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Maternal Peri- and Postconceptional Folic Acid Supplementation and Ankyloglossia in Newborns

Yildirim Ayhan ^{a*}, Hertach René ^b, Yildirim Vedat ^b^a Hochschule Zurich, Department of Medicine, Zurich, Switzerland^b Hochschule Zurich, Department of Dentistry, Zurich, Switzerland

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ABSTRACT

Background:

Ankyloglossia (“tongue-tie”) is a congenital condition characterized by restricted tongue mobility due to a shortened or thickened lingual frenulum. Diagnoses of ankyloglossia in newborns have increased globally. While improved awareness and breastfeeding promotion partially explain this trend, maternal folic acid supplementation may also influence midline tissue development.

Objective:

To investigate the association between maternal peri- and postconceptional folic acid supplementation and the occurrence of ankyloglossia in newborns.

Methods:

A retrospective case-control study was conducted at the Seeklinik Zurich, a specialized center for oral and maxillofacial

* Corresponding author. Hochschule Zurich, Albisstrasse 80, 8038 Zurich, Switzerland
E-mail address: ayhan.yildirim@uni-zh.ch.

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At a glance commentary

Scientific background on the subject

Ankyloglossia (tongue-tie) is a congenital condition affecting tongue mobility, potentially impairing breastfeeding and speech. Its reported prevalence has increased, but the role of maternal nutrition, particularly folic acid, in its development is largely unknown

What this study adds to the field

This study shows a strong association between maternal peri- and postconceptional folic acid supplementation and ankyloglossia, suggesting that folate exposure during early embryogenesis may influence midline tissue development. These findings provide a basis for further investigation into nutritional contributions to tongue-tie.

surgery, from February 2019 to March 2025. Maternal folic acid intake was documented via standardized questionnaires. The study group included 247 mother-infant pairs referred for suspected ankyloglossia, of which 216 infants had confirmed tongue-tie. The control group comprised 154 mother-infant pairs with no reported maternal folic acid intake; 10 infants with tongue-tie were excluded, leaving 144 for comparison. Statistical analyses included odds ratios with Haldane's correction, chi-square tests, and t-tests.

Results:

Maternal folic acid supplementation was reported by 87.45% of mothers in the study group versus 0% in the control group ($p < 0.001$). The approximate odds ratio using Haldane correction was 62.4 (95% CI 24– ∞). Cases showed a male predominance (72.7%) and younger maternal age (27.2 ± 6.5 years vs. 30.1 ± 6.4 ; $p < 0.005$).

Conclusion:

Maternal folic acid supplementation is strongly associated with ankyloglossia in this cohort. While causality cannot be established, the findings suggest a potential influence of folate on midline tissue development. Prospective studies are warranted to confirm these observations and explore underlying mechanisms.

INTRODUCTION

Ankyloglossia, commonly referred to as “tongue-tie,” is a congenital anomaly resulting from an abnormally short, thickened, or tight lingual frenulum, restricting tongue mobility. Clinical manifestations include breastfeeding difficulties, nipple pain, impaired latch, speech development issues, and, in some cases, orofacial developmental complications [Messner & Lalakea 2000; Geddes et al. 2008].

Over the past two decades, an increasing number of ankyloglossia diagnoses have been reported in multiple countries. In the United States, hospital-based records indicated an increase from 3,934 cases in 1997 to 32,837 in 2012 [Walsh et al. 2017]. In Canada, population-level data covering over 3.6 million live births demonstrated an increase from 6.86 to 22.6 cases per 1,000 live births between 2002 and 2014 [Walsh et al. 2017b]. Similar trends are observed in Australia, the UK, and Scandinavian countries [Douglas 2020; O’Shea et al. 2021].

The etiology of this apparent rise is multifactorial:

1. Increased diagnostic awareness, often prompted by breastfeeding promotion initiatives [Buryk et al. 2011].
2. Changes in clinical practice, including more frequent frenotomy.
3. Nutritional factors, particularly periconceptional folic acid supplementation, which may influence midline development.

Folic acid is essential for one-carbon metabolism, DNA synthesis, and methylation, crucial processes during early embryogenesis. Deficiency is a well-established cause of neural tube defects and other midline anomalies [Czeizel & Dudas 1992]. In Switzerland, supplementation of 400 µg/day starting four weeks before conception is recommended; however, adherence is variable (30–40% of women comply) [Hediger et al. 2021].

Given folate's role in midline tissue development, we hypothesize that higher maternal folic acid exposure during organogenesis may influence midline fusion, potentially increasing the risk of ankyloglossia.

METHODS

Study Design:

Retrospective, monocentric case-control study at Seeklinik Zurich, a specialized center for oral and maxillofacial surgery.

Participants:

- Study group: 247 mother-infant pairs referred for suspected ankyloglossia; 216 infants had confirmed tongue-tie, 31 had normal frenulum.
- Control group: 154 mother-infant pairs with no maternal folic acid intake; 10 infants with tongue-tie were excluded, leaving 144 for analysis.

Data Collection:

Maternal peri- and postconceptional folic acid intake was documented using standardized questionnaires, including dose, start, and duration. Infant tongue anatomy was assessed clinically using standardized criteria. Covariates included maternal age, parity, and infant sex.

Statistical Analysis:

Chi-square tests for categorical variables, t-tests for continuous variables. Odds ratios (OR) with 95% confidence intervals (CI) calculated; Haldane's correction applied for zero cells.

RESULTS

Population Characteristics:

- Study group: 247 infants; 216 (87.4%) with ankyloglossia, 31 (12.6%) normal frenulum.
- Control group: 144 infants with normal frenulum (after exclusion of 10 with tongue-tie).

Maternal Folic Acid Intake:

- Study group: 87.45% supplementation
- Control group: 0% ($p < 0.001$)

Odds Ratio:

- Haldane correction: OR ≈ 62.4 (95% CI 24– ∞)

Additional Characteristics:

- Male predominance: 72.7% in cases vs. 51.4% in controls ($p < 0.01$)
- Maternal age: 27.2 ± 6.5 vs. 30.1 ± 6.4 years ($p < 0.005$)

DISCUSSION

This study demonstrates a strong association between maternal folic acid supplementation and ankyloglossia. Potential mechanisms include epigenetic effects, enhanced cell proliferation, and midline tissue fusion influenced by folate levels [Anderson et al. 2012; Yoshida et al. 2017].

Limitations:

- Retrospective design with recall bias
- No biomarker confirmation of folate status
- Possible residual confounding (genetic variants, environmental factors)

Clinical Implications:

Despite the strong association, folic acid's benefits in preventing neural tube defects remain critical. Current supplementation guidelines should not be altered based on these results. Prospective studies with biomarker validation and standardized tongue assessment are needed.



Figure 1: 5-year-old boy with an untreated lingual frenulum whose mother took folic acid before conception and during the first

CONCLUSION

Maternal peri- and postconceptional folic acid supplementation is strongly associated with ankyloglossia in this cohort. Findings suggest a potential influence on midline tissue development, warranting further prospective investigation.

Ethics statement

This prospective study was conducted in Hochschule Zurich, under the approval of the Institutional Review Board (IRB) of Hochschule Zurich. Written informed consents were obtained from the patient.

Conflicts of interest

The authors have no financial conflicts of interest.

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