

باب العالمين

OVERVIEW OF IODINE IN PREGNANCY



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TSH



Iodine



T3

T4

Thyroid Hormone Synthesis

Thyroid Hormone

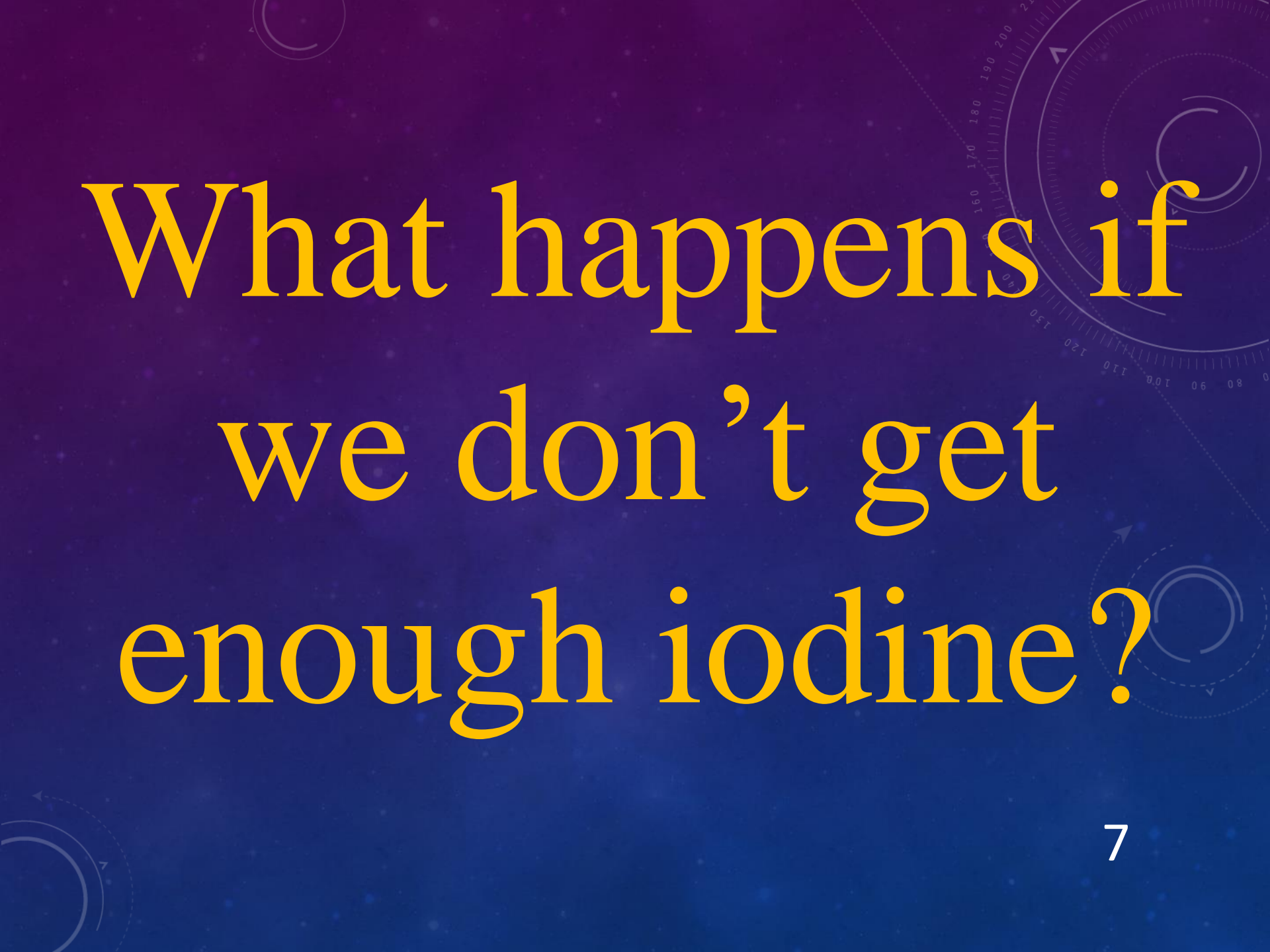
- Optimal mental & physical development
- Regulation of body metabolism
- Generation & utilization of body energy

Iodine

- Iodine is a chemical and essential trace element for the human
- Total quantity present in body is 15-20 mg , mostly in thyroid gland(60%)
- Iodine contributes 65% of T_4 and 59% of T_3 molecular weight.

How Much Do We Need?

Age group	Daily requirement	Tolerable upper level
Preschool children	90 µg/day	200
Schoolchildren(6-12 y)	120 µg/day	300-450
Adult (>12 y)	150 µg/day	600-1100
Pregnant & Lactating women	250-300 µg/day	600-1100

The background is a dark blue gradient with a subtle pattern of white stars and faint technical diagrams. In the top right, there is a circular scale with markings from 0 to 210 degrees. In the bottom left, there is a partial circular diagram with an arrow. In the bottom right, there is another circular diagram with an arrow.

What happens if
we don't get
enough iodine?

The Spectrum Of IDD

Fetus	<ul style="list-style-type: none">▪ Abortions▪ Stillbirths▪ Congenital anomalies▪ Increased perinatal mortality▪ Neurologic cretinism▪ Psychomotor defects
Neonate	<ul style="list-style-type: none">▪ Neonatal goiter▪ Neonatal hypothyroidisms
Child & adolescent	<ul style="list-style-type: none">▪ Goitrous juvenile hypothyroidism▪ Impaired mental function▪ Retarded physical development
Adult	<ul style="list-style-type: none">▪ Goiter with its complications▪ Hypothyroidism▪ Impaired mental function

Severe Iodine Deficiency is Associated with Adverse Obstetric Outcomes

Fetus

- Congenital anomalies
- Decreased intelligence
- Neurological cretinism spasticity, deaf mutism, mental deficiency

Neonate

- Neonatal goiter
- Neonatal hypothyroidism
- Endemic mental retardation
- Increased susceptibility of the thyroid gland to nuclear radiation

Pregnant Women

- Prematurity
- spontaneous abortion
- Still birth
- Increased infant mortality

Iodine nutrition in the general population and in pregnant women in 2021(IGN)

- General Population:
(194 Country)

Adequate : 156

Insufficient : 26

Excessive : 12

- Pregnant Women :
(69 Country)

Adequate : 23

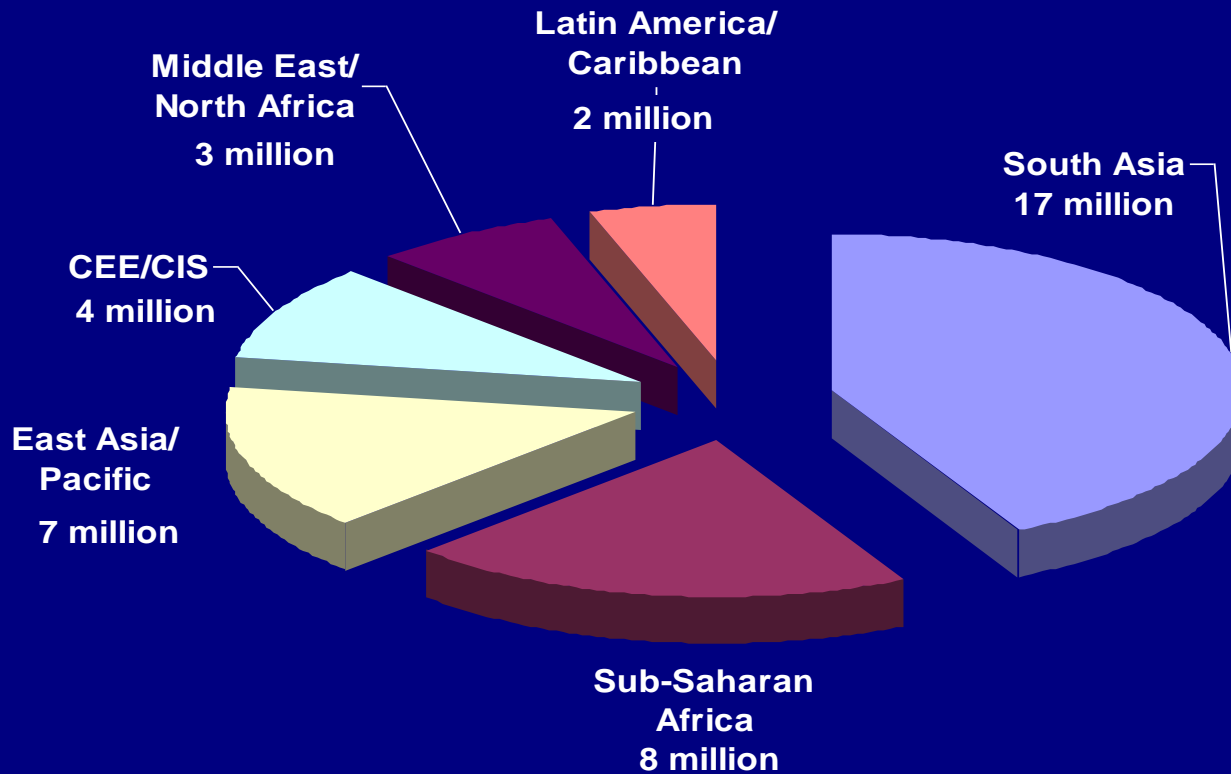
More than

adequate : 7

Insufficient : 39

41 million newborns still unprotected:

against brain damage due to lack of iodine during pregnancy

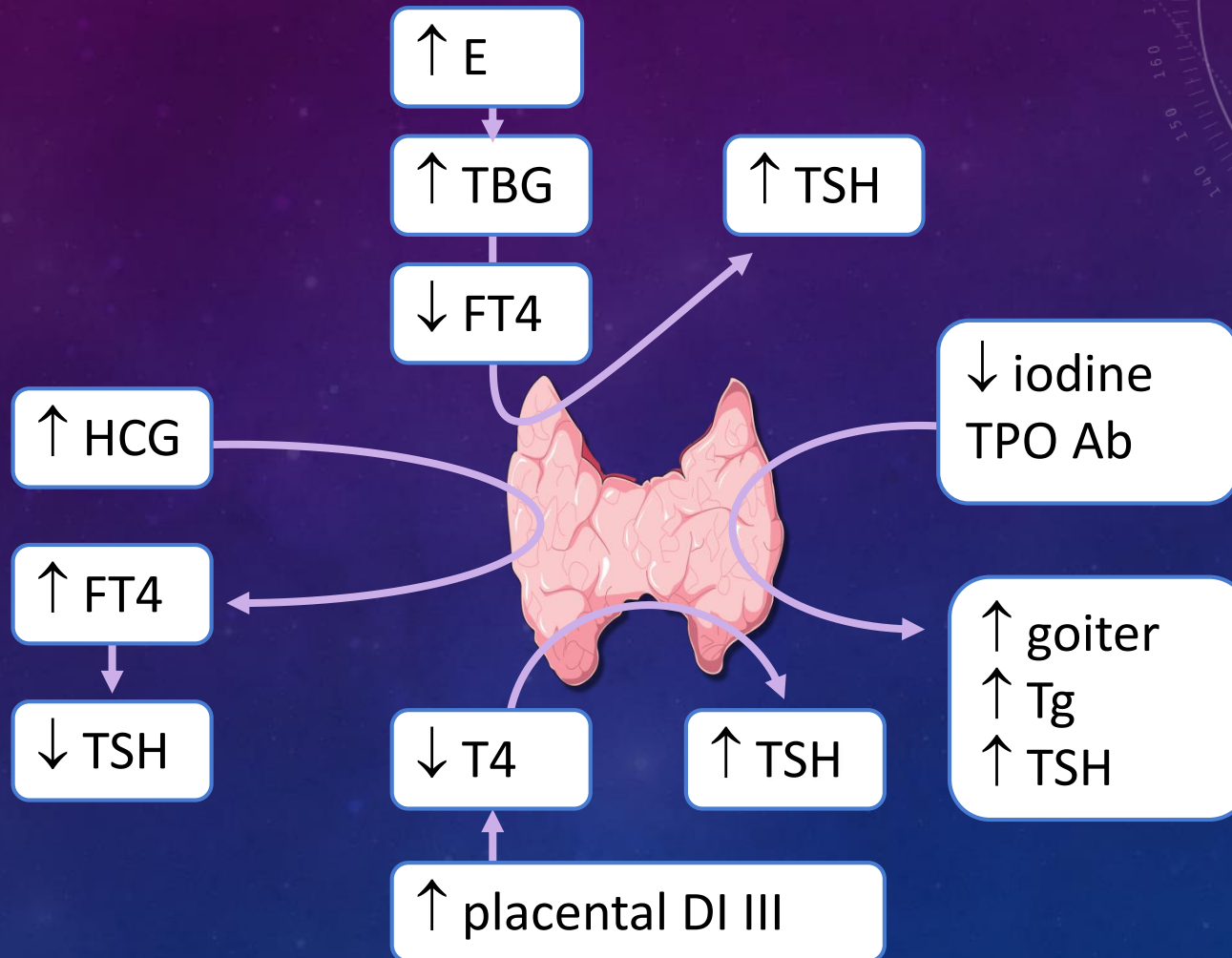




Pregnancy

Relative Iodine Deficiency

Factors For Thyroid Stimulation During Pregnancy



Increased GFR

Decreased
renal tubular
reabsorption

Active transport
to feto-placental
unit

Increased thyroid
iodine uptake from
the blood (3 fold)

Increase iodine
excretion in urine
(2 fold)

Fall of plasma iodine

Increase
maternal iodine
requirement

Pregnancy :
Relative Iodine Deficiency

Iodine Requirement ($\mu\text{g/day}$)

During pregnancy	$\mu\text{g/day}$
Basal	150
40-50 % increased T4 requirements	50 - 100
Transfer of T4 and I from mother to fetus	50
Increased renal clearance of I	?
Total	250 - 300
During lactation	
Basal	150
0.5-1.1 L milk/day x 150-180 $\mu\text{gI/L}$	75 - 200
Total	225 - 350

Pregnancy & Breastfeeding

Mothers are the sole source of iodine for their babies



The Fetal Thyroid

- Begins concentrating iodine at 10-12 weeks
- Controlled by pituitary TSH by approximately 20 weeks
- Maternal T4 essential for first 24 weeks of gestation
- Foetal T4 starts at 24 weeks

Developing brain needs normal level of circulating T4

T4 From mother

T4 From child

Cochlea

Cerebral cortex

Subarachnoid pathways

Corpus callosum

Eye

Face

Myelination

Cerebellum

Dentation of hyppocampus

Month

0

1

2

3

4

5

6

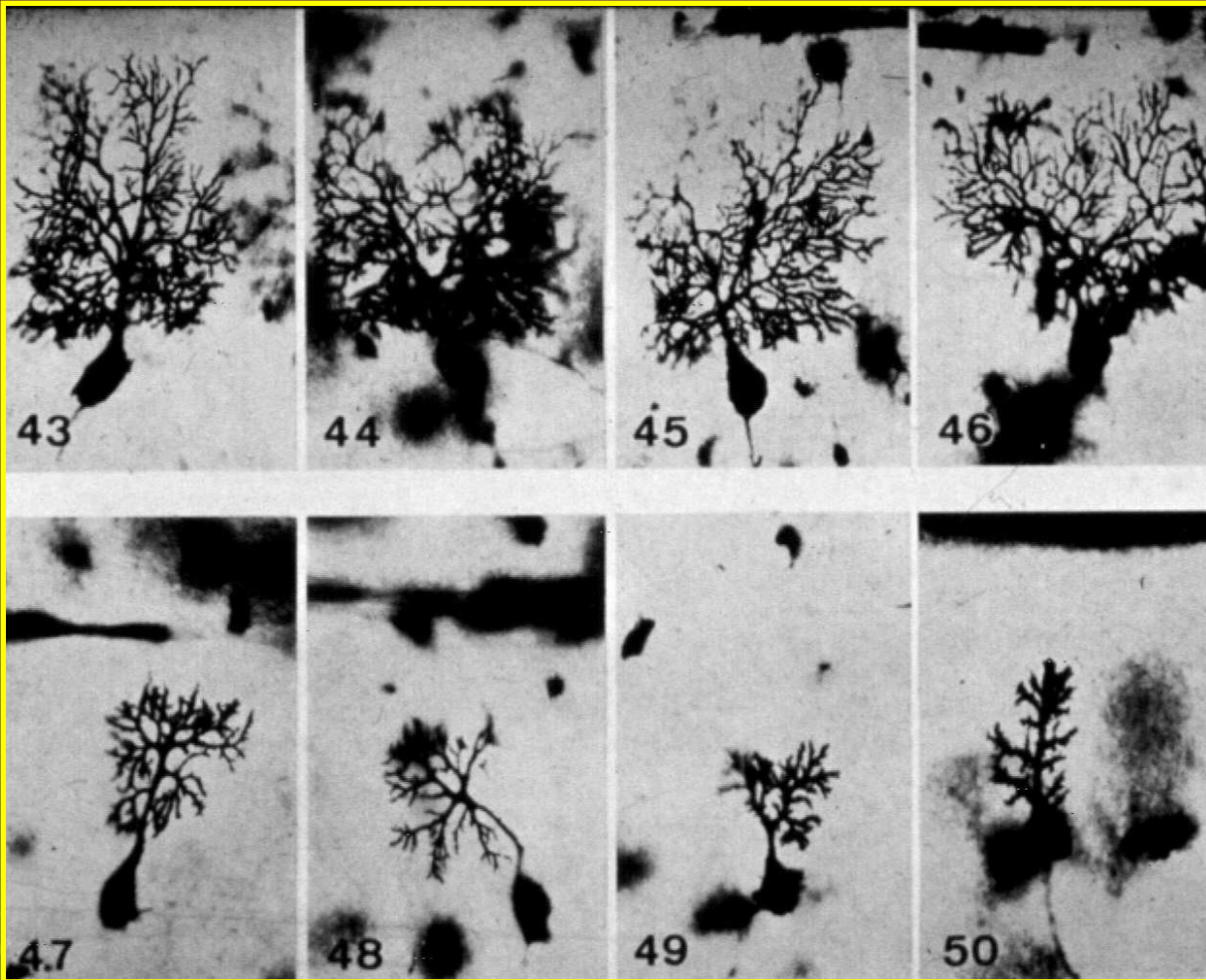
7

8

Birth

17

The network of connections are less dense in Iodine Deficient Brain



Iodine Sufficient Brain

Iodine Deficient Brain

Epidemiologic criteria for assessing iodine nutrition based on median UIC of pregnant women

Median Urinary Iodine ($\mu\text{g/L}$)	Iodine Intake
<150	Insufficient
150 - 249	Adequate
250 - 499	Above Requirement
≥ 500	Excessive

Iodine nutrition in the general population in Iran in 2014 (The 5th National Survey)

- General Population: SAC=18,000

Median UIC : 161 $\mu\text{g/L}$

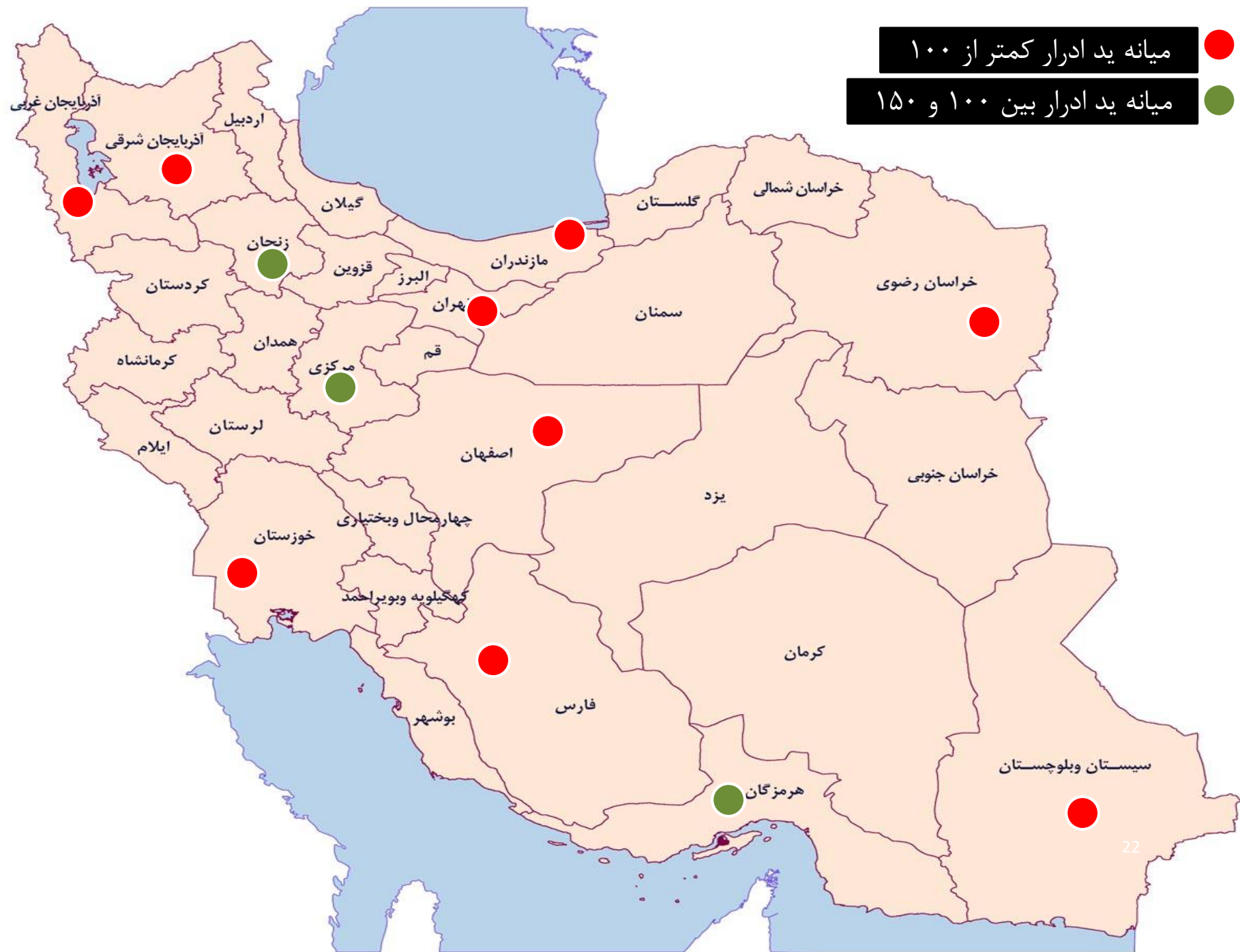
98% of households consumed iodized salt

83% of the household salts contained ≥ 20 ppm.

The 1st and the 2nd Study on Iodine Nutrition of Pregnant Women in Iran

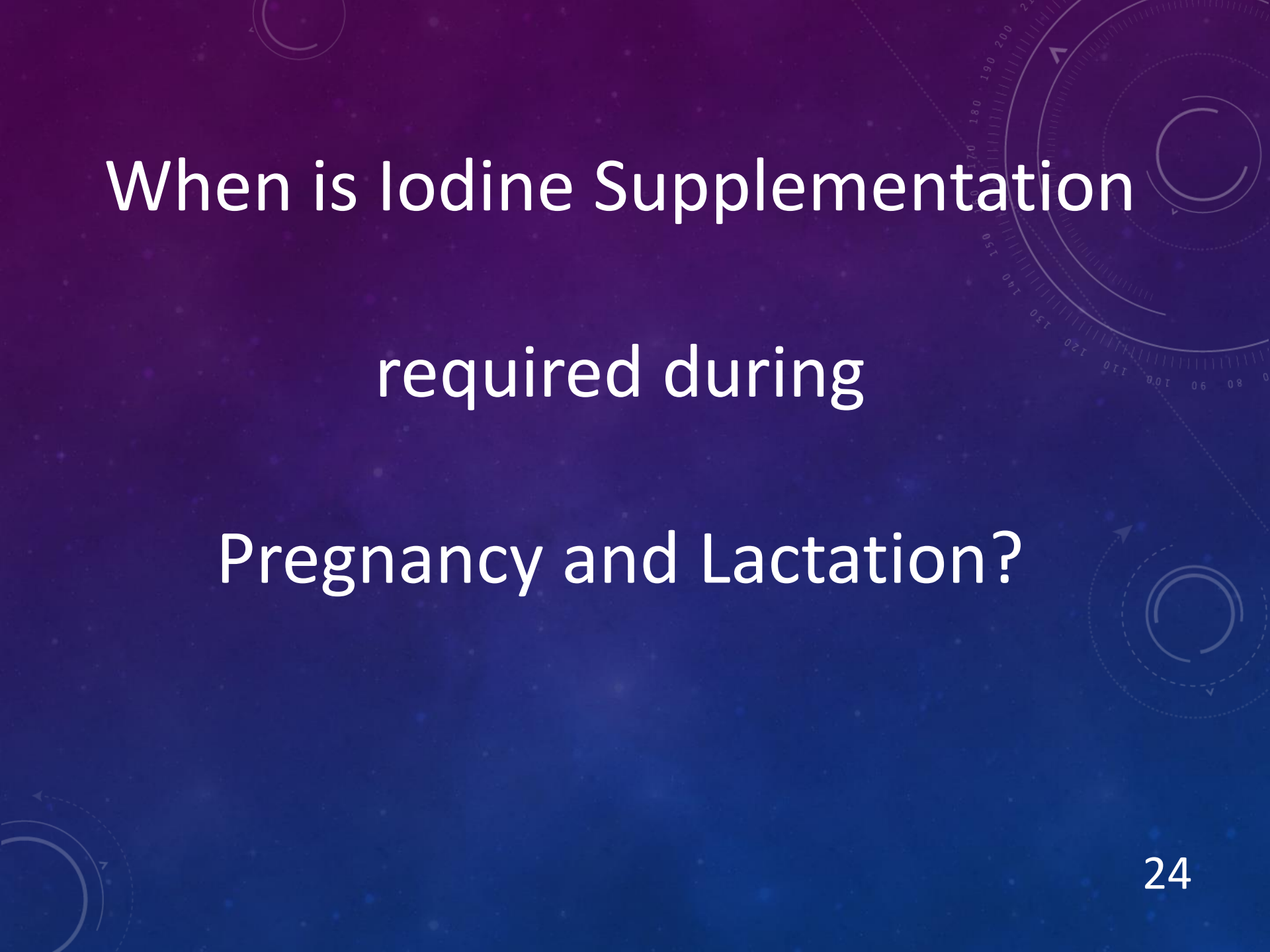
نتایج کلی

Parameter	The 1 st Survey 1394	The 2 nd Survey 1396
Median UIC	87 µg/L	188 µg/L
Mean T4	11.2 µg/dl	10.8 µg/dl
Mean TSH	2.2 mIU/L	2.5 mIU/L
Isolated hypothyroxinemia	11%	0.6%



Conclusion

- Consumption of salt fortified with iodine may not be enough to meet the dietary needs of pregnant and lactating women in Iran ,an area of iodine sufficiency.
- They should take iodine supplement to make up for the deficiency.

The background is a dark blue gradient with faint, light blue circular patterns and a scale. A large circular scale is visible in the upper right corner, with numbers ranging from 0 to 210. There are also smaller circular patterns and arrows scattered throughout the background.

When is Iodine Supplementation required during Pregnancy and Lactation?

Iodine Supplementation And Pregnancy

- **Iodized salt consumption started at pregnancy:**

- ❖ 38% thyroid failure, hypothyroxinemia with normal serum TSH
- ❖ MUI = 63 $\mu\text{g/L}$

- **Iodized salt consumption begun 2yr prior to pregnancy:**

- ❖ 6.4% thyroid failure
- ❖ MUI = 115 $\mu\text{g/L}$

Lesson: By the time women become pregnant, it may be too late for iodized salt to be effective

Iodine Supplementation in Pregnancy

- Before conception & First trimester:

Folic Acid + Iodine 150 µg/day

- Second and third trimesters:

Multivitamins + Iodine 150 µg/day

Tab. Iodofolic

150 µg of Iodine
500 µg of folic acid

One Tab. per day:

Start 3 months before planning a pregnancy,



Tab. Ivita

17 minerals and essential elements

Folic acid = $600 \mu\text{g}$

Iodine = $150 \mu\text{g}$



One Tab. per day:

Start from second trimester of pregnancy,
Continue through lactation.

The impact of iodine deficiency during pregnancy

Iodine Deficiency In Pregnancy

- ▶ Severe iodine deficiency (ID) during gestation is associated with neurocognitive sequel.
- ▶ Results from observational studies, have indicated that even mild to moderate iodine deficiency (ID) in pregnancy might negatively affect child neurodevelopment.

Evidences:

Bath SC, et al. 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**). *Lancet* 2013 382:331–337

- Urinary iodine concentration measured in stored samples from 1040 first-trimester pregnant women.
- Intelligence quotient (IQ) measured in the offspring at age 8 years.
- Children of women with UIC < 150 µg/L were more likely to have scores in the lowest quartile for verbal IQ , reading accuracy and reading comprehension than were those of mothers with UIC > 150 µg/L.

Hynes KL. et al. Mild iodine deficiency during pregnancy is associated with reduced educational outcomes in the offspring: 9-year follow-up of the gestational iodine cohort.

J Clin Endocrinol Metab. 2013; 98(5):1954-62.

Hynes KL, et al. Reduced educational outcomes persist into adolescence following mild iodine deficiency in utero, despite adequacy in childhood: 15-Year follow-up of the Gestational Iodine Cohort investigating auditory processing speed and working memory.

Nutrients 2017

Abel MH, et al. Suboptimal maternal iodine intake is associated with impaired child neurodevelopment at 3 years of age in the Norwegian Mother and Child Cohort Study.

J Nutr 2017;147:1314–1324

Abel MH, et al. Maternal iodine intake and offspring attention-deficit/hyperactivity disorder: Results from a large prospective cohort study.

Nutrients 2017

Mario Murcia, et al. J Epidemiol Community Health 2018;72:216–222

The **INMA** Mother and Child Cohort Study (**I**nfancy **M**edio **A**mbient)

- A prospective cohort study in four Spanish regions(iodine-sufficient or mildly iodine-deficient) with recruitment of pregnant women between 2003 and 2008 and follow-up of their children up to 4–5 years
- Cognitive and motor function was assessed in 1803 children
- They found an association between low maternal urinary iodine and lower cognitive scores in childhood.

The impact of iodine supplementation

Evidences

Taylor PN, Okosieme OE, Dayan CM, Lazarus JH

Eur J Endocr (2014)

Impact of iodine supplementation in mild-to-moderate iodine deficiency: systematic review and meta-analysis.

- Nine RCTs and 8 observational studies conducted in mild-to-moderate iodine deficient areas (MUI 36-109 μ g/L) in European countries.

Results:

- After iodine supplementation of 150 ~300 $\mu\text{g}/\text{d}$
 - Maternal UI concentration increased
 - Maternal thyroid volume and Tg decreased
 - Neonatal thyroid volume and Tg decreased
 - No effect on neonatal FT4
- Cognitive evaluation of offspring at 6 ~ 18 month
 - Increase psychomotor development index (PDI) significantly
 - Increase IQ markedly when iodine supplement as early as 4week gestation.

Six controlled trial studies in several moderately iodine-deficient European regions have also assessed the effects of iodine supplementation during pregnancy and they report that: Neonatal psychological and neurocognitive measures improved in supplemented mothers, compared with those born to non supplemented ones.

- 1- **Velasco I**, The Journal of Clinical Endocrinology & Metabolism. 2009;94(9):3234-41.
- 2- **Antonangeli L**. European Journal of Endocrinology. 2002;147(1):29-34.
- 3- **Glinoeer D**, The Journal of Clinical Endocrinology & Metabolism. 1995;80(1):25-69.
- 4- **Nøhr SB**, The Journal of Clinical Endocrinology & Metabolism. 2000;85(2):623-7.
- 5- **Berbel P**, Thyroid 2009;19:511–9.
- 6- **Romano R**, American Journal of Obstetrics & Gynecology. 1991;164(2):482-5.

Home messages

- Iodine supplementation is mandatory in all pregnant and lactating women residing in iodine deficient regions.
- Consider iodine supplementation of pregnant and lactating women even in areas of iodine sufficiency
- Maintain adequate iodine nutrition in mothers before conception

Home messages

- ATA recommends supplementation with **150** mcg of iodine daily during pregnancy and lactation.
- This recommendation has been endorsed by WHO, UNICEF and Iodine Global Network (IGN).
- The tolerable upper intake amount of iodine for pregnant women:
 - The WHO : **500** mcg daily
 - The National Academy of Medicine : **1100** mcg daily

الهی دریاب که می توانی

در سناه حق باشید