maternal thyroid function at 28 weeks’ gestation and infant thyroid function at 3 months of age (log scale) ............................................................... 228
Table 6.1: Infant growth measurements at birth and 3 month of age ........................................ 228
Table 6.2: Raw scores of PCS and MCS measured using the SF-36 questionnaire...................... 248
Table 6.3: Proportion of women categorised into the different levels of severity across the three scales measured from the DASS questionnaire ............................................................... 250
Table 6.4: The relationship between maternal thyroid function at 28 weeks’ gestation and pregnancy/birth outcomes ............................................................................................................. 252
Table 6.5: The relationship between maternal total iodine intake in pregnancy and infant growth measurements (Z-scores) ........................................................................................................ 254
Table 6.6: The relationship between maternal thyroid function at 28 weeks’ gestation and infant growth measurements (Z-scores) ........................................................................................................ 254
Table 6.7: The relationship between maternal total iodine intake in pregnancy and the PCS and MCS measured from the SF-36 questionnaire ........................................................................ 257
Table 6.8: The relationship between maternal total iodine intake in pregnancy and severity of depression, stress and anxiety scales measured from the DASS questionnaire ................. 258
Table 6.9: The relationship between maternal thyroid function at 28 weeks’ gestation and the PCS and MCS scores measured from the SF-36 questionnaire ..................................................... 260
Table 6.10: The relationship between maternal thyroid function at 28 weeks’ gestation and depression, stress and anxiety scales measured from the DASS questionnaire ................. 261

viii
List of Figures

Figure 1.1 Iodine status worldwide based on median urinary iodine ........................................2
Figure 2.1: Iodine and thyroid hormone metabolism .................................................................8
Figure 4.1: Total number of women screened and recruited .....................................................171
Figure 4.2: Women that completed each stage of the study ....................................................172
Figure 4.3: Major food sources of iodine in pregnancy ............................................................176
Figure 4.4: Correlation between total iodine intake in pregnancy ..........................................186
Figure 4.5: Correlation between total iodine intake in pregnancy (baseline and 28 weeks’
       gestation) (µg/day) and BMIC (µg/L) at ........................................................................191
Figure 5.1: Infants that completed each stage of the study ....................................................214
Figure 6.1: Women and infants that completed each stage of the study ...............................247
Abstract

Iodine is crucial for thyroid hormone production which is essential for growth and development. Iodine deficiency in pregnancy can lead to cognitive impairment, poor growth, congenital abnormalities and in severe situations cretinism. Mild iodine deficiency re-emerged in Australia in the last decade. To address this issue, in 2009 mandatory iodine fortification of bread was implemented and in 2010 routine iodine supplementation in pregnancy was recommended. Since mandatory iodine fortification there has been limited data on the iodine intake and iodine status of Australians, including pregnant women.

Intervention trials in iodine deficient populations have shown a higher maternal and infant urine iodine concentration (UIC) in iodine supplemented groups compared to controls, with the effect on thyroid function being less clear. However, no studies have assessed the relationships between maternal iodine intake from food and supplements in pregnancy and maternal or infant iodine status and thyroid function in mildly iodine deficient or sufficient populations.

The primary aims of the thesis were to examine the associations between maternal iodine intake/iodine status/thyroid function in pregnancy and markers of maternal and infant iodine status/thyroid function. The secondary aims were to examine the associations between maternal iodine intake/thyroid function in pregnancy and pregnancy/birth outcomes, infant growth and the general health of pregnant and postnatal women.

783 pregnant women in South Australia participated in the study. An iodine specific food frequency questionnaire (I-FFQ) was developed and validated to assess dietary iodine intake at baseline (<20 weeks’ gestation) and 28 weeks’ gestation. Maternal UIC, maternal thyroid
function and the general health and wellbeing of pregnant and postpartum women was assessed at baseline, 28 weeks’ gestation and 3 months postpartum. Breast milk iodine concentration (BMIC) was assessed at birth and 3 months postpartum. Thyroid stimulating hormone (TSH) was collected from newborn screening at birth. Pregnancy/birth outcome data and infant anthropometrics at birth were collected from the women’s and infant’s medical records and infant UIC, infant thyroid function and infant growth was measured at 3 months of age.

Based on the median UIC, pregnant women in this study were classified as iodine sufficient, both with or without the use of iodine supplements during pregnancy. Maternal iodine intake in pregnancy was positively associated with maternal UIC and BMIC (Chapter 4), while no association was found with maternal thyroid function (Chapter 4), infant UIC, infant thyroid function (Chapter 5) or clinical outcomes (Chapter 6). At 28 weeks’ gestation maternal free triiodothyronine (fT3) was positively associated with infant fT3 at 3 months of age, while maternal fT3 and thyroglobulin (Tg) was inversely associated with infant TSH at 3 months of age (Chapter 5). Furthermore, markers of maternal thyroid function at 28 weeks gestation was associated with the mental and physical health of women at 3 months postpartum as well as the severity of stress at 28 weeks gestation (Chapter 6).

In summary, maternal iodine intake in pregnancy is not associated with maternal or infant thyroid function in an iodine sufficient population, although maternal thyroid function at 28 weeks’ gestation is associated with infant thyroid function at 3 months of age and with aspects of the general health and wellbeing of pregnant and postnatal women. Further research is needed to better understand these relationships in populations with various iodine status and their impact on infant development.
Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

My PhD project is a component of a larger project titled ‘The PINK cohort study’. Due to this the study concept and design had been developed and research staff assisted in the recruitment and with aspects of data collection. In addition, data entry and cleaning was performed by data analysts and statisticians assisted with complex data analysis. I certify that I was involved in all aspects of my PhD, including the recruitment of women and data collection at all time points from August 2011-December 2013. I developed an extensive data analysis plan and made decisions regarding the statistical analysis as well as performing all descriptive analysis. I provided intellectual input throughout the study and interpreted all of the results. In addition, I performed an iodine food frequency questionnaire validation study in which I was involved in all aspects including the conception and design, data collection, data entry and the analysis and interpretation of the results.

I give consent to this copy of my thesis when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968.
The author acknowledges that copyright of published works contained within this thesis resides with the copyright holder(s) of those works.

I also give permission for the digital version of my thesis to be made available on the web, via the University’s digital research repository, the Library catalogue and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

Signed:

Date:
Acknowledgements

I would like to take this opportunity to thank many people that supported me and assisted with the completion of my PhD. Firstly I would like to thank the women who agreed to participate in the study and involve their babies in research. Your time and dedication to research is extremely appreciated and without you this work would not have been possible.

My special thanks goes to my supervisor, Dr. Jo Zhou who has supported and encouraged me throughout this whole process. Thank you for your guidance and patience, for reading through my drafts many times, answering my simple questions and for seeing me through my many break downs. Your knowledge and work ethic is incredible and I am extremely fortunate to have had you by my side.

To Professor Maria Makrides, it has been honour working with you. You are truly one of the most inspirational women I have met. Your commitment to maternal and child nutrition is remarkable and I feel extremely lucky to have completed my PhD and gained such invaluable research experience under your guidance.

A many thanks goes to the staff at the Child and Nutrition Research Centre at both the Women’s and Children’s Hospital and Flinders Medical Centre. Your assistance with recruitment and data collection to fulfil the requirements of my PhD is truly appreciated. I feel so blessed to have worked with such a supportive, fun and motivating team and the friendships I have made are ones that I will always cherish. A special thanks goes to Ms Anna Seamark, for your inspiring, wise words and encouragement. You have allowed me to think in a different way, given me confidence in my ability and have provided me with the opportunity
to explore my areas of strength. I truly believe that my successes in the future will be driven by your influence during this time.

To Mrs. Mandy Anderson, thank you for your support. I see you as my third supervisor as your work on the PINK Cohort study and the time you spent reading through my drafts is extremely appreciated. Your availability, advice and encouragement throughout my PhD has been phenomenal.

I would like to acknowledge the work of the statisticians, Dr. Stuart Howell, Dr. Nancy Briggs, Ms Kara Cashman, Ms. Juanita Ottaway and Dr. Primali de Silva from Data Management and Analytical Services, University of Adelaide, who assisted with data cleaning, data entry and performed parts of the statistical analysis. A special thanks goes to Dr. Dao Huynh at the Waite Analytical Services who performed the urine and breast milk analysis and who shared this PhD experience with me, this project would not have been possible without you. To the laboratory staff at SA Pathology, thank you for the analysis of thyroid function for all of our mothers and babies.

I would like to take this opportunity to thank the most important people in my life- my husband and my family. To my husband Gerard, there are no words to explain how much I appreciate your unconditional love, support, encouragement and patience in this crazy journey. You have stood by my side the whole way and have been my strength in some of my weakest times. I can imagine that it is just as difficult being married to someone completing a PhD as it is actually doing it and you have done an amazing job. To my Mum and Dad- thank you for everything. From your reassuring and heartening words to knowing when I need help with daily tasks like cooking- I could not have completed this PhD without you. You have both taught me the skill of perseverance and have instilled a work ethic in me that saw me to the end of this adventure.
List of Abbreviations

AI       Adequate Intake
ATA      American Thyroid Association
b        Coefficient
BMI      Body Mass Index
BMIC     Breast Milk Iodine Concentration
CDC      Centres for Disease Control and Prevention
CH       Congenital Hypothyroidism
CI       Confidence Interval
CRF      Clinical Report Form
DASS     Depression and Anxiety Stress Scale
DMAC     Data Management and Analysis Centre
EAR      Estimated Average Intake
EPDS     Edinburgh Postnatal Depression Scale
EQUI     Ensuring the Quality of Iodine Procedures
FFQ      Food Frequency Questionnaire
FMC      Flinders Medical Centre
FSANZ    Food Standards Australia and New Zealand
fT3      Free Triiodothyronine
fT4      Free Thyroxine
fTI      Free Thyroid Index
hCG      Human Chorionic Gonadotrophin
I        Iodide ion
ICCIDDD  International Committee for the Control of Iodine Deficiency Disorders
IDD  Iodine Deficiency Disorder
I-FFQ  Iodine Food Frequency Questionnaire
KI  Potassium Iodide
LT4  Levothyroxine
MIS  Management Information System
NATA  National Association of Testing Authorities
NHMRC  National Health and Medical Research Council
NINS  National Iodine Nutrition Survey
NIS  Sodium (Na)/iodine (I) symporter
NR  Not Reported
NS  Not Significant
OR  Odds Ratio
PINK  Pregnancy Iodine and Neurodevelopment in Kids
PPT  Postpartum Thyroiditis
RCT  Randomised Controlled Trial
RCTs  Randomised Controlled Trials
RDI  Recommended Dietary Intake
RR  Relative Risk
rT3  Reverse Triiodothyronine
SAS  Statistical Analysis System
SAC  Southern Adelaide Clinical
SD  Standard Deviation
SDS  Self-Rating depression scale
SE  Standard Error
SEM  Standard Error of the Mean
SES  Socio-Economic Status
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-36</td>
<td>Short-Form 36</td>
</tr>
<tr>
<td>SGA</td>
<td>Small for Gestational Age</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for the Social Sciences</td>
</tr>
<tr>
<td>T3</td>
<td>Triiodothyronine</td>
</tr>
<tr>
<td>T4</td>
<td>Thyroxine</td>
</tr>
<tr>
<td>TBA</td>
<td>Thyroxine Binding Albumin</td>
</tr>
<tr>
<td>TBG</td>
<td>Thyroxine Binding Globulin</td>
</tr>
<tr>
<td>TBPA</td>
<td>Thyroxine Binding Prealbumin</td>
</tr>
<tr>
<td>Tg</td>
<td>Thyroglobulin</td>
</tr>
<tr>
<td>TMAH</td>
<td>Tetramethyl Ammonium Hydroxide</td>
</tr>
<tr>
<td>TPO</td>
<td>Thyroid Peroxidase</td>
</tr>
<tr>
<td>TRH</td>
<td>Thyroid Releasing Hormone</td>
</tr>
<tr>
<td>TSH</td>
<td>Thyroid Stimulating Hormone</td>
</tr>
<tr>
<td>TT4</td>
<td>Total Thyroxine</td>
</tr>
<tr>
<td>UIC</td>
<td>Urine Iodine Concentration</td>
</tr>
<tr>
<td>UIE</td>
<td>Urine Iodine Excretion</td>
</tr>
<tr>
<td>WAS</td>
<td>Waite Analytical Services</td>
</tr>
<tr>
<td>WCH</td>
<td>Women's and Children's Hospital</td>
</tr>
<tr>
<td>WCHN</td>
<td>Women’s and Children’s Health Network</td>
</tr>
<tr>
<td>Weeks’</td>
<td>Weeks of</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
</tbody>
</table>

xviii