



INTRODUCTION

- Iron is critical for erythropoiesis, notably haemoglobin synthesis.
- Food insecurity is associated with micronutrient deficiencies including iron, and subsequently with poor health outcomes^{1,2}.
- However, iron biomarkers and their association with food insecurity among Malaysian children remains unknown.
- Thus, establishing the association between iron status and food insecurity is important for children's well-being.

OBJECTIVE

To assess the association between iron status and food insecurity among primary school children in Peninsular Malaysia

METHODOLOGY

Study Design	Sampling	
Cross-sectional study; part of South East Asian Nutrition Surveys (SEANUTS II) Malaysia	Multistage cluster sampling	
Study location	Subjects	
Peninsular Malaysia; both urban and rural locations	Inclusion criteria ✓ Malaysian children ✓ 7 to 12 years old ✓ Parental written informed consent Exclusion criteria X All conditions that prevent involvement during data collection or blood withdrawal	
Region	Urban	Rural
Northern	Timur Laut	Kerian
Southern	Seremban	Kota Tinggi
Central	Kuala Lumpur	Kuala Langat
East Coast	Kuantan	Pasir Mas

Ethical Approval & Permission to Conduct Study

- UKM Research Ethics Committee (UKM JEP-2018-569)
- Ministry of Education, Malaysia

Terminology

Term	Definition
Iron deficiency ³	Serum ferritin <15 µg/L
Anaemia ⁴	Haemoglobin concentration ≤114 g/L (7-11 years old) ≤119 g/L (12 years old)
Iron deficiency anaemia (IDA) ⁵	Both serum ferritin and haemoglobin concentration levels below the normal range

Instruments

Questionnaires:

- Sociodemographic (SES)
- Radimer/Cornell Hunger and Food Insecurity Instrument (Malay-translated version) (FIQ)

Blood analysis:

- Full blood count (FBC)
- Serum ferritin
- C-reactive protein (CRP)

Statistical Analysis

- IBM SPSS Version 26
- Pearson Chi Square test
- Fisher exact test
- Independent T-test

RESULTS

Table 1: Haemoglobin concentration, serum ferritin and CRP between urban and rural areas

Variables	Total subjects, n=312		95% CI	t	p-value
	Urban	Rural			
Haemoglobin, g/L (Mean ± SD)	133.4±9.0	132.2±9.2	-1.0, 3.4	1.07	0.285
Ferritin, µg/L (Mean ± SD)	57.7±31.6	61.0±29.5	-10.8, 4.2	-0.877	0.381
CRP, mg/L (Mean ± SD)	0.38±0.49	0.67±2.47	-1.07, 0.43	-4.662	<0.01**

Significance difference based on independent t-test at ** p<0.01. Subjects with inflammation marked by elevated C-reactive protein (CRP) concentration >5 mg/L were excluded in analysis³.

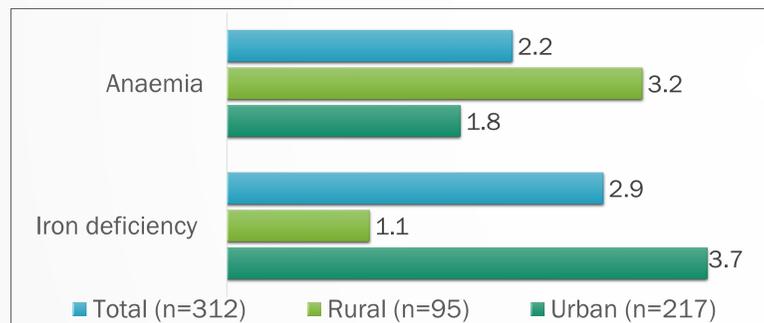


Figure 1: Prevalence of iron deficiency and anaemia

Table 2: Food security status by location

Classification	Total subjects, n=312			χ ²	p-value
	Overall	Urban	Rural		
Food secure households	190 (60.9)	133 (61.3)	57 (60.0)	0.312	0.958
Food insecure households	57 (18.3)	40 (18.4)	17 (17.9)		
Individual food insecure	24 (7.7)	17 (7.8)	7 (7.4)		
Child hunger	41 (13.1)	27 (12.4)	14 (14.7)		

RESULTS

Table 3: Association between iron status and food security status among primary school children

	Normal iron stores	Iron deficiency	χ ²	p-value
Food secure	185 (97.4)	5 (2.6)	-	0.741
Food insecure	118 (96.7)	4 (3.3)		

* Fisher's Exact Test

DISCUSSION

Prevalence of iron deficiency and anaemia

- Majority of children had normal iron status (97.1%) and were non-anaemic (97.8%) (Figure 1).
- Iron deficiency and anaemia prevalence among school aged children aged 7-12 were only 2.9% and 2.2%, respectively (Figure 1).
- Overall, only 1 subject (0.3%) can be categorised as having IDA (female, living in rural location).
- Prevalence of iron deficiency and anaemia in this study was lower compared to local studies^{6,7} among school aged children.

C-reactive protein (CRP)

- Higher CRP value among rural children indicated that they are more susceptible to infection probably parasitic infections⁸, thus increasing their risk of developing anaemia.

Food security status

- More than half the children (60.9%) lived in food secure households (Table 2).
- Both children living in rural and urban areas experiencing similar household food insecure, individual food insecure and child hunger status (Table 2).
- Children experiencing child hunger, an indicator of severe household food insufficiency⁹ were at risk of poor general health¹⁰.

DISCUSSION

Iron Status and its Association with Food Insecurity

- No association between iron status and food security status (Table 3) may be due to low prevalence of iron deficiency and IDA among children 7-12 years old.
- This result was similar to a Canadian study¹ whereby no association between serum ferritin (<15 µg/L) with food security status was found.
- However, a study in United States¹¹ shown that children from food insecure households were 2.95 times at risk of IDA compared to children from food secure households.

CONCLUSION

- No association between iron status and food insecurity was seen in this study.
- However, it is worthy to note that rural children had higher CRP value, thus this may affect the child's development in the long term.
- Other inflammatory marker such as α-1-acid glycoprotein (AGP) should be included in the future studies for the interpretation of serum ferritin.

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