



Children's Health Ireland
at Crumlin

Micronutrient Deficiency in A Toddler with an Extremely Restricted Diet

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Ag Rialáil Gairmithe Sláinte
agus Cúraim Shóisialaigh
Regulating Health +
Social Care Professionals



When you all
feel a bit like
this....



Background

Micronutrient deficiency burden has generally reduced in the developed world but.....

- Iron deficiency still affects about 1 in 10 Irish toddlers¹
- Vitamin A and D deficiency has also been highlighted in Irish toddlers¹
- Children with more restricted diets are at greater risk of deficiency²
- Recent reports have highlighted vitamin A & D³ and vitamin C deficiencies in a number of children⁴ with autism and restricted diets

Assessing Micronutrient Status

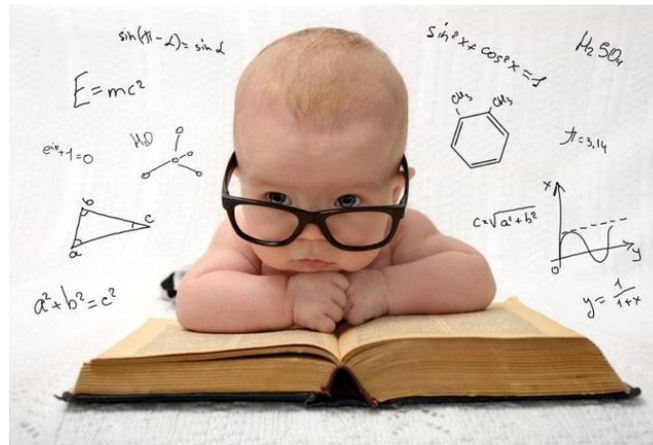
Intake

Comparative Standards: EFSA RDAs/PRIs, ARs and AIs

Inadequate intake does not always cause clinical deficiency

Biochemical

- Functional/indirect vs direct markers
- Sensitivity and specificity
- Confounding factors



Physical Exam

Subjectivity
Not general sensitive alone

Vignette

Patient 'X'

Medical History

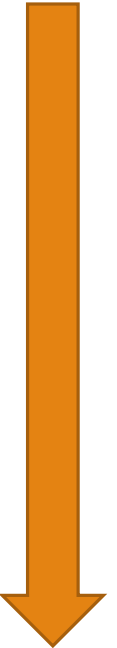
- Developmental delay
- Non-verbal
- Visual impairment (uncharacterised)

Medical Presentation

- Presented with diagnosis of iron deficiency anaemia at 4 years of age
- Referred to Dietetics with an 'extremely restricted diet'
 - query need for oral nutrition supplements
- Suspected Autistic Spectrum Disorder

Biochemistry and Haematological Findings

Test	Level	Units	Ref Range
Serum Ferritin	3.7	ng/ml	4.63-204
Haemaglobin	75	g/L	105-135
MCV	56	fL	70-86
MCH	15	pg	23-31



Physical Exam

- No clear signs or symptoms of deficiency on physical exam
- Poor dentition with clear dental tartar
- No lower GI issues reported at baseline

Anthropometry*

Variable	Result	Centile
Weight	18kg	98%
Height	100cm	91%
BMI	18.kg/m ²	98%

Appropriate weight for height.

No apparent historical issues

*UK-WHO Centile Data

Nutritional Intake

Fruit/Veg

✕

Meat/Fish/Poultry

✕

Legumes/Nuts

✕

Dairy

- Milk (800ml), yogurt (2)

Grains

- Popcorn (1-2), cereal (rarely)

Other

- Waffles (1-2), crisps (2-3)

1500mls weak tea

- 1.5 tsp sugar

- Milk was included here

Feeding History

- Reported food jags
- Very sensitive to changes in food taste, smell, appearance, texture
- Parents report giving 'whatever' to settle
- Never met a dietitian before
- Will not accept capsules/tablets



Image Source: <https://www.childfeedingguide.co.uk/tips/common-feeding-pitfalls/food-refusal/>

What now?

A word cloud featuring various vitamins and minerals. The words are arranged in a dynamic, overlapping manner with different colors and orientations. The most prominent words include 'Iron' in large white letters at the bottom left, 'Folate' in large orange letters in the center, and 'B12' in large orange letters on the right. Other visible words include 'Vitamin E', 'Copper', 'Pantothenate', 'Riboflavin', 'Thiamine', 'Manganese', 'Biotin', 'Niacin', 'Pyroxidine', 'Iodine', 'Selenium', 'Phosphorus', 'Zinc', 'Vitamin A', 'Molybdenum', 'Vitamin K', and 'EFAs'.

Iron

EFAs

Vitamin E

Riboflavin

Pantothenate

Thiamine

Manganese

Biotin

Folate

Niacin

Pyroxidine

Iodine

Selenium

Phosphorus

Zinc

Vitamin A

Molybdenum

Vitamin K

B12

Copper

Milk Composition

Nutrient provision per 200ml/1 serving

➤ 25-40% EFSA RDA

Riboflavin, calcium, phosphorus, iodine, potassium, cobalamin, pantothenate, vitamin A

➤ 10-25% EFSA RDA

Niacin, biotin, pyridoxine, folate, zinc

➤ 5-10% EFSA RDA

Thiamine, vitamin C, magnesium, selenium

Main Nutrients of Concern?

Minerals

- Copper
- Selenium
- Iron

Vitamins

- Vitamin D
- Vitamin K
- Vitamin E
- Folate

Further Biochemical Assessment

- Blood levels were suggested to screen for concomitant deficiencies

• Vitamin D:	Low at 15nmol/L	Inadequate intake, high prevalence
• Folate:	Low at 3ng/ml	Inadequate intake, masked by IDA
• Serum copper/selenium:	Normal	Inadequate intake, existing IDA
• Vitamin A:	Normal	Visual disturbance of unclear origin

Iron & Vitamin C

- Started on ferrous fumarate, 45mg elemental iron
- After a normalised FBC and Ferritin, moved to a low dose iron supplement with additional vitamin C
- Weaned off tea and no dairy around supplement time
- Annual FBC & Ferritin

Vitamin D, E, K

- Given 8 weeks of 3000IU vitamin D and 400IU there after as maintenance
 - repeat level in 4-6 months
- Vitamin E deficiency without disease even with low intake not reported⁴
 - no need assess
- No available direct marker for Vitamin K
 - PT is the only marker that sees interpretable and reliable change⁵
- Annual vitamin D and PT/PTT

Folate

- Fortified milk would provide additional Folic Acid to meet RDA (and vitamin D, E)
- Repeat level (with Vitamin D) in 4-6 months
- If within range and intake adequate, no further screens
 - FBC will indirectly assess for MA

Selenium & Copper

- Likely low risk; serum levels are **NOT** perfect markers
- Diets are rarely **totally** devoid
- Conservative monitoring approach (related to biochemical functions)
 - change in hair colour or integrity (copper, selenium)
 - growth delay (potentially copper)
 - refractory anaemia or neutropenia (copper)
 - unexplained hypothyroidism with adequate iodine (potentially selenium)

Management: General



- Review bi-annually
- Focus on monitoring, supplementation and reassurance
- Milk intake was maintained
- Annual FBC, Ferritin, PT +/- Vitamin D

Closing Thoughts - Assessing

- Children can grow well EVEN with extremely restricted diets
- Monitor and be cognisant of the physical features/symptoms you might expect
- Be selective and have a rationale for what biochemical screens you do
- Trace-elements.co.uk is a really useful resource for biochemical testing information
- For RDs, '*Pediatric Nutrition-Focused Physical Exam Pocket Guide*' by the Academy of Nutrition & Dietetics is excellent
- If you are a GP or PHN, try access a local dietetic service



Closing Thoughts - Management



- Be mindful of preparations and avoid 'tricking' children to take supplements
- Consider the side-effects of supplements!
- Be pragmatic
- The child doesn't need ONS. A follow-on formula milk COULD be considered



FOR STAYING
AWAKE!



Image Source: <https://www.picturepunches.com/picture/96780>

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