

Maternal hypothyroxinemia in early pregnancy is associated with poorer arithmetic performance in a school test in offspring at age 5 years

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Background

- Overt hypothyroidism in pregnant women has been associated with a lower intelligence quotient in their children [1].
- Subtle impairments in maternal thyroid function have been associated with minor cognitive deficits in offspring [2,3].
- The effect of maternal free T4 within normal limits on school performance has however never been studied.

Methods

Population

1,196 Mother-child pairs from the Amsterdam Born Children and their Development (ABCD) Study were available for analysis. Free T4 was measured at the first prenatal visit, at a gestational duration of 90 (IQR: 83-100) d. At age 5 years, school test results were obtained. The Figure displays the derivation of the study sample.

Analysis

Predictors

Maternal free T4 across the normal range and maternal hypothyroxinaemia, i.e. a maternal free T4 level <10% percentile.

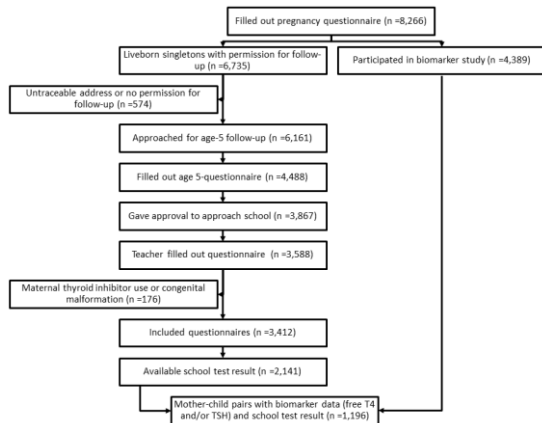
Outcomes

School performance was based on CITO (Central Institute for Test Development) test results, which are part of the Dutch monitoring and evaluation system for primary school children (Table 1). Poor school performance was defined as a test score in the lowest 25% of distribution and subnormal school performance as a score in the lowest 50%.

Statistical models

Model 1: adjusted for gender and age. Model 2: + adjusted for family background (years of maternal education and ethnicity). Model 3: + adjusted for perinatal conditions (maternal BMI, hypertension and diabetes).

Figure: Derivation of study sample



Results

Arithmetics

Maternal free T4 was inversely associated with risk of subnormal arithmetic performance (Table 2), which relation became non-significant in models 2 and 3.

Maternal hypothyroxinemia was associated with an increased risk of subnormal arithmetic performance, which relation remained significant in models 2 and 3. It was also associated with an increased risk of poor arithmetic performance but statistical significance was lost in models 2 and 3.

Language

Maternal hypothyroxinemia was associated with an increased risk of poor language performance (Table 2). However, statistical significance was lost in models 2 and 3.

Table 1: Composition of CITO test

	Grade 1	Number of questions	Grade 2	Number of questions
Arithmetics test	Colors	6	Shapes	6
	Shapes	6	Classifying	6
	Classifying	6	Sequencing	12
	Size	6	Comparing	6
	Sequencing	6	Counting	6
	Comparing	6	Numbers	6
	Counting	6		
	Total	42	Total	42
Language test	Passive vocabulary	32	Passive vocabulary	16
	Accurate listening	16	Accurate listening	8
			Sound and rhyme	8
			Recognition of first and last word	8
			Orientation in writing	8
			Auricular synthesis	8
	Total	48	Total	56

Conclusion

Maternal hypothyroxinaemia at the end of the first trimester was associated with increased risk of subnormal arithmetic performance during a school test in offspring at the age of 5. Longer follow-up is required to investigate whether this association persists.

References

1. Haddow JE, et al. N Engl J Med 1999, 341:549-555
2. Henrichs J, et al. J Clin Endocrinol Metab 2010, 95:4227-4234
3. Finken MJ, et al. J Clin Endocrinol Metab 2013, 98:1417-1426

Table 2: Associations between maternal free T4 levels and school performance in offspring

	Subnormal school performance			Poor school performance		
	OR	95% CI	P	OR	95% CI	P
Arithmetics test						
Free T4 (pmol/l)	0.89	0.81-0.98	0.02	0.88	0.76-1.01	ns
Hypothyroxinaemia	1.86	1.24-2.79	0.003	1.89	1.13-3.13	0.02*
Language test						
Free T4 (pmol/l)	0.98	0.89-1.07	ns	0.95	0.83-1.07	ns
Hypothyroxinaemia	1.36	0.90-2.06	ns	1.71	1.04-2.82	0.04*

* Statistical significance was lost in models 2 and 3.

