Common factors determining iodine status in pregnancy across Europe

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A study funded by the EUthyroid project identified the determinants of iodine status during early pregnancy in three European populations of differing iodine status.

The early stages of pregnancy mark the beginning of crucial fetal brain development processes such as neuron proliferation, migration, and differentiation. These processes are thyroid hormone-dependent, therefore, the mother needs sufficient iodine to maintain optimal thyroid function. Even mild-to-moderate maternal iodine deficiency in early pregnancy has been associated with suboptimal offspring cognitive outcomes (1-3). Better knowledge of factors that determine the iodine status in pregnancy in iodine deficient and sufficient areas may help to identify women at particular risk of low iodine status.

The objectives of the study were: (1) to establish whether iodine status during early pregnancy is associated with maternal socio-demographic, anthropometric, lifestyle factors, and pregnancy characteristics; (2) to determine how maternal iodine status is influenced by dietary intake during pregnancy; and (3) to identify similarities and differences in the main determinants of iodine status between deficient and sufficient pregnant populations.

Pooling ALSPAC, Generation R, and INMA studies

Data from three prospective population-based birth cohorts were pooled: (i) the Avon Longitudinal Study of Parents and Children (ALSPAC) in the United Kingdom (UK) (4); (ii) Generation R in the Netherlands (5); and (iii) INfancia y Medio Ambiente (INMA) in Spain (6) (*Table 1*). Urinary iodine concentration (UIC, µg/L) was measured in spot-urine samples collected at a median (25–75th percentile) gestational age of 11.0 (8.0–15.0) weeks in ALSPAC, 13.1 (12.1–14.6) weeks in Generation R, and 13.0 (12.4–13.9) weeks in INMA.

Iodine status in pregnant women

The population of pregnant women from the Netherlands was iodine-sufficient, while the women from the UK and Spain were mildly-to-moderately deficient (*Table 2*).

Differences in iodine status among pregnant women across European countries may be partly explained by differing use of iodized salt.

TABLE 1 **Three prospective population-based birth cohorts were included in this study**

Study	No. of pregnant women in the final study population	From	Expected delivery date
ALSPAC	2,852	Avon area, South West of England	Apr 1991 – Dec 1992
Generation R	2,254	Rotterdam, Netherlands	Apr 2002 – Jan 2006
INMA	1,460	Valencia, Sabadell and Gipuzkoa regions, Spain	Nov 2003 – Jan 2008
Total	**6,566**		

TABLE 2 **Iodine status in early pregnancy (≤ 18 gestational weeks) expressed as urinary iodine concentration (UIC) and urinary iodine-to-creatinine ratio (UI/Creat)**

	ALSPAC (n = 2852)	Generation R (n = 2254)	INMA (n =1460)
Gestational age at urine sampling, weeks	11.0 (8.0–15.0)	13.1 (12.1–14.6)	13.0 (12.4–13.9)
UIC, μg/L	95 (56–151)	165 (94–277)	130 (76–219)
UI/Creat, μg/g	121 (81–193)	210 (140–303)	151 (96–255)

Data presented as median (25–75th percentiles)

Milk, dairy, fish, and cereals

Several dietary (milk and dairy products) and maternal factors (maternal age, BMI, and gestational week) were associated with maternal iodine status (expressed as the urinary iodine-to-creatinine ratio, UI/Creat) across all cohorts. Milk and dairy products have been previously identified as important determinants of iodine status in pregnancy in studies in Norway, Iceland, Italy, Spain, the UK, and Australia. In the present study, a portion of "milk and dairy products" equivalent to a glass of milk (200 g) was associated with 5–14 μg/g increase in UI/Creat across cohorts. This result might be different if repeated now, especially in the UK, where the iodine concentration in milk is now higher than estimated when ALSPAC women were recruited in 1990/1991, i.e., 427 vs. 150 μg/kg.

Important cohort-specific dietary determinants were identified, such as fish intake in the UK, egg and cereal/cereal product intake in the Netherlands, and fish, salt, and meat intake in Spain. An average portion of fish (120 g) was associated with some 6–34 μg/g increase in UI/Creat, across cohorts. Variation in the effect size could partly reflect the variability in average fish consumption (e.g., women in Spain consumed more white fish than women in the UK). Consumption of cereal products was a statistically significant determinant of UI/Creat only in the Netherlands; this association is probably driven by consumption of bread which is made with iodized salt in the Netherlands (7).

Iodized salt

Intake of iodized table salt was measured only in pregnant women from Spain; 1 g of salt was associated with around 32 μg/g increase in UI/Creat. It suggests that iodized salt consumed either discretionarily (e.g., as table salt in Spain), or as part of processed foods (e.g., in bread in the Netherlands) is an important dietary determinant of iodine status. The differences in iodine status between the countries may be partly explained by differing use of iodized salt. The iodized salt penetration rate in households and the food industry (e.g., bread-making) in the Netherlands has been estimated as 60% and 70%, respectively, while a 16% penetration rate has been reported in Spanish households (8). By contrast, iodization of salt was never common in the UK, and even nowadays, its availability is very limited (21.5%); furthermore, the iodine concentration of the major UK brands is low (9).

Ethnicity

The iodine status of pregnant women from the Netherlands varied by ethnic origin, with higher iodine status in Moroccan, Turkish and other non-Western women, and lower iodine status in Surinamese and Dutch Antilles women, even after adjusting for socio-demographic factors. Variation in diet may partially explain these differences, as some of the effect estimates were attenuated when adjusting for dietary intake. Ethnicity was not significantly associated with iodine status in ALSPAC or INMA, but this may reflect the small sample sizes of other ethnic groups in these cohorts. Ethnic differences in iodine status could help to identify subgroups at high-risk for iodine insufficiency; in countries with a large proportion of diverse ethnic groups, culturally-specific approaches to improve dietary adequacy may be more suitable than a single solution for the whole population.

Conclusions

The cohort-specific dietary determinants probably reflect not only dietary habits but iodine fortification policies. Therefore, public-health interventions to improve iodine intake in pregnancy may need to be country-specific. Between countries, but also within countries with a large proportion of different ethnic groups, culturally-specific recommendations are probably necessary. Achieving and maintaining iodine sufficiency in populations require monitoring dietary determinants of iodine status so that appropriate action can be taken, where necessary.

References

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