Section: Biochemistry

Research

URINARY IODINE LEVELS IN PREGNANT WOMEN OF INDIA: A META-ANALYSIS STUDY

Gulshan Prakash[1], Abhishek Bansal[2], Sumit Dokwal[3]

[1]Assistant Professor, Department of Biochemistry, Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences, Rohtak, Haryana, India
[2]Demonstrator, Department of Biochemistry, Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences, Rohtak, Haryana, India
[3]Associate Professor, Department of Biochemistry, Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences, Rohtak, Haryana, India

Received : 10/10/2022
Received in revised form : 13/11/2022
Accepted : 26/11/2022

Keywords:
Pregnancy, Urinary Iodine, Thyroid Function.

Corresponding Author:
Dr. Sumit Dokwal,
Email: drsumitdockwal80@gmail.com
ORCID: 0000-0002-1964-6341

DOI: 10.47009/jamp.2023.5.1.1

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (1); 1-4

Abstract

Background: According to WHO recommendations, median urine iodine concentrations (UIC) are used to categorise the severity of iodine shortage in populations, with 100mg/l serving as the minimum acceptable level for non-pregnant individuals. Iodine requirements rise during pregnancy and lactation. For foetal neurological development in the first trimester, partial thyroxine transfer through the placenta to the foetus is necessary. The objective is to evaluate the iodine levels in pregnant women's urine. **Materials and Methods:** The results of ten published studies that looked at urine iodine levels in pregnant women were subjected to a meta-analysis. An estimation of the pooled mean was performed using a random-effects model. **Result:** The pooled mean of urine iodine in expectant women was 196.07 g/L (95% CI: 162.25-229.90), with an I2 of 98.92%. There was a significant amount of variation among the studies, with the index of heterogeneity exceeding 90%. **Conclusion:** According to UIC levels, pregnant women's average iodine consumption was sufficient. Iodine supplementation during pregnancy should be taken into consideration in populations where iodized salt is either not available or is not sufficiently iodized, even if the study indicated that a well-functioning iodized salt programme can give pregnant women with enough iodine.

INTRODUCTION

Iodine is essential trace element for vital functions of human body,essential for the production of thyroid hormones, normal growth and development.[1] rich sources of iodine supply for most human are Dairy products and seafood.[2] Inadequate iodine levels leads to insufficient synthesis of thyroid hormones. The effects of hypothyroidism on pregnancy include spontaneous miscarriage, stillbirth, perinatal mortality, and stunted development. If dietary iodine intake is inadequate, several organs fail to operate adequately.[3,4,5,6,7]

A total of 71 million Indians are thought to suffer from dietary iodine inadequacy, making it a widespread problem. In India, 335 of the 386 districts that were studied had IDD that was endemic (total goitre rate: >0000000005%).[8,9,10] Foods that contain goitrogens in big quantities and little dairy or seafood consumption may make this problem worse. Indian soil might be more deficient in iodine as a result of heavy rains and flooding in.[11] In the whole world, iodine deficiency would be the leading reversible factor in brain damage.[1] For non-pregnant women, the daily need for iodine is 150 mg; during pregnancy, it rises to 250 mg. If this increased iodine need isn't met, thyroid hormones won't be supplied in appropriate amounts to the growing brain, which causes impaired cognitive development in the infant.[12,13,14]

Iodine shortage in communities is categorised by median urine iodine concentration (UIC), with 100mg/l being the lower acceptable level for non-pregnant people10. The need for iodine rises during pregnancy and breastfeeding.[15] Fetal neurological development during the first trimester depends on the placenta's ability to partially transport the hormone thyroxine to the foetus. Later, the foetal thyroid grows to the point where it can make its own thyroxine, while more maternal iodine is still needed.[16] Iodine intake during pregnancy and lactation has recently been amended by WHO and the International Council for the Control of Iodine Deficiency Disorders to 250mg/d10. Dietary requirements may be augmented by higher renal clearance in pregnancy and lactation.[17] Due to the difficulty in measuring dietary iodine intake, urine

iodine is regarded as the main indicator of the iodine status of the population (since 90% of iodine consumed is excreted), with a lower limit of 150mg/l as a threshold for sufficiency for the pregnant population.[10]

Recent studies from various locations have come to a variety of conclusions about the distribution of iodine levels in pregnant women as highlighted in this study's [Table 1], This lack of a systematic review and meta-analysis of this important health concern causes these results to mislead the physician in their choice of the appropriate measure for each of the relevant criteria. Therefore, the current study was conducted to assess the amounts of urinary iodine in pregnant women.

MATERIALS AND METHODS

The investigation was carried out in compliance with the PRISMA-P recommendations for completing a network meta-analysis.[18,19]

Literature Search

The PubMed database was searched on October 31, 2022. 2012 to the present was chosen as the search date range restriction. A thorough Cochrane review from 2007,[18] includes the search parameters utilised in the literature search. Our search results were integrated with relevant studies from that review. The search was conducted using the terms "Urinary Iodine," "Pregnancy," and "India." For this analysis, only full-length publications in peer-reviewed journals that were authored in the English language were taken into consideration. For further evidence, the references provided in these articles were also consulted.

Inclusion & Exclusion Criteria

Studies that addressed correlations between urinary iodine and pregnancy were taken into account for the meta-analysis. Studies that met the following criteria were also chosen: A cross-sectional or case series design is required for the study, and the urine iodine levels must be reported together with their respective 95% confidence intervals (CIs). An illustration of the research selection process's flowchart shows the numbers that were included and excluded at various levels, is shown in [Figure 1].

Data Extraction

The first author, publication year, location of the study, number of participants, and mean and SD of urine iodine levels shown in [Table 2] their separate and combined risk, were retrieved from search results from online databases and imported into Microsoft Excel where duplicates were deleted.

Statistical Analysis

The overall mean (combined for all relevant cross-sectional as well as case series studies) and its 95% CI were obtained using the random-effects model for urinary iodine since it was believed that the data included in the meta-analysis were drawn at random from all relevant studies. The case series and cross-sectional investigations were conducted in hospitals in India. STATA 16 statistical software was used to create a forest plot and funnel plot to represent individual research and the pooled mean. The I2 value revealed that there were differences between the trials. I2 numbers under 50% were seen as poor and indicative of higher levels of similarity between studies. A p-value of less than 5% was chosen as the threshold for statistical significance since meta-analyses are a type of observational research and mistakes can occur during study inclusion and analysis. The study's bias can be assessed using the funnel graph.

RESULTS

We included ten publications in our study that met the qualifying requirements and were concerned with the association between pregnancy and urinary iodine levels. The mean and SD levels of urinary iodine are summarised in [Table 1] along with the year and location.

Table 1: Study Characteristics for Urinary Iodine levels among pregnant women.

S. No.	Author	Year	Country	Population	Mean	SD
1	Sara S et.al.19	2017	India	133	159.2	34.68
2	Kant S et.al.20	2017	India	139	251	24.73
3	Grewal E et.al.21	2013	India	50	290	10.47
4	Charoo BA et.al.22	2013	India	82	139.12	2.29
5	Sekhri T et.al.23	2016	India	86	178.2	13.28
6	Pramanik S et.al.24	2020	India	80	205	1.89
7	Jaiswal N et.al.25	2014	India	33	169.9	82.74
8	Jaiswal N et.al.26	2014	India	321	184.2	5.28
9	Gowachirapant S et.al.27	2017	India	409	125	23.66
10	Kumar D et.al.28	2021	India	202	229.1	7.80

All ten studies examining the connection between iodine levels in the urine and pregnancy. With an overall mean of 196.07 µg/L (95% CI: 162.25-229.90) and an I2 of 98.92%, all investigations are heterogeneous, as illustrated in [Figure 1A].

Because all studies were positioned at the top and inside of the funnel figure, as illustrated in figure 2B, research publication bias was minimal.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

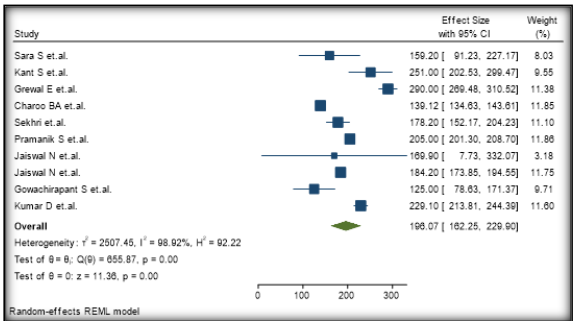

Figure 1: A- Forest plot of random-effects meta-analysis for Urinary Iodine levels among pregnant women.

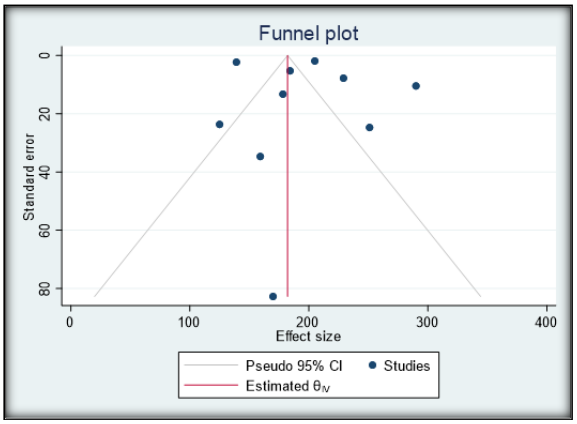

Figure 1: B- Funnel plot with Pseudo 95% Confidence Interval for Urinary Iodine levels among pregnant women.

DISCUSSION

The biochemical parameters of thyroid function are altered during pregnancy due to the increased demand for thyroid hormone. The primary modifications are a decrease in free hormone levels and a minor rise in basal thyroid stimulating hormone (TSH) Iodine is required for the manufacture of thyroid hormone; its insufficiency affects thyroxine formation, which could result in a variety of IDDs, including enlargement in pregnant women.[20,21,22,23,24,25,26,27,28,29,30]

The goal of the current study was to determine the levels of urine iodine in pregnant women because serum iodine levels are not a reliable indicator of iodine status while urinary iodine concentrations (UI) reflect current iodine intake across populations. This study utilised a random-effects model and assumed that every one of the included studies used samples that were randomly selected for analysis. The significant variability of each variable type that was found in the research was primarily caused by the numerous eras under which the investigations were carried out as well as the diversity of localities, cultures, and economic situations. The aggregated mean of urinary iodine in pregnant women, which is greater than 150 g/L, was determined to be sufficient by our meta-analysis research.[31] implying that IDD did not pose a problem for the community's public health. This result agrees with that of the earlier investigation from the same region.[19,20,21,22,23,24,25,26,27,28] A few studies also produced findings that were contrary to those of our study.[22,27]

CONCLUSION

According to UIC levels, pregnant women's average iodine consumption was sufficient. Iodine supplementation during pregnancy should be taken into consideration in populations where iodized salt is either not available or is not sufficiently iodized, even if the study indicated that a well-functioning iodized salt programme can give pregnant women with enough iodine.

REFERENCES

1. Seal AJ, Creeke PI, Gnat D, Abdalla F, Mirghani Z. Excess dietary iodine intake in long-term African refugees. Public Health Nutr. 2006;9(1):35-9. doi: 10.1079/phn2005830.
2. Venance MS, Martin HD, Kimiywe J. Iodine Status and Discretionary Choices Consumption Among Primary School Children, Kinondoni Tanzania. Pediatric Health Med Ther. 2020;11:359-368. doi: 10.2147/PHMT.S265117.
3. Fisher J, Tran T, Biggs B, Tran T, Dwyer T, Casey G, et al. Iodine status in late pregnancy and psychosocial determinants of iodized salt use in rural northern Viet Nam. Bull World Health Organ. 2011;89(11):813-20. doi: 10.2471/BLT.11.089763.
4. Kochupillai N, Pandav CS, Godbole MM, Mehta M, Ahuja MM. Iodine deficiency and neonatal hypothyroidism. Bull World Health Organ. 1986;64(4):547-51.
5. Vrijkotte TG, Hrudey EJ, Twickler MB. Early Maternal Thyroid Function During Gestation Is Associated With Fetal Growth, Particularly in Male Newborns. J Clin Endocrinol Metab. 2017;102(3):1059-1066. doi: 10.1210/jc.2016-3452.
6. Noten AME, Loomans EM, Vrijkotte TGM, Van De Ven PM, Paul Van Trotsenburg AS, Rotteveel J, et al. Maternal hypothyroxinaemia in early pregnancy and school performance in 5-year-old offspring. Eur J Endocrinol. 2015;173(5):563–71.
7. Strączyńska A. Maternal hypothyroidism in the perinatal period and child development. Pedagog Psychol Sport. 2020;6(4):109–17.
8. Kaur G, Anand T, Bhatnagar N, Kumar A, Jha D, Grover S. Past, present, and future of iodine deficiency disorders in India: Need to look outside the blinkers. J Family Med Prim Care. 2017;6(2):182-190. doi: 10.4103/jfmpc.jfmpc_372_16.
9. Kochupillai N, Mehta M. Iodine deficiency disorders and their prevention in India. Rev Endocr Metab Disord. 2008;9(3):237-44. doi: 10.1007/s11154-008-9094-0.
10. Lean MIFA, Lean MEJ, Yajnik CS, Bhat DS, Joshi SM, Raut DA, et al. Iodine status during pregnancy in India and related neonatal and infant outcomes. Public Health Nutr. 2014;17(6):1353–62.
11. Lightowler HJ, Davies GJ. Iodine intake and iodine deficiency in vegans as assessed by the duplicate-portion technique and urinary iodine excretion. Br J Nutr. 1998;80(6):529-35. doi: 10.1017/s0007114598001627.
12. Vithanage M, Herath I, Achinthya SS, Bandara T, Weerasundara L, Mayakaduwa SS, et al. Iodine in commercial edible iodized salts and assessment of iodine exposure in Sri Lanka. Arch Public Health. 2016;74:21. doi: 10.1186/s13690-016-0133-0.
13. Majumder A, Jaiswal A, Chatterjee S. Prevalence of iodine deficiency among pregnant and lactating women: Experience in Kolkata. Indian J Endocrinol Metab. 2014;18(4):486.
14. Bath SC, Steer CD, Golding J, Emmett P, Rayman MP. Effect of inadequate iodine status in UK pregnant women on cognitive outcomes in their children: results from the Avon Longitudinal Study of Parents and Children (ALSPAC).

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Lancet. 2013;382(9889):331-7. doi: 10.1016/S0140-6736(13)60436-5.
15. Patel J, Landers K, Li H, Mortimer RH, Richard K. Thyroid hormones and fetal neurological development. J Endocrinol. 2011;209(1):1-8. doi: 10.1530/JOE-10-0444.
16. Mian C, Vitaliano P, Pozza D, Barollo S, Pitton M, Callegari G, et al. Iodine status in pregnancy: role of dietary habits and geographical origin. Clin Endocrinol (Oxf). 2009;70(5):776–80.
17. Delange F. Iodine requirements during pregnancy, lactation and the neonatal period and indicators of optimal iodine nutrition. Public Health Nutr. 2007;10(12A):1571–80.
18. Page MJ, Moher D, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. BMJ. 2021;372:n160. doi: 10.1136/bmj.n160.
19. Stinca S, Andersson M, Weibel S, Herter-Aeberli I, Fingerhut R, Gowachirapant S, et al. Dried Blood Spot Thyroglobulin as a Biomarker of Iodine Status in Pregnant Women. J Clin Endocrinol Metab. 2017;102(1):23-32. doi: 10.1210/jc.2016-2829.
20. Kant S, Haldar P, Lohiya A, Yadav K, Pandav CS. Status of Iodine Nutrition among Pregnant Women Attending Antenatal Clinic of a Secondary Care Hospital: A Cross-sectional Study from Northern India. Indian J Community Med. 2017;42(4):226-229. doi: 10.4103/ijcm.IJCM_312_16.
21. Grewal E, Khadgawat R, Gupta N, Desai A, Tandon N. Assessment of iodine nutrition in pregnant north Indian subjects in three trimesters. Indian J Endocrinol Metab. 2013;17(2):289-93. doi: 10.4103/2230-8210.109716.
22. Charoo BA, Sofi RA, Nisar S, Shah PA, Taing S, Jeelani H, et al. Universal salt iodization is successful in Kashmiri population as iodine deficiency no longer exists in pregnant mothers and their neonates: Data from a tertiary care hospital in North India. Indian J Endocrinol Metab. 2013;17(2):310-7. doi: 10.4103/2230-8210.109713.
23. Sekhri T, Juhi JA, Wilfred R, Kanwar RS, Sethi J, Bhadra K, et al. Trimester specific reference intervals for thyroid function tests in normal Indian pregnant women. Indian J Endocrinol Metab. 2016;20(1):101-7. doi: 10.4103/2230-8210.172239.
24. Pramanik S, Mukhopadhyay P, Bhattacharjee K, Bhattacharjee R, Mukherjee B, Mondal SA, et al. Trimester-Specific Reference Intervals for Thyroid Function Parameters in Indian Pregnant Women during Final Phase of Transition to Iodine Sufficiency. Indian J Endocrinol Metab. 2020;24(2):160-164. doi: 10.4103/ijem.IJEM_561_19.
25. Jaiswal N, Melse-Boonstra A, Sharma SK, Srinivasan K, Zimmermann MB. The iodized salt programme in Bangalore, India provides adequate iodine intakes in pregnant women and more-than-adequate iodine intakes in their children. Public Health Nutr. 2015;18(3):403-13. doi: 10.1017/S136898001400055X.
26. Jaiswal N, Melse-Boonstra A, Thomas T, Basavaraj C, Sharma SK, Srinivasan K, et al. High prevalence of maternal hypothyroidism despite adequate iodine status in Indian pregnant women in the first trimester. Thyroid. 2014;24(9):1419-29. doi: 10.1089/thy.2014.0071.
27. Gowachirapant S, Jaiswal N, Melse-Boonstra A, Galetti V, Stinca S, Mackenzie I, et al. Effect of iodine supplementation in pregnant women on child neurodevelopment: a randomised, double-blind, placebo-controlled trial. Lancet Diabetes Endocrinol. 2017;5(11):853-863. doi: 10.1016/S2213-8587(17)30332-7.
28. Kumar D, Raina SK, Chauhan R, Kumar P, Sharma S. Iodine intake among pregnant mothers residing in hilly terrains of two districts of Himachal Pradesh, India. Indian J Public Health. 2021;65(2):185–9.
29. Alexander EK, Pearce EN, Brent GA, Brown RS, Chen H, Dosiou C, et al. 2017 Guidelines of the American Thyroid Association for the Diagnosis and Management of Thyroid Disease During Pregnancy and the Postpartum. Thyroid. 2017;27(3):315-389. doi: 10.1089/thy.2016.0457.
30. Basnet B, Patil A, Metgud S, Singh L, Parajuli K, Basnet B. Urinary iodine in second trimester of pregnancy: A cross sectional study in tertiary care hospital of Belagavi. Asian J Med Sci. 2020;11(5):93–7.
31. Zimmermann MB, Andersson M. Global perspectives in endocrinology: Coverage of iodized salt programs and iodine status in 2020. Eur J Endocrinol. 2021;185(1):R13–21.

ISSN (O): 2687-5365; ISSN (P): 2753-6556