Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.3, No.8, 2013

Maternal Urinary Iodine and Pregnancy Outcomes in Ngargoyoso Sub-District, Central Java, Indonesia

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Abstract
Ngargoyoso sub-district has long been known as a pocket area of iodine deficiency in Central Java Indonesia. Unfortunately, there is no data available on iodine status of pregnant women in this area. Therefore, the present sutdy was aimed at measuring iodine status of pregnant women and their pregnancy outcomes. All pregnant women (N=153) who were listed in the health centre of Ngargoyoso sub-district in October 2012 included in the study. Urinary iodine was measured using method A (Sandell-Kolthoff reaction) from spots urine in an accredited IDD laboratory at Magelang, Central Java, Inodnesia. The pregnant women were followed up untill delivering their babies. The study was ended in May 2013. By using 150µg/L as cut-off point, 83(54.3%) pregnant women were found to be iodine deficient, whereas 43 (28.1%) of them were severely iodine deficient (i.e. <100µg/L). Pregnancy outcomes were recorded after delivery. No cretins and congenital malformations were reported, however there were 2 abortions (13.1/1000 live births) and 5 stillbirths (32.7/1000 live births). There was no correlation between urinary iodine of the mother and birthweight of the babies, even after stratification into low and normal urinary iodine excretion of the mother. The study revealed that abortion and stillbirth deleteteriously affected the pregnancy outcomes in the study area.
Keywords: iodine deficiency, pregnant women, pregancy outcomes, stillbirth.

1. Introduction

Ngargoyoso sub-district has long been known as a pocket area of iodine deficiency in Central Java, Indonesia (Gunawan et al, 1985). In 1996, when iodized oil capsules were distributed by the Health Centre to schoolchildren and women at reproductive age, the total goiter rate (TGR) was 29% (Kauldhar, 1996) and classified as moderatly endemic ((WHO, 2007). In 2004 the Government of Indonesia declared decentralization decree. Since then health budget allocation including nutrition has been the responsibility of district administration. Unfortunately due to limited budget availability there was no allocation for buying iodized oil capsules. To make thing worst, in 2009 the Department of Health, Republic of Indonesia officialy banned the use of iodized oil capsules in its iodine deficiency disorders (IDD) elimination programme. Nowadays, IDD elimination programme in Indonesia relies solely upon the universal salt iodization (USI). The last survey in Ngargoyoso sub-district showed that only 61% households used iodized salt. Hence, the total goitre rate increased steeply to 51,9% in 2010 (Suprapto et al, 2010), and classified as severely endemic (WHO, 2007). It is believed that TGR in schoolchildren reflects iodine status of the populations. However, Zimmermann (2009) remined us that median urinary iodine in schoolchildren may not reflect iodine status in pregnant women. Thus, it may be prudent to monitor pregnant women directly. Unfortunatley, there are insufficient data to estimate the global prevalence of iodine deficiency in pregnant women (de Benoist et al, 2008). We have conducted studies on preschoool children (Dewi et al, 2012) and schoolchildren recently (Suprapto & Dewi, 2012), but no data available on pregnant women in the sub-district. Therfore, this study would explore the iodine status of pregnant women in Ngargoyoso sub-district, Central Java, and its effects on pregnancy outcomes.

2. Subjects and methods

2.1. Location

Ngargoyoso sub-district is located on the high slope of Mount Lawu, Central Java, Indonesia, at an altitude between 900 to 1100 meters above the sea level, with heavy rainfall. Population in the sub-district is about 30.000 living from subsistent farming. People get access of drinking water from natural spring wells, but it contains no iodine (Dewi et al, 2012). Only 61% households used iodized salt (Suprapto et al, 2010) and the total goitre rate among schoolchildren was 51,9% (Suprapto et al, 2010). It can be classified as severely endemic (WHO, 2007).

2.2. Subjects

One hundred and fifty three pregnant women in the sub-dsitrict who were listed in Ngargoyoso Health Centre in October 2012 agreed to participate in the study. They were asked to collect their urine in a plastic bottle (±50 ml) with a cap, but without preservative in the morning. The bottles were sent to IDD Laboratory at Magelang, Central Java, next day.

2.3. Study Protocol

Village midwives collected data from pregnant women at health centre and their homes in October 2012. They also did the follow up untill delivery. They also collected the spot urine before urinary iodine measurement in IDD Laboratory at Magelang, Central Java, Indonesia. All data were entered into a database using SPSS for Windows release 17.0 (Chicago IL, USA).

2.4. Urinary iodine measurement

Urinary iodine was measured using Method A (Sandell-Kolthoff (reaction). Casual urine samples were taken without preservative and refrigeration in plastic bottles in the morning, and then sent to IDD Laboratory at Magelang, Central Java, Indonesia. The results expressed as µg/L urine.

2.5. Anthropometric measurements

Weight was recorded on a calibrated mechanical bathroom scale to the nearest 0.1 kg (Krups, Ireland) after zeroing for each measurement, Women were lightly clothed and removed their footwear. Height was recorded using a microtoise (Statumeter™, Indonesia) and measured to the nearest 0.1 cm. The woman stood with her buttocks, heels and back against the wall and her head in the Frankfurt plane. Data were analazyed for calculating Body Mass Index. Babies were weighed using baby scale to the nearest 1 g (Krups, Ireland).

2.6.Statistical analysis

All statistical analysis was performed using SPSS for Windows release 17.0 (Chicago IL, USA).

2.7. Ethical considerations

The study is part of the Central Java province IDD Surveillance Project 2012. Pregnant women were informed about the nature of the study and agreed to participate,

3. Results

In October 2012 there were 153 pregnant women listed in Ngargoyoso Health Centre. They were eagerly participating in the study. Table 1 showed the characteristics of the subjects. There were 2 abortions (13.1/1000 live birth) resulting from two pregnant women with urinary iodine 119 µg/L and 149 µg/L respectively. Five stillbirths (32.7/1000 live birth) delivered by mothers with urinary iodine 82 µg/L, 94 µg/L, 124 µg/L, 200 µg/L and 350 µg/L. Urinary iodine <150µg/L was considered insufficient (WHO, 2007). Based on this cut off, 83(54.2%) pregnant women in Ngargoyoso sub-district were iodine deficient.There was no correlation between maternal urinary iodine and live birthweights. Stratification into pregnant women with urinary iodine >150 µg/L, 100-149 µg/L and <100 µg/L also failed to show any correlation.

4. Discussion

Dietary iodine requirements increase during pregnancy (Mu and Eastman, 2012), due to: 1) an increase in maternal thyroxine (T4) production to maintain maternal euthyroidism and transfer thyroid hormone to the fetus early in the first trimester, before the fetal thyroid is functioning; 2) iodine transfer to the fetus, especially in later gestations; and 3) an increase in renal iodine clearance (Zimmermann, 2009). Iodine deficiency during pregnancy has far reaching consequences. Maternal iodine deficiency can compromise the thyroid status of both the mother and the fetus (Mina et al, 2011). Therefore iodine excretion of pregnant women living in iodine deficient area, such as Ngargoyoso sub-district, Central Java, Indonesia should be assessed routinely. Complications of iodine deficiency in pregnant women affect both mother and fetus including goitre, abortions, stillbirth, and brain damage (Hetzel, 2004). In the present study, we assessed urinary iodine excretion in pregnant women as an indicator of recent iodine intakes (WHO, 2007). More than a half of them were iodine deficient. It could be the results of low iodized salt usage within the households due to higher prize (Dewi et al, 2012) and low iodine intakes in drinking water. A village with iodine deficiency would always become deficient unless a supplementation programme installed, or food imported from outside the village contains enough iodine consumed. Antenatal care, a concept imported from developed countries (Rouse, 2003) may not be the answer for a village like Ngargoyoso. We promoted iodine supplementation into drinking water in *kendi* (Dewi et al, 2012) with good acceptance. For a family with five members we suggested five *kendi*, one liter each. Iodine supplement as KIO3 would expend 1.6 rupiah (US$ 0.00016) per day/person. A family on the average spent 500.000-750.000 rupiah/month (US$ 50-75/month), thus this proposal is feasible and affordable (Dewi et al, 2012). Ngargoyoso sub-district has a health centre with more than fifty health poststhat guarantee health services for people in the village, including obstetrics services. There are nine midwives working in nine villages within the sub-district. Thus,the rate of abortions (13.1/1000 live birth) and stillbirth (32.7/1000 live birth) in the sub-district could not be accounted for the lack of health services. We argued that iodine deficiency may be responsible for these high prevalences. In the present study we used mean rather than median urinary iodine excretion, because of small samples. Median urinary iodine usually required a bigger sample (N=1200 or more).

In a study among schoolchildren in Romania, Kun et al (2013) found that mean urinary iodine excretion was higher than median urinary excretion, probably due to the skewness of the data. There was no correlation between urinary iodine excretion of the mothers and birthweight of the offsprings. Supplementation study using 300 µg potassium iodine in pregnant women in Spain also failed to show difference in birthweight (Velasco et al, 2009). The present study also revealed that BMI of the mothers had no correlation with birthweight of the babies. It can be speculated that because the average of BMI of the pregnant women in Ngargoyoso within "normal" limits (23.1±3.47kg/m2) their babies also weighed within the "normal" limit (2971,5 ± 497.7 g). We also failed to find cretins and congenital malformation, although last year two new cretins were reported by Ngargoyoso Health Centre. According to Hetzel (2004) fatal outcomes of iodine deficiency in pregnant women were abortions and stillbirth. Our present study showed that the prevalence of abortion and stillbirth were 13.1/1000 live births and 32.7/1000 live births, respectively. These findings just like the tip of an iceberg. Babies born to iodine deficient mothers have higher perinatal and neonatal mortality rate due to preterm delivery, fetal distress, small for gestational age, and congenital malformation (Su et al, 2011). However, the most devastating complication of iodine deficiency is impaired neuropsychological development. It is a continuum starts from cretin (the most severe one) and minimal brain damage. Even children who look "normal" living in an area with severe iodine deficiency have an IQ deficit about 13.5 points (Bleichrodt&Born, 1994). Our supplementation study on preschool children (who looked healthy) in Ngargoyoso sub-district, Central Java, Indonesia showed an increase of 8.8 IQ points (Dewi et al, 2012). Mental deficit due to iodine deficiency can be prevented, if iodine status of pregnant women is corrected, preferably before or at least at early pregnancy (WHO, 2007). Anecdotal reports from the Village of Sengi, Central Java (Djokomoeljanto, 1974) and the Village of Jixian, Northern China (Ma and Lu, 1996, cited by Hetzel, 2004) showed improved school performance and income. Indeed, iodine deficiency reduced productivity by 10% (Norgan NG, 2000). The importance of maintaining iodine status during pregnancy also stressed by Dunn and Delange (2001) to reduce reproductive risks including over hypothyroidism, infertility and increased abortions. Table 1 showed that number of pregnancy was about two for each woman, but their were young enough to be pregnant again in the future. The study also showed that 54.2% of pregnant women in the study area were iodine deficient. Since they are living in an iodine deficient area like Ngargoyoso sub-district, Central Java, Indonesia and are facing with all reproductive risks, an iodine supplementation programme is warranted.

5. Conclusion

Iodine deficiency is highly prevalent among pregnant women in Ngargoyoso sub-district, Central Java, Indonesia. The most frequent complications were abortions dan stillbirth. Iodine supplementation programme for pregnant women shoul be initiated soon to prevent all reproductive risks.

Acknowledgements

We would like to thanks the mothers in Ngargoyoso sub-district, Central Java, Indonesia who were eagerly participating in the study. We also appreciate all staffs of IDD Laboratory at Magelang, Central Java for measuring urinary iodine and village midwives at Ngargoyoso sub-district for their assisstance during the study.

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Table 1. Characteristics of the subjects (N = 153, pregnant women)

.Variable	Mean	Range	Standard deviation
Age (years)	27.86	18-41	5.47
Schooling (years)	9.45	6-16	2.18
No. of pregnancy	1.95	1-9	1.04
Body mass index (kg/m2)	23.11	14.19-35.50	3.47
Urinary iodine (µg/L)	161.0	11 – 494	99.3
Birth weight (g)	2971.5	500 – 4000	497.7