

**Determination of Urinary Iodine Excretion (UIE) to Assess Iodine
Deficiency Disorder (IDD) among Pregnant Women in District
Hospital of Sindhupalchowk, Nepal**

**Submitted to
Society for Eliminating Nepalese Iodine Deficiency (SENID), Osaka, Japan**

**Submitted by
Public Health and Infectious Disease Research Center (PHIDReC)
Kathmandu, Nepal**

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We would like to express sincere thanks to pregnant women who provided us information and allowed us for collection of urine samples.

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PHIDReC Team
June, 2016
Kathmandu

Summary

Pregnant women and infants are risk populations of iodine deficiency disorders (IDD). Our previous studies also revealed that pregnant women are at risk of non-visible IDD. Therefore, this study has been designed to explore the status of Iodine Deficiency Disorders (IDD) among pregnant women through analysis of urinary iodine excretion (UIE). A total of 97 pregnant women from Chautara Hospital Sindhupalchowk was included to analyze UIE. Although the general clinical status of women was satisfactory, the urinary iodine excretion revealed that still 25.2 percent of pregnant women and 20 percent children below one year of age in Sindhupalchowk had insufficient iodine intake. About 80% mothers had heard of iodized salt. Most of the households except one were using iodized salt with two children logo during the survey. About 13% mothers had knowledge of benefits of iodized salt, 41.9% had knowledge of iodine deficiency diseases, 38.4% had knowledge on iodine source. Although awareness of iodine and use of iodized salt was satisfactory, pregnant women are still at risk of iodine deficiency disorder and they should be in priority population for the IDD prevention program.

1. Introduction

Iodine Deficiency Disorder (IDD) is the world's single most significant cause of preventable brain damage and mental retardation. Twenty nine percent of the population (1570 million people) is at risk of iodine deficiency today in the world. The immense danger to health due to IDD arises from the fact that these disorders can begin even before the child is born. Although iodine is needed in small amount on an average of 150 mcg (100 to 300) per person per day,^{1,2} lack of iodine is associated with wide range of clinical and sub-clinical conditions. The most obvious sign of IDD is goiter, which is a gross enlargement of the thyroid gland in the neck, with a global prevalence of 12%. In addition to goiter, IDD leads to infant mortality, stillbirths, birth complications, mental retardation and depressed psychomotor functions. Moderate IDD in early childhood has been estimated to lower the intelligence quotient by about 10-15 points, while in adults it causes lethargy.³

IDD is an important major micronutrient deficiency problem in Nepal. In some isolated mountainous area of Nepal, most of the adult woman had goiter and up to 10% of population were cretins, the severest form of IDD.⁴

In areas with severe iodine deficiency (<50 mcg intake/day), goitrogenesis as well as hypothyroidism were frequently observed in mother and newborn as a result of the inability of the thyroid gland to adjust to changes in thyroid economy associated with pregnancy. Hence, the pregnant woman and the newborn have been considered primary targets for iodine supplementation in such areas.⁵ Ministry of Health and Population has prioritized Iodine Deficiency Disorders as a high level activity in its Nutrition Policy and Strategy 2004. By the year 2017 iodine deficiency disorders will be eliminated virtually from Nepal.⁷

We implemented iodine supplementation among pregnant mothers in Antenatal Care (ANC) Clinic of Chautara Hospital Sindhupalchowk. We found significant positive outcome in mothers and children born from iodine supplemented mothers.

All these findings associated with pregnant women justify the burning issue for the research on iodine deficiency disorders among pregnant mother and newborn. With these motivations, this study was designed to screen among pregnant women and newborn in Sindhupalchowk district hospital in 2015 and 2016 analyzing urinary iodine.

2. Objectives

To determine the status of Iodine Deficiency Disorders (IDD) in pregnant women in Chautara Hospital Sindhupalchowk.

Specific objectives

1. To assess physical health including blood pressure measurement of women.
2. To determine the status of IDD among pregnant women and children below one year of age analyzing urinary iodine excretion.
3. To assess physical health of the newborn.

3. Methodology

3.1 Research design

This cross-sectional study was conducted to determine the status of IDD among pregnant mothers in Chautara Hospital Sindhupalchowk during September, 2015 to February 2016. In addition, health education on iodized salt and iodine deficiency disorder were provided to women. This was a follow up study with adding some variables for assessing IDD among pregnant women.

3.2 Study site

The site of this study was Chautara Hospital Sindhupalchowk. Sindhupalchowk district is situated in hilly ecological region of Central Region of Nepal. Women were followed up in their household to assess their physical health as well as their newborn.

3.3 Sample size and sampling

We enrolled 97 pregnant mothers seeking ANC in Chautara Hospital. Urine samples from those women and children below one year of age were collected for determination of urinary iodine excretion. We also provided health education for those women.

3.4 Physical examination of pregnant women

Women visiting Chautara District Hospital for antenatal check up were examined for blood pressure. The attending nurse/ANM measured the blood pressure of examined mothers.

Thirty one mothers and their newborn were followed up in the household in May 2016 and their physical examination was performed. Urine samples were collected from 25 children for urine iodine estimation during recent follow up visit in August 2016.

Pregnant women with high blood pressure were counseled in the hospital during her follow up ANC visit not to take too much salt.

3.5 Collection of urine samples

Urine samples were collected from 97 pregnant women in the hospital and 25 children below one year of age from communities for the analysis of Urinary Iodine Excretion (UIE) to screen IDD status. The urine samples were collected in clean leak proof container. The collected urine samples were kept in refrigerator at -20°C until analysis. The UIE analysis was conducted at BP Koirala Institute of Health Sciences (BPKIHS), Dharan.

3.6 Data collection

Knowledge on iodine and IDD, perceptions of mothers on iodized salt were collected using questionnaire from mothers. The UIE test data were collected after sample analysis. The descriptive qualitative information regarding the mother's perceptions on iodized salt were collected through interview.

3.7 Data management and analysis

Collected data were entered in SPSS version 21 and analyzed. Descriptive analyses were performed. Qualitative data were triangulated with quantitative data. The following classification of urinary iodine excretion (UIE) for pregnant women and children below two years of age was used.

Table 1: WHO classification of iodine deficiency disorders (IDD) on the basis of urinary iodine excretion for pregnant women

Median Urinary Iodine ($\mu\text{g/L}$)	Iodine intake	Iodine status
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<150 µg/L	Insufficient	Severe iodine deficiency
150-249µg/L	Adequate	Adequate iodine nutrition
250–499 µg/L	Above requirements	Risk of iodine induced hyperthyroidism
≥500 µg/L	Excessive	Risk of adverse health consequences
Children aged less than two years		
<100	Insufficient	
≥ 100	Adequate	

4. Findings

Characteristics of women involved in the study

The age range of women included for UIE was 17-35 years. The mean age of the women was 23.2 years (SD-3.8 years). Majority of women (83.9 percent) were of age 21-35 years.

Table 2: Characteristics of the women

Characteristics	Number (n=97)	Percent
<i>Age distribution (in years)</i>		
Less than or equal to 20	16	16.1
21-35	81	83.9
More than 35	0	0.0
Mean age (S.D.)	23.2±3.2 (Min.-17; Max.-35)	
Mean weight (Kg)	51.1±7.6 (Min.-38; Max.-74)	

One mother had hypertension.

Table 3: Blood pressure category of women

Blood pressure	Number	Percent
Normal	96	99.0
Hypertension	1	1.0

Ninety percent of women had normal clinical status whereas two percent had abnormal clinical status.

Table 4: General clinical status of women

Clinical status	Number	Percent
Normal	97	100.0
Abnormal	0	0.0

Urinary iodine level among pregnant women

Urinary iodine excretion (UIE) level indicates that 27 percent of women had insufficient

iodine intake. Similarly, 31 percent of women had excessive UIE greater than 500 µg/l.

Table 4: Urinary iodine excretion level and iodine intake status

UIE level (µg/l)	Number	Percent (n=91)
Insufficient (<150)	23	25.2
Adequate (150-249)	29	31.9
Above requirements (250-499)	39	42.9
Excessive (≥500)	-	-

Urinary iodine excretion (UIE) level indicates that 20 percent of children had insufficient iodine intake. Similarly, 52 percent of children had sufficient UIE between 150-249 and 24 percent children had UIE greater than 550 µg/l which is above requirement.

Table 4: Urinary iodine excretion level and iodine intake status of children below one year

UIE level (µg/l) *	Number	Percent (n=25)
Insufficient (<100)	5	20.0
Adequate (150-249)	13	52.0
Above requirements (250-499)	6	24.0
Excessive (≥500)	-	-

Note: One sample was contaminated with stool and urine iodine estimation was not done.

*Epidemiological criteria for assessing iodine nutrition based on median urinary iodine concentration for children aged less than one year.

Follow up results of women

We followed 31 mothers and their newborn in May 2016. Most of the followed up mothers were from Chautara and surrounding VDCs of Chautara.

Table 5: VDC wise distribution of number of mother and newborn followed up

VDC	Number	Percent
Batase	3	9.7
Chautara	11	35.5
Irkhu	3	9.7
Kunchowk	3	9.7
Pipaldanda	8	25.8
Sanosiruwari	3	9.7

The average height, weight and BMI of mothers were normal. However, some mothers had height less than 145 cm, low weight upto 37Kg and BMI less than 18Kg/m².

Table 6: Physical parameters of followed up mother

Parameters	Mean (\pm S.D.)	Range (min.-max.)
Height (cm)	150.23 \pm 4.63	141-161
Weight (Kg)	52.65 \pm 7.25	37-69
BMI (Kg/m ²)	23.25 \pm 2.83	17-28

Most of the mothers had normal BMI whereas one mother had BMI less than 18 Kg/m² and 22.6% had BMI greater than 25 Kg/m².

Table 7: BMI categories of followed up mother

BMI categories (Kg/m ²)	Number	Percent
<18	1	3.2
18-25	23	74.2
>25	7	22.6



Photograph 1: Physical examination of follow up mother

None of the mothers had pallor sign, jaundice and oedema during physical examination. Similarly, they did not have swelling of thyroid. According to mother's report, they did not have goiter during pregnancy. Followed up mothers mentioned that 77.4% of them had still birth in the past but none of them had still birth in last delivery.

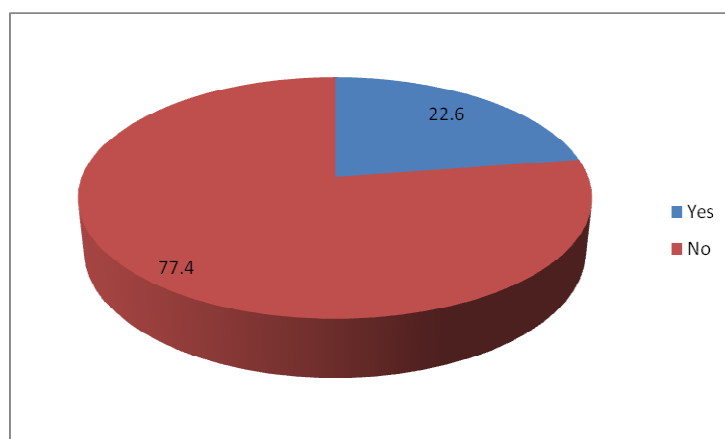


Figure 1: Still birth in the past from followed up mother

About 80% mothers had heard of iodized salt. Most of the households except one were using iodized salt with two children logo during the survey. About 13% mothers had knowledge of benefits of iodized salt, 41.9% had knowledge of iodine deficiency diseases, 38.4% had knowledge on iodine source.

Table 8: Iodine awareness and use of iodized salt among mothers

Variables	Number	Percent (n=31)
Heard of iodized salt	25	80.6
Use iodized salt with two children logo	30	96.8
<i>Knowledge on benefits of iodized salt (multiple response)</i>	4	12.9
Mental development	3	9.6
Physical growth	2	6.4
Disability prevention	1	3.2
<i>Knowledge on iodine deficiency diseases (multiple response)</i>	13	41.9
Goitre	5	16.0
Disability	4	12.8
Memory loss	1	3.2
Lethargy	1	3.2
<i>Knowledge on iodine source (multiple response)</i>	12	38.4
Beans	3	9.6
Vegetables	5	16.0
Meat	2	6.4
Fruits	3	9.6

Majority of mothers (93.5%) took iron tablets during their last pregnancy.

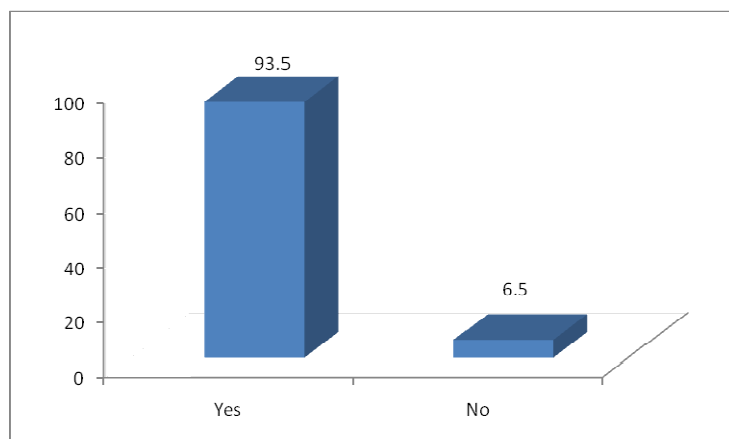
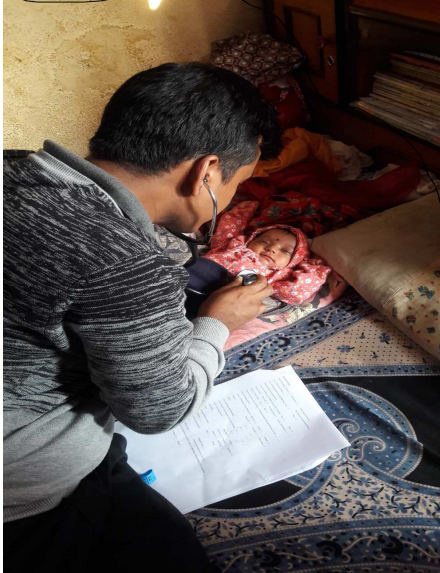


Figure 2: Mothers taking iron tablets during last pregnancy

None of the family members of followed up mothers had goiter.

Assessment of newborn babies born from mothers included in the study

We followed 31 newborn of age less than six months. Among followed up children, 29% were first child of the mother, 51.6% were second child and 19.4% were third and fourth child of the mother.



Photograph 2: Doctor examining newborn baby

Table 9: Characteristics of followed up children

Characteristics	Number	Percent (n=31)
Age of child (months)		
<1	7	22.6
1-3	14	45.1
4-6	10	32.3
Sex		
Male	18	58.1
Female	13	41.9
Birth order		
1	9	29.0
2	16	51.6
3	4	12.9
4	2	6.5

Among 31 followed up newborn, one had congenital anomalies, 7 had history of jaundice within 24 hours of birth, 2 had sluggish feeding and suckling ability, one had no smile at mother.



Photograph 3: Physical examination of child at Sindhupalchowk hospital

Table 10: Status of newborn babies

Characteristics	Number	Percent (n=31)
Congenital anomalies	1	3.2
History of jaundice within 24 hours of birth	7	22.6
<i>Feeding and suckling ability of baby</i>		
Normal	29	93.5
Sluggish	2	6.5
<i>Smile at mother</i>		
Yes	15	48.4
No	1	3.2

Not at applicable to this age 15 48.4

All children had immunization applicable within six months of age. All of the children had normal weight according to age.



Photograph 4: Weighing of the baby

Regarding status of health and diseases among newborn, 22.6% had history of disease/surgery/hospitalization, 41.9% had fused fontanel, 6.5% had swollen eyelid. None of the newborn had puffiness in face, open mouth with protuberant tongue, and neck swelling goiter. One child had wheeze and crepitations, and two had wheeze during the survey.

Table 11: Status of diseases and health

Characteristics	Number	Percent (n=31)
History of disease/surgery/hospitalization	7	22.6
<i>Status of fontanel</i>		
Open	12	38.7
Wide	6	19.4
Fused	13	41.9
<i>Eyelid</i>		

Normal	29	93.5
Swollen	2	6.5
Pallor	2	6.5
Puffiness in face	0	0.0
Open mouth with protuberant tongue	0	0.0
Neck swelling goiter	0	0.0
<i>Cardiovascular system</i>		
Clinically clear	28	90.3
Wheeze and crepitations	1	3.2
Wheezy	2	6.5



Photograph 5: Physical examination of child

5. Conclusions

Although the general clinical status of women was satisfactory, the urinary iodine excretion revealed that still 25.2 percent of pregnant women and 20 percent of the children below one year of age in Sindhupalchowk had insufficient iodine intake. This indicates that pregnant women and children are still at risk of iodine deficiency disorder and they should be in priority population for the IDD prevention program. The follow up results indicate that iodine related awareness and use of iodized salt were satisfactory. There was some health disorders in newborn related to factors other than iodine. Therefore, mothers and newborn health and their nutrition should be in priority to achieve desirable results of reducing maternal and neonatal/infant morbidity and mortality.

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Annex-I
Performa for collection of urine samples from pregnant women

Date:

Name of the mother:

Name of the husband:

Address: District:

VDC:

Village:

Ward No.:

Name of the Hospital:

1. Age of the mother:
2. Caste:
3. Religion:
4. Blood pressure (mmHg):
5. Weight:
6. General clinical status
 - a. Normal
 - b. Not normal
7. Urine sample collected in filter paper
 - a. Yes
 - b. No

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Annex-II
Follow up Tool for Newborn

**Questionnaire and Data collection tool to test Anthropometric Status of Children of
Urine Iodine Estimated Mothers in Sindhupalchowk District, May 2016**

Interviewer' name:Case No:..... Date:-.....

Individual information:

Name of the Mother

District : Village/Municipality : Ward No:

Name of the child:

Age (in months):

Sex : Male () Female () Order of the child :

Antenatal history:

Was Iodine supplementation done to the mother during pregnancy? Yes () No ()

Duration of the supplementation..... Dose of the supplementation.....

Urine Iodine level of the pregnant mothers _____

Natal history:

Gestational age: Birth weight of the baby:.....

Any visible congenital anomalies: Yes () No ()

If yes, mention.....

Postnatal history:

History of jaundice after 24 hours of birth: Yes () No ()

Feeding and sucking ability of baby: Normal () Sluggish ()

Growth and development of the child

What is the pattern of the growth of the child as compared with other children of the same age?

Normal () Forward () Delayed ()

If delayed/forward, mention if the mother observes: Lethargy () Restlessness ()

Duration of sleep in hours per day.....

Developmental milestone (age wise)

- Smiled at mother.....
- Erected head.....
- Could sit with support.....
- Could sit without support.....
- Started crawling.....
- Could stand without support....
- Started walking.....
- First word.....
- First sentence.....

Dietary history:

Breast feeding: Done () Not done () Weaning started at....

No. of feeds per day..... Any Special supplementation.....

Any choking spells during feeding : Yes () No ()

Relevant general questions

Is Immunization up to date as per EPI schedule: Yes () No ()

Bowel habit: Normal () Constipation () Hyper defecation ()

History of hair-fall: Yes () No ()

Please mention if any history of disease/surgery/hospitalization so far.....

Clinical Examination:

Status of Fontanel (Esp. Posterior): Normal () Wide () Fused ()

Eyelid: Normal () Swollen () Retracted ()

Pallor: + () - ()

Face puffiness/oedematous: + () - ()

Open mouth with large protuberant tongue: + () - ()

Neck: Swelling/ Goiter: + () - ()

Abdomen: Normal () Large ()

Tone: Normal () Flaccid () Spastic ()

Neurological abnormality: Speech () Hearing ()

Skin condition..... CVS:..... Resp:.....

Anthropometric parameters

Weight in gm..... Height in cm.....

Head circumference in cm.....

Chest circumference in cm.....

Length and head circumference of the baby at the time of the birth (if available)

MUAC: Green () Yellow ()

Red ()

Annex-III
Follow up Tool for Mothers

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Vital:

- BP
- Height (CM)
- Weight (Kg)
- BMI

General:

(Skin colour)

- Pallor
- Jaundice
- Oedema

Neck:

(Thyroid swelling)

- Stage I
- Stage II
- Stage III

Was goiter was formed during the pregnancy (if any goiter) Yes [] No []

Did goiter regressed after the birth of the baby? Yes [] No []

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Annex-IV

Information Sheet for Pregnant Women and Parents of Children

Name of Principle Investigator:

Name of Organization: Public Health and Infectious Disease Research Center (PHIDReC)

Name of Sponsor: Society for Eliminating Nepalese Iodine Deficiency Disorder (SENID) Japan

Information sheet for individuals participating in the research

"Screening of Iodine Deficiency Disorder (IDD) and Supplementation of Iodine among Pregnant Women in Beni Hospital, Myagdi, Nepal"

(I am and I work at the PHIDReC Kathmandu. We are doing some research on the Iodine Deficiency Disorder to determine its burden in risk population such as pregnant women and children.)

Purpose of the research

Iodine Deficiency Disorder (IDD) is an important major micronutrient deficiency problem in Nepal. In areas with severe iodine deficiency (<50 mcg intake/day), goitrogenesis as well as hypothyroidism were frequently observed in mother and newborn as a result of the inability of the thyroid gland to adjust to changes in thyroid economy associated with pregnancy. Hence, the pregnant woman and the newborn have been considered primary targets for iodine supplementation in such areas.

All these findings associated with pregnant women justify the burning issue for the research on iodine deficiency disorders among pregnant mother and newborn. With these motivations, this pilot study has been designed to screen IDD in children born from iodine supplemented mothers during pregnancy and pregnant mothers testing TSH in order to implement iodine supplementation in pregnant women.

Procedures

The site of this study is Beni Hospital Myagdi. We will collect urine samples from 400 pregnant mothers when they seek ANC. We also assess knowledge and perceptions of mothers on IDD and iodine. The mothers will also be assessed clinically. Similarly, urine samples will also be collected from newborns from the same hospitals during the study period. Urine samples will be analyzed for urinary iodine excretion using standard procedure.

Risks and Discomforts

There will be no any risks during collection of urine sample. The urine sample will be collected using sterile leak proof container in the hospital when you seek ANC.

Benefits

Your participation is likely to help us to find out more about what is the burden of Iodine Deficiency Disorder (IDD) in high risk population in Nepal and this information will be useful to implement iodine deficiency control programme.

Incentives

You will not be provided any incentive to take part in the research.

Confidentiality

The information that we collect from this research will be kept confidential. Information about you that will be collected from the study will be stored in a file which will not have your name on it, but a number assigned to it. Which number belongs to which name will be kept under lock and key, and will not be divulged to anyone except the researchers, and research sponsors.

Right to refuse or withdraw

You do not have to take part in this research if you do not wish to do so, and this will not affect the future treatment of your family at the health facility at the District Hospital in any way. You will still have all the benefits that you would otherwise have.

You may stop participating in the research at any time that you wish to, without losing any of your rights as a patient or otherwise.

Who to contact

If you have any questions you may ask those now or later. If you wish to ask questions later, you may contact: (Prof. Chitra Kumar Gurung, PHIDReC, Kathmandu, Phone: +977-1-4494254).

Consent Form from Pregnant Women for Blood Sample Collection for IDD Screening

I have read/has been read to me the foregoing information. I have had the opportunity to ask questions about it and any questions I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this study and understand that I have the right to withdraw from the study at any time without in any way affecting me and my family as a health care seeker.

Participant's Name:

Signature:

Place:

Date:

Witness (Name):

Place:

Signature:

Date: