

Thiamine supplementation benefits language development in infants at risk for thiamine deficiency

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Overview

Israeli infants exposed to a defective soy-based formula lacking in **thiamine -- a B-vitamin necessary for deriving energy from nutrients** -- subsequently displayed measurable delays in language development (Fattal-Valevski, et al., 2009).

These findings have raised widespread concern, given that millions of infants, especially in regions such as Southeast Asia, currently remain at risk of thiamine deficiency (National Institute of Statistics, 2011; Whitfield, et al., 2017).

Our study: In the context of a larger randomized, controlled trial, **we**

Method Overview

A four-parallel-arm, double-blind, randomized, controlled trial provided daily thiamine supplementation (a capsule containing 0, 1.2, 2.4 or 10 mg of thiamine hydrochloride) to 248 exclusively breast-feeding Cambodian mothers when their infants were between 2 and 24 weeks of age

We measured infants' language development -- both receptive and expressive -- via the **Mullen Scales of Early Learning (MSEL) at 2, 12, and 24 weeks ("endline")**, and again at a **52-week follow-up (6 months after maternal thiamine supplementation had ended)**

At 24 weeks ("endline"), **infants also participated in the IDS Task, assessing the magnitude of enhanced visual**

Mullen Scales of Early Learning (MSEL)

The MSEL assesses early cognitive development across 5 domains: (a) gross motor, (b) fine motor, (c) visual reception (non-verbal problem solving), (d) receptive language, and (e) expressive language. Studies of adapted and transnational versions of the MSEL have shown that it is a viable assessment tool across cultures and LMICs (Jensen, et al., 2019).

Prediction: We predicted a dose-response relationship between maternal thiamine supplementation and infants' language performance on the MSEL at "endline" (24 weeks)

Regression analyses controlling for baseline cognitive ability and baseline breastmilk thiamine levels revealed:

1. Infants whose breast-feeding mothers received higher dosage thiamine supplementation displayed significantly higher MSEL **receptive language scores** (beta-weight 0.136, $t = 2.36$, $p = 0.019$)
2. Infants whose breast-feeding mothers received higher dosage thiamine supplementation displayed marginally higher MSEL **expressive language scores** (beta-weight 0.10, $t = 1.73$, $p < 0.084$)
3. **Infants in the 10 mg/d group** displayed significantly higher levels of receptive and expressive language compared to all other treatment groups (no other significant group differences emerged)
4. **At 52-week follow-up (6 months after**

IDS-Related Attentional Enhancement

The IDS Task measures the extent to which infants display enhanced attention to a visual stimulus when hearing infant-directed-speech (IDS) relative to adult-directed-speech (ADS).

Rationale for the task:

- Across many cultures, speech to infants has a special character: simplified, emotionally rich, with exaggerated structure
- A recent large-scale, multi-site, replication study involving 2,329 infants demonstrated that IDS systematically elicits enhanced visual attention from infants relative to ADS (ManyBabies Consortium, 2020). This occurred even for a subset of infants who were hearing IDS and ADS instantiated in a non-native language
- IDS-enhanced attention requires that infants differentiate IDS from ADS, which in turn involves abilities for analysis of complex, streaming linguistic information

Hypothesis: Access to thiamine is important to the development of the language processing skills that underpin IDS-related attentional enhancement

Prediction: higher dosage maternal thiamine supplementation will be associated with increased magnitude of infants' IDS-related attentional enhancement

Method:

- Infants' IDS-related attentional

Relationship between MSEL and IDS Task

Not surprisingly, MSEL receptive and expressive language scores at 24 weeks were strongly positively correlated, ($r = .63$, $p = .000$)

Interestingly, however, neither infants' MSEL receptive nor expressive language scores at 24 weeks were significantly correlated with the magnitude of their IDS-related attentional enhancement at that same age (r 's $< .07$, p 's $> .25$)

These findings suggest that the MSEL measures and the IDS Task tap different aspects of infants' emerging language skills

Strikingly, maternal thiamine supplementation dose displayed a

Summary

1. **Maternal thiamine supplementation of 10 mg daily appears to protect the integrity of language development and language processing in infants at risk for thiamine deficiency**
2. **Language development is foundational to all learning;** thus, maternal thiamine supplementation during early infancy may be crucial in helping to protect infants' cognitive development more generally

VIDEO SESSION

CHAT SESSION

AUTHOR INFORMATION

ABSTRACT

REFERENCES

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