

**THE PREVALENCE OF ANAEMIA AND
ITS ASSOCIATED RISK FACTORS IN CHILDREN
ADMITTED TO GENERAL PAEDIATRIC WARD
AT HOSPITAL UNIVERSITI SAINS MALAYSIA,
KELANTAN**

DR SUI PAN YUEN

**Dissertation Submitted in Partial Fulfilment of the Requirements
for the Degree of Master of Medicine (Paediatrics)**



UNIVERSITI SAINS MALAYSIA

2022

CHAPTER I

THE PRELIMINARIES

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I would like to thank our Human Research and Ethics Committee (JEPeM), School of Medical Sciences, Universiti Sains Malaysia for the approval to proceed with this dissertation.

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I would like to take this opportunity to thank my beloved parents and husband for their love, support, and prayers throughout my journey.

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ABBREVIATIONS AND NOMENCLATURE

USM	Universiti Sains Malaysia
Hospital USM	Hospital Universiti Sains Malaysia
ED	Emergency Department
WHO	World Health Organization
FBC	Full Blood Count
Hb	Haemoglobin
RBC	Red Blood Cell
MCV	Mean Corpuscular Volume
MCH	Mean Corpuscular Haemoglobin
kg	Kilogram
ID(A)	Iron Deficiency (Anaemia)
SPSS	Statistical Package for Social Sciences
(A)OR	(Adjusted) Odds Ratio

ABSTRAK

Pengenalan: Anemia merupakan penyakit yang biasa berlaku di kalangan kanak-kanak di seluruh dunia, namun ia adalah satu masalah kesihatan yang kerap diabaikan jika ia tidak mengancam nyawa. Kajian ini bertujuan untuk menentukan prevalen anemia di kalangan kanak-kanak yang dimasukkan ke hospital dan mengenal pasti faktor risiko yang berkaitan dengan anemia.

Kaedah: Kajian retrospektif telah dijalankan dari Januari hingga Disember 2021 ke atas 792 pesakit kanak – kanak berumur dari 6 bulan hingga kurang daripada 12 tahun, yang mengalami penyakit akut dan telah dimasukkan ke wad pediatrik di Hospital Universiti Sains Malaysia dari bulan Januari hingga Disember tahun 2021. Kami telah menganalisis data sosioekonomi dan demografi, dan faktor risiko yang berkaitan dengan anemia.

Keputusan: Prevalen anaemia di kalangan pesakit kanak-kanak yang berumur dari 6 bulan hingga 12 tahun adalah 16.4%. Lingkungan umur dari 6 hingga 59 bulan mempunyai perkaitan yang signifikan dengan anemia dimana nisbah ganjil adalah 3.73 berbanding kumpulan pesakit yang berumur 5 hingga 11 tahun (Adj OR 3.73, 95% CI 2.53-5.49). Berat lahir melebihi 2.5kg mempunyai perkaitan yang signifikan dengan anemia dimana nisbah ganjil adalah 1.80 berbanding dengan pesakit kurang daripada 2.5kg (Adj OR 1.79, 95% CI 1.12-2.88).

Kesimpulan: Berdasarkan ‘WHO severity classification’, prevalen anemia di kalangan populasi yang dikaji adalah masalah kesihatan awam tahap ringan. Kanak-kanak yang berumur dari 6 hingga 59 bulan dan berat lahir mereka yang melebihi 2.5kg lebih berkemungkinan menghadapi anemia. Suplemen zat besi awal perlu diambil kira untuk mengurangkan anemia di kalangan populasi ini.

Kata Kunci: prevalen, anemia, faktor risiko, kanak - kanak, penyakit akut

ABSTRACT

Introduction: Anaemia is a common disease in children worldwide, yet a commonly overlooked health problem if not life-threatening. This study aimed to determine the prevalence of anaemia in hospitalized children and identify its associated risk factors.

Methods: A retrospective study was conducted from January to December 2021 on 792 patients aged 6 months to less than 12 years old with acute illnesses, who were admitted to general paediatric ward in Hospital Universiti Sains Malaysia. We analysed socioeconomic and demographic data, and risk factors associated with anaemia.

Result: The overall prevalence of anaemia among children aged 6 months to less than 12 years old was 16.4%. The age group of 6 to 59 months has a significant association with anaemia with 3.73 odds compared to the age group of 5 to 11 years (Adj OR 3.73, 95% CI 2.53-5.49). Birth weight of more than 2.5kg has a significant association with anaemia with 1.80 odds compared to weight less than 2.5kg (Adj OR 1.79, 95% CI 1.12-2.88).

Conclusion: The prevalence of anaemia in the studied population was considered as a mild public health problem according to WHO severity classification. Children aged 6 to 59 months and those with birth weight more than or equivalent to 2.5kg were more likely to be anaemic. Early iron supplementation should be taken into consideration to reduce anaemia in this population.

Keywords: Prevalence, anaemia, risk factors, children, acute illness

CHAPTER II: THE TEXT

2.1 Section A

INTRODUCTION

INTRODUCTION

Anaemia is one of the most common diseases in children globally. According to World Health Organization (WHO) data in the year 2019, the global anaemia prevalence was 39.8% (95% UI 36.0%, 43.8%) in children aged 6 to 59 months, equivalent to 269 million children with anaemia. Since the year 2000, the global prevalence of anaemia in children under five has slowly decreased over the years, from 48.0% (95% UI 45.1%, 51.0%) to 39.8% (95% UI 36%, 43.8%), and it remained static from the year 2010. In Malaysia, the overall prevalence of anaemia in 2019 for those aged 6 to 59 months was 24.6%, considered a moderate public health problem according to the WHO severity classification [1]. Among Malaysian preschool and school-aged children, the SEANUTS study reported that the prevalence of anaemia was 6.6% [2]. On the other hand, some studies in several remote locations in Malaysia, have found that the prevalence of anaemia among Malaysian children ranged between 26.2% and 48.5% [3].

Anaemia is defined as a condition of insufficient red blood cells or haemoglobin concentration to meet physiological needs which can lead to various consequences including impaired cognition and behavioural problems. Haemoglobin concentration is the most reliable indicator of anaemia at the population level. Anaemia is defined as having haemoglobin level below the cut-off point according to different age ranges and sex as defined by WHO: (i) ≤ 10.9 g/dL for 6 to 59 months old; (ii) ≤ 11.4 g/dL for 5 to 11 years; and (iii) ≤ 11.9 g/dL for 12 to 14 years [4-6]. Anaemia can be further classified into normochromic normocytic, hypochromic microcytic, and hyperchromic macrocytic by the mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) levels.

In Malaysia, various studies were conducted where most of them focused on iron deficiency anaemia (IDA) and thalassaemia specifically. Studies published in Kelantan in 2006 and 2019 noted that the prevalence of anaemia and IDA among these children was high because

of prolonged breastfeeding beyond six months of age and failure to introduce formula milk [7]. Birth weight, household size, height, weight, and body mass index was significantly associated with iron deficiency (ID) based on serum ferritin level [8].

Most of the studies were done in healthy individuals; whereas there was a lack of exploration on anaemia in children presenting with acute illness.

This study is the first study done in the east coast and northern region of Malaysia to determine the prevalence of anaemia and its associated risk factors in hospitalized children. Knowing the risk factors associated with anaemia will provide huge input to the clinician particularly to detect and investigate the aetiology, focusing on the socio-economic and demographic background of patients. This will lead to more meticulous prevention and management of anaemia to reduce further complications.

Full blood count (FBC) is a routine investigation for children who require admission to the ward. This is a good opportunity to capture the data of these children at risk especially when they presented with concurrent acute illness.

Anaemia is often a neglected issue in children admitted to the wards with acute illness, where most of us only focus on and treat the main presenting condition. Anaemia would not gain immediate attention if it is not life-threatening. Hence, this study aim to determine the prevalence of anaemia, and its associated factors in children with acute illnesses, who were admitted to the general paediatric ward at Hospital Universiti Sains Malaysia.

2.2 SECTION B:

STUDY PROTOCOL

2.2.1 DOCUMENTS SUBMITTED FOR ETHICAL APPROVAL

DISSERTATION PROPOSAL



School of Medical Science

Universiti Sains Malaysia

Prepared in Partial Requirement Fulfilment

For the Degree of Master in Medicine (Paediatrics)

2018/2022

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**Research Title: The Prevalence of Anaemia and Its Associated Risk Factors in Children
Admitted to General Paediatric Ward at Hospital Universiti Sains Malaysia, Kelantan.**

Principal Investigator : Dr Sui Pan Yuen, Hospital Raja Perempuan Zainab II, Kelantan

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Co-Supervisor : Assoc. Prof. Dr Ariffin Nasir, Hospital USM, Kelantan.

Introduction

Anaemia is one of the most common diseases in children globally. According to World Health Organization (WHO) data in the year 2019, the global anaemia prevalence was 39.8% (95% UI 36.0%, 43.8%) in children aged 6 to 59 months, equivalent to 269 million children with anaemia. Since the year 2000, the global prevalence of anaemia in children under five has slowly decreased over the years, from 48.0% (95% UI 45.1%, 51.0%) to 39.8% (95% UI 36%, 43.8%), and it remained static from the year 2010. In Malaysia, the overall prevalence of anaemia in 2019 for those aged 6 to 59 months was 24.6%, considered a moderate public health problem according to the WHO severity classification [1]. Among Malaysian preschool and school-aged children, the SEANUTS study reported that the prevalence of anaemia was 6.6% [2]. On the other hand, some studies in several remote locations in Malaysia, have found that the prevalence of anaemia among Malaysian children ranged between 26.2% and 48.5% [3].

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Full blood count (FBC) is a routine investigation for children who require admission to the ward. This is a good opportunity to capture the data of these children at risk especially when they presented with concurrent acute illness.

Anaemia is often a neglected issue in children admitted to the wards with acute illness, where most of us only focus on and treat the main presenting condition. Anaemia would not gain immediate attention if it is not life-threatening. Hence, the aim of this study is to determine the prevalence of anaemia, and its associated factors in children with acute illnesses, who were admitted to the general paediatric ward at Hospital Universiti Sains Malaysia.

Problem statement & Study rationale

This study is the first study done in the east coast and northern region of Malaysia to determine the prevalence of anaemia and its associated risk factors in hospitalized children. Identifying the risk factors associated with anaemia will provide huge input to the clinician particularly to detect and investigate the aetiology, focus on the socio-economic and demographic background of patients and be more meticulous in the prevention and management of anaemia to reduce further complications.

Study Objectives

General: To address the issue of anaemia in children admitted to general paediatric ward in Hospital USM.

Specific:

1. To describe epidemiological features in children with anaemia.
2. To determine the prevalence of anaemia cases in children admitted to general paediatric ward in Hospital USM.
3. To examine the association between multiple risk factors toward the presence of anaemia.

Literature Review

Anaemia remains a common health problem in children. A pro active screening and follow up programme with early intervention needs to be enforced to prevent further complications.

A cross sectional study by Siti Noor et al determined the prevalence of anaemia was 65.1% among pre-school children in Kota Bharu, Kelantan. Result showed prolonged breastfeeding more than six months of age had significant association with anaemia [7].

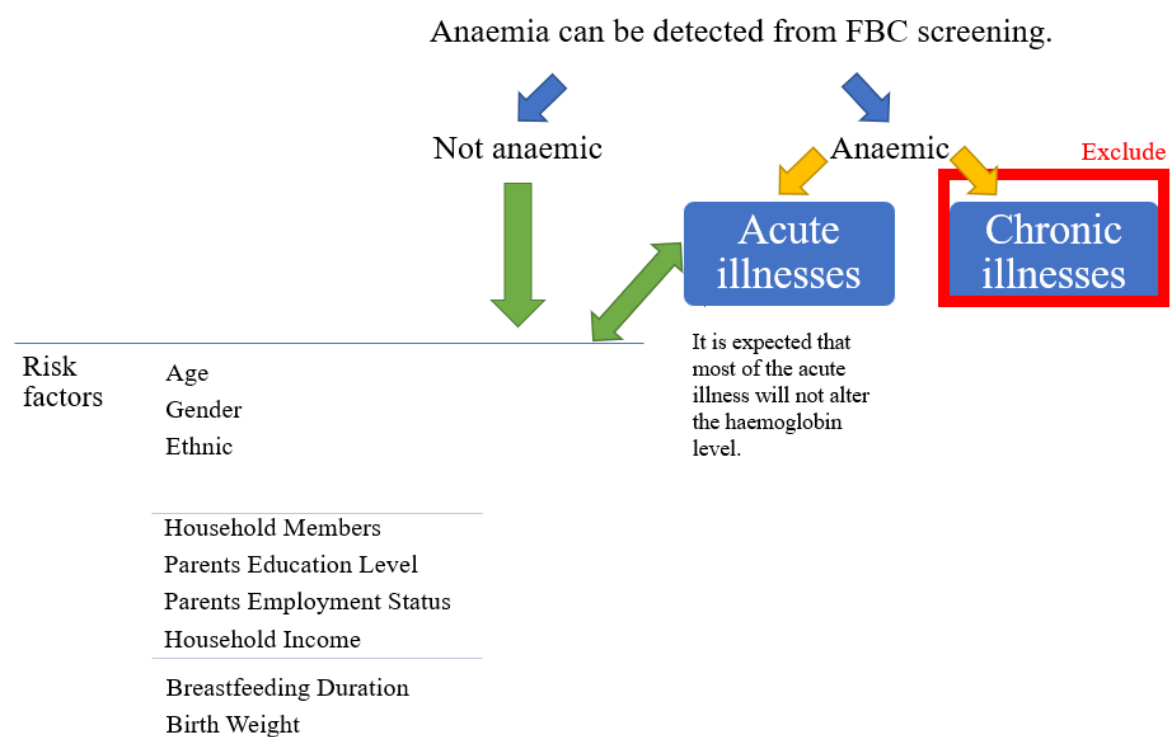
A study by Halib et al reported the prevalence of 7.7% iron deficiency anaemia and its associated risk factors among primary school children in Kelantan. Result showed that birth weight, household size, anthropometric parameters was significantly correlated with iron deficiency [8].

A cross sectional study by Salami et al among Lebanese hospitalized children analysed sociodemographic data, iron supplementation and disease of diagnosis in association with anaemia. Results showed that the prevalence of mild anaemia was 71.8%. The risk of anaemia increases by 3.4 folds among malnourished children, whereas the risk decreased by 42% in children receiving iron supplement [9].

A cross sectional study by Suria et al determine the prevalence of anaemia was 22.3% in children aged six months to fifteen years old. However no significant association was found [13].

A study by Romano Ngui et al reported the prevalence of anaemia was 26.2% in children from rural areas in West Malaysia. Neglected parasitic infections were significantly associated with anaemia [27].

Conceptual Framework



Methodology

Research design

This is a cross-sectional study of paediatric cases presented with acute illnesses that were admitted to general paediatric ward in Hospital USM from January to December year 2021. Data was collected after obtaining informed consent from parents.

Study area

General paediatric ward at Hospital USM.

Study population

Children presented with acute illness, with laboratory findings of anaemia, who are admitted to general paediatric ward in Hospital USM.

Subject criteria

Inclusion Criteria:

Children aged from 6 months to less than 12 years old admitted to paediatric general ward presented with acute illness, with no known underlying illness, with haemoglobin level considered as anaemia based on age range as recommended by WHO, from January to December 2021.

Exclusion Criteria:

Children with underlying chronic illness, medical condition lasting a year or more, and require ongoing medical attention or having limited activities of daily living, or both. (E.g. children with cerebral palsy, thalassaemia, chronic kidney disease etc.)

Sample size estimation

The sample size is calculated using the Sample Size calculator v2.0

1 proportion – Estimation		
Proportion (p)	24.60%	
Precision	5.00%	
Significance level (α)	0.050	Two-tailed
Drop-out	10%	
Sample size	286	
Sample size (with drop-out)	318	

The proportion of 24.6% is used as a cross-reference [1].

$$n = \frac{Z^2 p(1 - p)}{d^2}$$

n = min. required sample

Z = value of standard normal distribution = 1.96

d = precision = 5%

p = 24.6%

n = 285

Considering 10% non-response, minimum required sample + 10% = 314

Sampling method and subject recruitment

As this is a retrospective study, all data will be retrieved from a list of patients identified from the general paediatric ward census from January to December 2021. Patients who fulfilled the inclusion criteria will be recruited into this study.

Research tool

A study proforma will be used to collect the information required in this study based on the inclusion criteria and the risk factors that are being studied.

Operational definition

- **Anaemia:** A condition. of insufficient red blood cells (RBC) or the haemoglobin (Hb) concentration to meet physiological needs, leading to various consequences associated with poor health, impaired cognitive development and behavioural problems. Anaemia is defined as having haemoglobin level below the cut-off point according to different age ranges and sex as defined by WHO: (i) ≤ 10.9 g/dL for 6 to 59 months old; (ii) ≤ 11.4 g/dL for 5 to 11 years; and (iii) ≤ 11.9 g/dL for 12 to 14 years [3-5].
- **Haemoglobin:** This is a measure of the concentration of the red blood cell pigment in whole blood, expressed as grams per 100 mL (dL) of whole blood. The WHO reference values for the severity of anaemia in children are as follows:

Haemoglobin levels to diagnose anaemia at sea level (g/dL)

Population	Non Anaemia	Mild	Anaemia Moderate	Severe
Children 6 – 59 months of age	≥ 11.0	10.0 – 10.9	7.0 – 9.9	< 7.0
Children 5 – 11 years of age	≥ 11.5	11.0 – 11.4	8.0 – 10.9	< 8.0
Children 12 – 14 years of age	≥ 12.0	11.0 – 11.9	8.0 – 10.9	< 8.0

- **Acute illness:** A disease of rapid onset, severe symptoms, and brief duration.

Oxford Medical Dictionary fifth edition

- **Household income:**

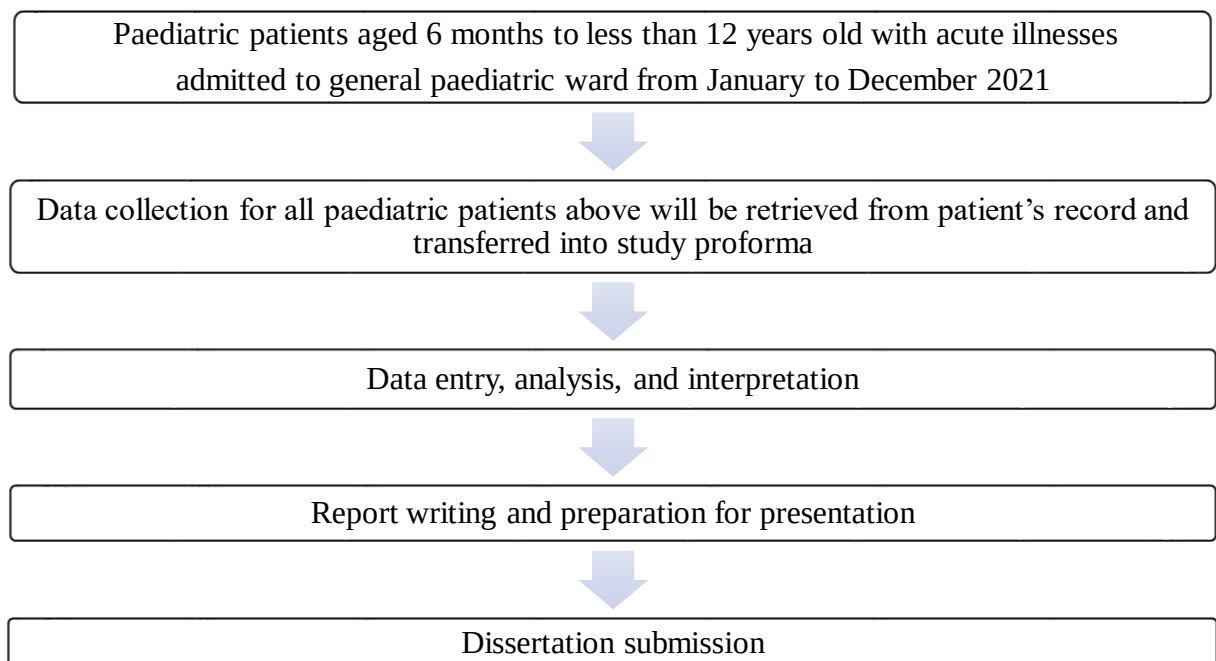
B40 – low	$< \text{MYR}4,850$
M40 – moderate	$\text{MYR}4,850 - \text{MYR}10,959$
T20 – high	$\geq \text{MYR}10,960$

Department of Statistics' Malaysia: Household Income and Basic Amenities Survey 2019

Data collection method

Data will be collected via study proforma which is only accessible to the research team and will be kept confidential.

Study flow chart



Data analysis

Data were analysed using IBM SPSS Statistics for Windows version 26 software. Descriptive analysis was conducted to describe the prevalence of anaemia. The relationship between sociodemographic factors and caregiver-related factor with anaemia were analysed using multiple logistic regression. A p-value of less than 0.05 was considered statistically significant.

Expected result(s)

Table 1: Sociodemographic factors and caregiver-related factors with anaemia in children aged 6 months to less than 12 years old admitted in general paediatric ward, Hospital USM.

Variables	Anaemia	Non-Anaemic	P value
Age 6 – 59 months 5 – 12 years			
Gender Male Female			
Ethnicity Malay Chinese Indian Others			
Household Members 1-3 person 4 – 6 person 7 – 9 person >10 person			
Parents/ Guardian's Level of Education No formal education/ Never been to school Primary school Secondary school College/ University			
Parents/Guardian's Employment Status Government sector Private sector Self-employed			

Labour work			
Not working/ housewife			
Others			
Household Income			
Exclusive breastfeeding duration			
< 6 months			
≥ 6 months			
Birth weight			
< 2.5kg			
≥ 2.5kg			

Table 2: Associated factors for anaemia by simple and multiple logistic regression.

Variables	Simple Logistic Regression		Multiple Logistic Regression	
	Crude OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Age 6 – 59 months 5 – 12 years				
Gender Male Female				
Ethnic Malay Chinese Indian Others				
Household Members 1-3 person 4-6 person 7-9 person >10 person				
Parents/ Guardian's Level of Education No formal education/ never been to school Primary school Secondary school College/ university				
Parents/ Guardian's Employment Status Government sector Private sector Self-employed Labour work				

Not working/ housewife Others				
Household income				
Exclusive breastfeeding duration < 6 months ≥ 6 months				
Birth weight < 2.5kg ≥ 2.5kg				

Ethical consideration(s)

Ethical clearance will be obtained from Research Ethics Committee from Hospital USM. Personal information will be safeguarded to ensure confidentiality. Socioeconomic status remained a sensitive issue for some. All individual data will not be reported and will be kept secured. All forms are anonymous using code numbers and will be entered into SPSS software. Only research team members can access the data. Data will be presented as grouped data and will not identify the responders individually. A separate list of names, and registration number with code numbers will be kept by the researcher.

Declaration for absence of conflict of interest

No conflict of interest.

Privacy and confidentiality

All forms are anonymous using code numbers and will be entered into SPSS software. Only research team members can access the data. Data will be presented as grouped data and will not identify the responders individually. A separate list of names, and registration numbers with code numbers will be kept by the researcher.

Community sensitivities and benefits

This study will benefit the community by further increasing the awareness and understanding of the disease concerned and help to improve the treatment and prevention of the disease.

Honorarium and incentives

Not applicable.

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