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IODINE SUPPLEMENTATION IN PREGNANCY

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SUMMARY – People of all ages can be affected by iodine deficiency, however, pregnant women and children are especially at a high risk. Because of changes that occur in maternal thyroid hormone economy during pregnancy and the potential unfavorable effects of iodine deficiency on the offspring, an adequate dietary iodine intake throughout the pregnancy is highly important. Therefore, the World Health Organization, United Nations Children's Fund and International Council for the Control of Iodine Deficiency Disorders have proposed that dietary intake of iodine during pregnancy should be 200-300 μg/day to compensate for the augmented T4 requirements in pregnant women. It has been shown that in countries with a longstanding and well-established universal salt iodination program where iodine sufficiency has been reached, there is a fraction of pregnant women that still have low median urinary iodine concentration, which indicates insufficient dietary iodine. Studies performed in such countries emphasize that pregnant women should use multivitamin and/or mineral tablets specifically prepared for the needs of pregnancy and containing iodine supplements. Only the United States of America and Canada have official recommendations concerning iodine supplementation. In other countries, no such firm decisions have yet been made by medical community and public health authorities. In Croatia, an iodine sufficient country, the situation is the same. There is a need to collect adequate data on iodine supplementation and urinary iodine during pregnancy, along with the universal salt iodination program, so that definitive conclusions can be made.

Key words: *Iodine deficiency; Pregnancy complications – prevention and control; Iodine – administration and dosage; Iodine – adverse effects; Nutrition policy*

Iodine Requirements in Pregnancy

As an essential component of thyroid hormones, iodine plays an important role in normal thyroid functioning. The extrathyroidal inorganic iodine sources are iodide derived from the diet and peripheral catabolism of thyroid hormones and iodothyronines by deiodination. These sources of iodine are in dynamic equilibrium with the thyroid gland and the kidneys[1,2]. According to the International Council for the Control of Iodine Deficiency Disorders (ICCIDD) and World Health Organization (WHO), the ideal daily iodine intake for normal, healthy adults is 150 μg[2]. However, in pregnancy, the requirement of iodine increases due to several factors. One of them is the significant increase in renal clearance of iodine because of the increased glomerular filtration rate. This begins in the early weeks of gestation and persists until term. Furthermore, in order to maintain normal global maternal metabolism, one of the main events is an increase in thyroid production of T4 by approximately 50%, mostly due to estrogen-induced rise in thyroxine-binding globulin. Also, maternal T4 and iodide cross the placenta before the onset of fetal thyroid function and 20%-40% of T4 measured in cord

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blood at birth is that of maternal origin[3-5]. At midgestation, when the fetal thyroid gland starts to produce thyroid hormones that are indispensable for appropriate fetal development, the increased maternal iodine requirement continues because a part of the available iodine from maternal circulation still passes to the fetal-maternal unit. Hence, when iodine deprivation already exists, it tends to become more severe in later stages of pregnancy. Therefore, an adequate maternal dietary intake of iodine in pregnancy is essential for maternal thyroxine production and later for fetal thyroid function.

Iodine Deficiency and Pregnancy

Iodine deficiency can lead to numerous health problems, also known as iodine deficiency disorders. They include thyroid gland dysfunction and various neurologic abnormalities. It has been recognized since 1986 as the most frequent cause, after starvation, of preventable mental defects[1,6]. The severity of the neurologic damage depends both on the developmental period when iodine deficiency occurs and on the severity of this deficiency. 'Cretinism', a state defined by severe mental retardation, hearing and speech deficits, and motor alterations (dysplegia or even tetraplegia), is a rare outcome of severe iodine deficiency during early development. It has been shown that in populations with chronic iodine deficiency, the mean intelligence quotient is reduced by 13.5 points[2]. In case of mild to moderate iodine deficiency, it can result in mild intellectual blunting that may go unrecognized unless carefully investigated, or may present with the attention deficit hyperactivity disorder. Even borderline iodine deficiency, as observed in many European countries, may be accompanied by impaired school achievements in apparently normal children. Additionally, iodine deficiency in pregnancy increases the risk of maternal and fetal goiter, stillbirths, abortions, congenital abnormalities, reduced fetal growth, neonatal hypothyroidism and damaged reproduction in adult life[7,8].

Iodine Supplementation

In order to prevent iodine deficiency disorders, most countries have introduced public health programs that are based on iodized salt as the preferred strategy in order to provide iodine supplements to the household[6,9]. The WHO, United Nations Children's Fund (UNICEF) and ICCIDD have proposed the dietary intake of iodine in pregnancy to be higher than 150 μg/day recommended for non-pregnant adults and adolescents. In gestation, it should be increased to 200-300 μg/day to compensate for the augmented requirements of T4 in pregnant women[3,10].

Median urinary iodine concentration (UIC) is used as an indicator of an adequate iodine intake and optimal status of iodine nutrition because 90% of ingested iodine is excreted in 24-h urine. In countries where systematic and periodic monitoring has been used, the results have shown an improvement in iodine intake and thyroid function in the general population. The WHO/UNICEF/ICCIDD have established that median UIC should be 100-199 μg/day in clinically healthy subjects and 150-249 μg/day in clinically healthy pregnant women[11]. Some studies have shown that, even in areas with adequate iodine intake, a significant proportion of pregnant women have UIC below the recommended levels. The reasons for such findings can be found in the fact that women are often recommended to limit their intake of salt in pregnancy and because of the metabolic changes that occur in pregnancy and lactation, resulting in an increased iodine requirement[6]. Today, the recommendations for limiting the salt intake do not only apply to pregnant women but also to the general population because of the occurrence of cardiovascular diseases in epidemic proportions. This may also involve women planning pregnancy. As mentioned above, when iodine deprivation already exists, it tends to become more severe in late stages of pregnancy. Therefore, several papers on this topic have raised a question whether additional iodine supplementation should be generalized in pregnant women[12]. Studies were performed in areas with mild to moderate iodine deficiency, in which a portion of pregnant women received iodine supplementation. These studies showed the maternal thyroid to be able to adapt to meet the increased thyroid hormone requirements of pregnancy. Iodine supplementation was effective in minimizing the increase in the size of thyroid during pregnancy, however, none of the studies showed its clear effect on maternal and neonatal total or free thyroid hormone concentrations[13].

In countries with a longstanding and well-established universal salt iodination program where iodine sufficiency has been reached, there is always a fraction

of pregnant women that still have an insufficient dietary iodine intake. According to recent data, Croatia belongs to this group of iodine sufficient countries. After the initial regulation of obligatory salt iodination with 10 mg of KI/kg of salt in 1953, mild to moderate iodine deficiency still persisted and a new regulation on 25 mg of KI/kg of salt was established in 1996 (Fig. 1). Croatia finally reached iodine sufficiency according to the WHO/ICCIDD reference values in the year 2002[14-18].

Studies performed in other iodine sufficient countries emphasize that pregnant women should use multivitamin/mineral tablets specifically prepared for the needs of pregnancy and containing iodine supplements[19,20]. Supplementation of pregnant and lactating women with 150 μg/day of iodine is considered safe.

In the United States of America and in Canada, there is an official recommendation since 2006, made by the Public Health Committee of the American Thyroid Association, that all pregnant women should receive 150 μg/day iodine supplements during pregnancy and lactation, and that those prenatal multivitamin and/or mineral preparations dispensed over-the-counter (OTC) should contain 150 μg/day of iodine[1,21]. In other countries, such firm decisions by medical community and public health authorities have not yet been made. In Croatia, there are eight multivitamin and/or minerals marketed as prenatal preparations, available for OTC distribution. Three of them contain iodine in the amounts of 140 μg/tbl, 150 μg/tbl and 200 μg/tbl, respectively. Women usually take multivitamin and/or mineral preparations on their own, since recommendation on the usage of these preparations depends on the gynecologist monitoring the woman's pregnancy. Prenatal preparations most commonly used by pregnant women contain no iodine.

Fig. 1. A 'cretin' and his mother from the Croatian Rude village (the 1950s).

Conclusion

There is still inadequate awareness of the role of iodine and in particular of its impact on fetal brain development in the general population and, unfortunately, also in the gynecological and obstetric circles. As mentioned above, numerous papers on iodine requirements in pregnancy contain recommendations for iodine supplementation in pregnant women and those planning pregnancy, however, official advice is still lacking. According to the WHO recommendations, in countries or regions where <90% of households are using iodinated salt and median UI concentration in school-age children is <100 μg/L, pregnant women should use iodine supplementation. Because of the variability of results even in iodine sufficient countries, more accurate data should be collected to make definitive conclusions. Until such a research is completed, attention should be focused on iodine supplementation and monitoring urinary iodine during pregnancy, along with programs of universal salt iodination.

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Sažetak

DODATNI UNOS JODA U TRUDNOĆI

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Nedostatak joda može zahvatiti bilo koju dobnu skupinu, ali je ta opasnost osobito visoka kod trudnica i djece. Dostatan unos joda u prehrani kroz cijelo razdoblje trudnoće je veoma važan zbog promjena koje nastaju u kretanju majčinih hormona štitnjače tijekom trudnoće i mogućih negativnih učinaka nedostatka joda na dijete. Stoga su Svjetska zdravstvena organizacija, Fundacija za djecu Ujedinjenih naroda i Međunarodni savjet za kontrolu bolesti uzrokovanih nedostatkom joda predložili unos joda prehranom tijekom trudnoće od 200-300 μg/dan kako bi se nadoknadile povećane potrebe za T4 kod trudnica. Pokazalo se da u zemljama s dugotrajnim i dobro uspostavljenim sveopćim programom za jodiranje soli u kojima je postignut dostatan unos joda uvijek postoji skupina trudnica koje ipak imaju nizak medijan koncentracije joda u mokraći, što pak ukazuje na nedostatak joda u prehrani. U istraživanjima provedenim u takvim zemljama naglašava se kako bi trudnice trebale uzimati tablete multivitamina i/ili minerala koje sadrže dodatak joda i namijenjene su upravo za primjenu u trudnoći. Sjedinjene Američke Države i Kanada su jedine zemlje koje imaju službene preporuke za dodavanje joda, dok u drugim zemljama takve čvrste odluke medicinske struke i javnozdravstvenih vlasti još nisu donešene. Takva je situacija i u Hrvatskoj, zemlji s dostatnim unosom joda. Uz programe općeg jodiranja soli potrebno je prikupiti dovoljno podataka o dodavanju joda i koncentraciji joda u mokraći za vrijeme trudnoće kako bi se mogli donijeti valjani zaključci.

Ključne riječi: *Nedostatak joda; Komplikacije trudnoće – prevencija i kontrola; Jod – davanje i doziranje; Jod – štetni učinci; Prehrambena politika*