

## Anaemia and its associated factors among pregnant women in Malaysia

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### ABSTRACT

**Introduction:** Despite remarkable improvement in maternal health, anaemia during pregnancy remains a significant public health threat to Malaysian women. This study aimed to determine the prevalence, severity, and associated factors of anaemia in pregnancy among pregnant mothers in Seremban, Negeri Sembilan. **Methods:** A total of 482 pregnant mothers were recruited using cluster sampling. Data were collected using a validated and pre-tested self-administered questionnaire consisting of four sections, namely socio-demographic and socio-economic details, obstetric history, nutritional factors, and iron supplementation status. In this study, anaemia in pregnancy was defined as haemoglobin (Hb) <11.0 g/dL, which was based on blood test taken during the first trimester. The data were analysed using IBM SPSS version 23.0. Multiple logistic regression analysis was conducted to determine the predictive model for anaemia during pregnancy among the respondents. **Results:** The prevalence of anaemia in pregnancy among the respondents was 22.0%, with 95.3% respondents mildly anaemic. Respondents with an intake of iron supplementation of once daily (AOR=0.191, 95% CI: 0.074-0.914), more than once daily (AOR=0.149, 95%CI: 0.091-0.248), and low intake of seafood (AOR=0.320, 95% CI: 0.187-0.526) were less likely to develop anaemia during pregnancy. **Conclusion:** The findings revealed moderate level of anaemia in pregnancy, which was dominated by those in the mild category, with increased risk predicted among young mothers. Iron supplementation (once daily or more) and low intake of seafood protected mothers from developing anaemia during pregnancy.

**Keywords:** anaemia, pregnancy, maternal health

### INTRODUCTION

Anaemia during pregnancy remains a public health concern globally, particularly in developing countries. It is associated with maternal and foetal adverse outcomes. According to the World Health Organization (WHO, 2001), anaemia is considered to be of a public health significance or problem if the prevalence is 5.0% or higher, while

a prevalence of more than 40% in a population is classified by WHO (2008) as a severe public health problem. High prevalence of anaemia has been reported among pregnant women in low- and middle-income countries (LMIC), with the highest in Sub-Saharan Africa (SSA) (57%), followed by Southeast Asia (48%), and lowest prevalence (24.1%) found in South America (WHO, 2008). In general,

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Pasricha & Drakesmith (2016) assumed that 50% of the cases of anaemia are due to iron deficiency, in which WHO (2015) reported iron deficiency anaemia (IDA) being one of the top ten contributors to global burden of disease. Pregnancy is associated with increased iron demand and therefore increases the risk of iron deficiency anaemia.

According to Milman (2008), women who become pregnant require favourable iron status to ensure good well-being of the mother, development of the foetus, and maturity of the newborn infant. In another study, Milman (2015) also reported the various negative impacts of IDA on the foetus and newborn, which include impaired brain development, premature birth, low birth weight for gestational age, and birth complications.

High prevalence of anaemia in pregnancy was previously reported in Malaysia, with 38% of pregnant women having anaemia according to the WHO survey (McLean *et al.*, 2009). Additionally, a frequency of 35% to 42% in Selangor, Johor and Kelantan, respectively, were reported in previous research, in both urban and rural areas (Hassan, Abdullah & Nik Hussain, 2005; Haniff *et al.*, 2007; Thirukkanesh & Zahara, 2010). Furthermore, the prevalence of anaemia was also reported to increase with increasing gestational age, being 12% in the first, 32% in the second, and 43% in the third trimester (Haniff *et al.*, 2007). Meanwhile, in a survey conducted by the Malaysian Institute of Public Health (IPH), a prevalence of 29.3% was reported, with 8.3% of pregnant women aged 15 to 49 years having associated medical conditions (Thirukkanesh & Zahara, 2010). This study aimed to determine the prevalence and associated factors of anaemia among pregnant mothers in Seremban, Negeri Sembilan. Negeri Sembilan was noted to have the highest prevalence of anaemia at 29.7%, compared to all other states in Malaysia

in the National Health and Morbidity Survey 2015 (IPH, 2020).

## **MATERIALS AND METHODS**

### **Study design and sampling**

A cross-sectional study was conducted among antenatal mothers in the Seremban district. Cluster sampling was employed to randomly sample five health clinics from a total of 12 in the district of Seremban. Based on the calculated cluster size, which was calculated using the estimated attendance of antenatal women per month of 2504 in the 12 health clinics, the estimated sample size was 548. The inclusion criteria were Malaysian and pregnant women who were 18 years old and above. Those who were known to have thalassaemia, sickle cell anaemia, Southeast Asian ovalocytosis, myeloma, sideroblastic anaemia, aplastic anaemia, anaemia secondary to chronic diseases, chronic kidney disease and hypothyroidism, parasitic infestation causing anaemia, and anaemia of any causes before pregnancy were excluded.

### **Study instrument**

The data were collected using a reliable and validated self-administrated questionnaire with Cronbach's alpha and kappa agreement coefficients ranging between 0.686 and 0.843, respectively. Content and face validity were conducted, with the content of the questionnaire assessed by two expert panel members - a Family Medicine Specialist and a Nutritionist. A pre-test involving 55 respondents (10% of estimated *N*) of similar background was conducted to check for face validity. All changes were addressed accordingly based on inputs given by the expert panelists, as well as the respondents involved in the pre-test. Back-to-back translation was also conducted to ensure accuracy of information in both

the Malay and English versions of the questionnaire.

There were 4 sections in this questionnaire, socio-demographic and socio-economic details, obstetric history, nutritional factors, and iron supplementation status. Anaemia in pregnancy was defined as haemoglobin (Hb) <11.0 g/dL, with mild, moderate and severe anaemia in pregnancy refer to Hb levels of 10.0 to 10.9, 7.0 to 9.9 and <7.0 g/dL respectively (WHO, 2011). Daily nutritional history was collected using a list of animal protein (6 items), vegetables (11 items), fruits (11 items), cereals (8 items), and seafood (6 items), as well as consumption of black tea (1 cup/day, >1 cup/day). All items were measured using a 5-point Likert scale ranging from 0 to 4, in which 0 = never consume, 1 = once monthly, 2 = once weekly, 3 = 2-3 times a day, and 4 = daily intake. As for iron supplementation status, a history related to the frequency of intake, supplier, and method of consumption were also obtained.

### Data analysis

Data were analysed using IBM SPSS version 22.0. The cut-off points for high intake of vegetables, fruits, cereals, meat, and seafood were decided based on their mean scores. The association between two categorical data was determined by Chi-square test, and a significant association was taken at  $p < 0.05$  with 95% CI. Meanwhile, multiple logistic regression was used to determine the predictors for anaemia during pregnancy.

### Ethical approval

Approvals were obtained from the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia, and Ethics Committee of Universiti Putra Malaysia prior to the study. Individual consent was also obtained prior to distribution of questionnaire.

## RESULTS

### Prevalence of anaemia in pregnancy

The prevalence of anaemia among the respondents is shown in Table 1, with 22% of them having anaemia during pregnancy, of which more than 90% were of mild severity.

**Table 1.** Prevalence of anaemia in pregnancy among respondents

Characteristics	<i>n</i>	%
Anaemia status		
No	376	78.0
Yes	106	22.0
Mild	101	95.3
Moderate	4	3.8
Severe	1	0.9

### Characteristics of respondents

Meanwhile, the general characteristics of the respondents are shown in Table 2. Mean age of the respondents was 29.8±4.8 years old, which were dominated by Malays (74.4%), those with tertiary education (76.6%), unemployed (56.2%), had a household income of >RM 5000 (31.5%), multigravida (56.4%), in the 3rd trimester of pregnancy (61.4%), singleton foetus (99.6%), no history of antepartum haemorrhage (95.2%) and miscarriages (79.9%), had a child spacing of 2 years or more (57.1%), non-obese (85.3%), and non-smoker (99.8%). Majority of the respondents were also non-vegetarian (99.4%), with low consumption of black tea (97.5%), and taking iron supplementation (88.8%) on a daily basis (79.4%) with plain water or fruit juices (98.4%).

### Factors associated with anaemia in pregnancy

Significant associations ( $p < 0.05$ ) were found between anaemia and maternal education, gravidity, pregnancy trimester, child spacing, seafood intake, intake of iron supplementation, frequency

**Table 2.** Characteristics of the respondents

<i>Characteristics</i>	<i>n</i>	<i>%</i>
Sociodemographic factors		
Age (Years) [mean±SD]		29.8±4.8
Ethnicity		
Malay	360	74.7
Chinese	57	11.8
Indian	57	11.8
Others	8	1.7
Residential area		
Urban	239	49.6
Rural	243	50.4
Maternal education		
Primary	14	2.9
Secondary	99	20.5
Tertiary	369	76.6
Maternal employment status		
Employed	271	43.8
Unemployed	211	56.2
Household income		
< RM 1000	2	0.4
RM 1000 – RM1999	56	11.6
RM 2000 – RM2999	92	19.1
RM 3000 – RM3999	106	22.0
RM 4000 – RM4999	74	15.4
> RM 5000	152	31.5
Marital status		
Married	476	98.8
Unmarried	6	1.2
Obstetric history		
Gravidity		
Primigravida	158	32.8
Multigravida	272	56.4
Grand-multigravida	52	10.8
Pregnancy trimester		
1 <sup>st</sup> trimester	17	3.5
2 <sup>nd</sup> trimester	169	35.1
3 <sup>rd</sup> trimester	296	61.4
Number of foetus		
Singleton	480	99.6
Twins or more	2	0.4
History of antepartum haemorrhage (APH)		
Yes	23	4.8
No	459	95.2
History of miscarriages		
Yes	97	20.1
No	385	79.9
Child spacing (years) <sup>†</sup>		
< 2 years	139	42.9
≥ 2 years	185	57.1

**Table 2.** Characteristics of the respondents [Cont'd]

<i>Characteristics</i>	<i>n</i>	<i>%</i>
Co-morbidities history		
Obesity status		
Obese	71	14.7
Non-obese	411	85.3
Smoking status		
No	481	99.8
Yes	1	0.2
Nutritional status		
Vegetarian		
Yes	3	0.6
No	479	99.4
Vegetables intake		
High intake ( $\geq$ mean score 18.01)	229	47.5
Low intake ( $<$ mean score 18.01)	253	52.5
Fruits intake		
High intake ( $\geq$ mean score 20.82)	243	50.4
Low intake ( $<$ mean score 20.82)	239	49.6
Cereals intake		
High intake ( $\geq$ mean score 7.95)	215	44.5
Low intake ( $<$ mean score 7.95)	267	55.5
Meat intake		
High intake ( $\geq$ mean score 10.10)	209	43.4
Low intake ( $<$ mean score 10.10)	273	56.6
Seafood intake		
High intake ( $\geq$ mean score 11.20)	232	48.1
Low intake ( $<$ mean score 11.20)	250	51.9
Black tea		
$\leq 1$ cup a day	470	97.5
$> 1$ cup a day	12	2.5
Iron supplementation history		
Intake of iron supplementation		
Yes	428	88.8
No	54	11.2
Frequency of intake ( $n=428$ )		
Daily	340	79.4
Twice a day	67	15.7
Thrice a day	5	1.2
Every other day	7	1.6
Weekly	9	2.1
Method of consumption ( $n=428$ )		
With plain water or fruit juices	421	98.4
Other beverages (e.g. milk, carbonated drinks, caffeinated drinks and cordial)	7	1.6

†Not applicable for 158 respondents who were primigravida

of intake, and consumption methods (Table 3).

**Predictors of anaemia in pregnancy**

Table 4 shows the factors that predicted anaemia in pregnancy. The risk of anaemia in pregnancy was found to be 2.9 times higher among young mothers aged <20 years old (AOR=2.941, 95% CI: 0.404-12.316). Meanwhile, pregnant women with an intake of iron supplementation of once daily

(AOR=0.191, 95% CI:0.074-0.914), more than once daily (AOR=0.149, 95%CI: 0.091-0.248), and low intake of seafood (AOR=0.320, 95% CI: 0.187-0.526) were less likely to develop anaemia during pregnancy.

**DISCUSSION**

Severe anaemia in pregnancy among women in Malaysia had been previously reported in other studies, with prevalence

**Table 3.** Factors associated with anaemia in pregnancy

Characteristics	Anaemia in pregnancy		Statistical findings		
	Yes n (%)	No n (%)	$\chi^2$ / Fisher exact test	df	p-value
Maternal education			11.889	1	0.003
Primary	4(28.6)	10(71.4)			
Secondary	34(34.3)	65(65.7)			
Tertiary	68(18.4)	301(81.6)			
Gravidity			6.510	2	0.039
Primigravida	28(17.7)	130(82.3)			
Multigravida	60(22.1)	212(77.9)			
Grand-multigravida	18(34.5)	34(65.4)			
Pregnancy trimester			10.752	2	0.005
1st Trimester	4(23.5)	13(76.5)			
2nd Trimester	23(13.6)	146(86.4)			
3rd Trimester	79(26.7)	217(73.3)			
Child spacing (years)			6.589	2	0.037
≥ 2years	52(28.1)	133(81.3)			
< 2years	26(18.7)	113(81.3)			
Not applicable	28(17.7)	130(82.3)			
Seafood intake			16.542	1	<0.001
High (≥mean score 11.2)	70(30.2)	162(69.8)			
Low (<mean score 11.2)	36(14.4)	214(85.6)			
Intake of iron supplementation			7.540	1	0.006
Yes	102(23.8)	326(76.2)			
No	4(7.4)	50(92.6)			
Intake frequency (n=428)			48.523	2	<0.001
Less than once daily	4(25.0)	12(75.0)			
Daily	58(17.1)	282(82.9)			
More than once daily	40(55.6)	32(44.4)			
Consumption method (n=428)					0.218†
Plain water and fresh juice	99(23.5)	322(76.5)			
Others	3(42.9)	4(57.1)			

†Fisher’s exact test

**Table 4.** Predictors of anaemia in pregnancy

Characteristics	$\beta$	SE	Wald	p-value	AOR	95% CI	
						Lower	upper
Maternal age							
<20years	1.079	0.921	1.372	0.024*	2.941	0.404	12.316
20-34years	-0.391	0.921	1.158	0.282	0.676	0.084	1.558
≥35years (ref)							
Iron supplement intake frequency							
>once daily	-1.905	0.331	33.14	<0.001**	0.149	0.091	0.248
Once daily	-1.655	0.731	5.124	0.024*	0.191	0.074	0.914
<once daily (ref)							
Seafood intake							
Low intake	-1.140	0.319	12.79	<0.001**	0.320	0.187	0.526
High intake (ref)							
Period of amenorrhea <sup>†</sup>							
Constant	1.436	0.876	2.876	0.101	4.204		

\*Significant at  $p < 0.05$

\*\*Significant at  $p < 0.001$

<sup>†</sup>Period of amenorrhea was controlled as confounder

Nagelkerke R square value=0.281

ranging between 38 to 43.8 percent (Tee *et al.*, 1984; Ahmad *et al.*, 1997; Thaneemali & Jamiyah, 2005; Mclean *et al.*, 2009; Milman, 2015). In comparison with the present study, a slightly higher prevalence of 29.3% was also reported in the National Health and Morbidity Survey (NHMS) 2015 (IPH, 2015). Although this study showed a lower prevalence of anaemia in pregnancy among the antenatal mothers who participated in this study, generalisation of this finding among antenatal mothers in Malaysia must be done with caution in view of the potential unequal chance for all eligible respondents to be selected for the study due to the use of cluster sampling.

Based on the WHO (2011) classification of public health importance, the prevalence of anaemia during pregnancy in this study was considered as moderate and was dominated by those of mild severity. However, the mild level of anaemia among majority of the respondents may be related to iron

supplementation, which was evident by the high proportion of respondents being prescribed this supplement during the conduct of this study, indicating underlying IDA as a potential cause. Anaemia in pregnancy is frequently reported among women in developing countries, indicating inadequate pre-existing iron stores and insufficient physiological adaptations to pregnancy to meet increased requirements (Osungbade & Oladunjoye, 2012).

According to a review by Santoyo-Sánchez *et al.* (2015), regardless of age, iron intake requirements reach a peak in pregnant women at 27mg/day, with iron deficiency being the most frequent cause of anaemia in women of reproductive age and pregnant women (Milman, 2015). IDA during pregnancy is reported to be associated with impaired brain development of the foetus or newborn, premature birth, a low birth weight for gestational age, and birth complications (Milman, 2015).

Anaemia in pregnancy remains a significant public health problem, particularly issues related to compliance towards iron supplementation and awareness related to its potential detrimental impacts. Oral iron supplementation is cheap, safe, and effective at correcting IDA, which is the second most common cause of anaemia during pregnancy, after physiologic anaemia of pregnancy. However, iron supplement may not be tolerated by some patients, which probably explains the once daily intake among most respondents in the current study.

The higher burden of anaemia in developing countries, particularly among women of reproductive age and children, are mainly related to malnutrition and low bioavailability of micronutrients commonly resulting from poor dietary habits and inadequate intake of foods rich in micronutrients, such as fresh fruits and vegetables (Ghose & Yaya, 2018). According to the WHO recommendations, fruits and vegetables intake of  $\geq 5$  servings/day is considered adequate, with anything less as inadequate (Ghose & Yaya, 2018). Compared to women who consumed at least five servings of fruits and vegetables, those who consumed less than five servings of fruits and vegetables had higher odds of suffering from severe and moderate anaemia (Ghose & Yaya, 2018). Despite the important role of dietary intake of fruits and vegetables in the prevention of anaemia, a non-significant relationship was demonstrated in this study with minimal differences observed between those with low and high intake of fruits and vegetables.

The finding of this study also reflected the role of teenage pregnancies or being pregnant at a younger age of  $< 20$  years old on the risk of developing anaemia in pregnancy. The association between young age and development

of anaemia in pregnancy had been reflected by the high prevalence of anaemia in pregnancy among teenage mothers in previous research. A very high prevalence of 53.1% (95% CI: 46.0, 60.0) was reported in a local study conducted by Nazirah, Tengku Alina & Aziah (2015) in Northwestern Malaysia. The study found that gestational age at booking was strongly associated with anaemia among teenage pregnancy, in which late bookers had 16 times higher odds of getting anaemia compared to early bookers (AOR=16.33; 95% CI: 6.51–40.99). This is because the risk of anaemia in pregnancy increases with the progression of pregnancy. Furthermore, a study involving 458 pregnant adolescents with a mean age of 16 years old in Brazil by Pinho-Pompeu *et al.* (2017) reported a prevalence of 41.27%, which was significantly associated with preterm labour ( $p=0.003$ ), gestational age at birth of  $< 37$  weeks ( $p=0.036$ ), and stillbirth ( $p=0.004$ ). Similarly, another study in Western Jamaica reported that younger mothers aged 18 to 24 years old were more likely to be anaemic compared to those  $\geq 35$  years old (odds ratio: 3.44; 95% CI: 1.07–11.06) (Wright *et al.*, 2017).

Meanwhile, the findings of this study also revealed that daily or more iron supplementation and low intake of seafood were protective towards anaemia during pregnancy. However, a systematic review on prophylactic iron supplementation in pregnancy concluded many arguments regarding its impact on maternal and infant outcomes (Friedrich & Friedrich, 2017). The review suggested considering other factors such as culture, geography, social and economic status, lifestyle, nutritional status, and all issues that determine health conditions in pregnancy and infancy in order to clarify the real impact of prophylactic iron

supplementation during pregnancy, especially in developing countries (Friedrich & Friedrich, 2017). Oral iron is an effective, cheap and safe way to replace iron store, with ferrous salts being preferred to ferric salts due to the poorer absorption and bioavailability of the latter (Nagpal & Choudhury, 2004). The National Guidelines in Malaysia recommends iron supplementation of 100 mg/day for pregnant women and the Malaysian Perinatal Care Manual advocates 100 mg elemental iron/day for prophylaxis in pregnant women (Milman, 2015). However, more recent studies have suggested some advantages from lower doses or intermittent supplementation (Pena-Rosas *et al.*, 2015), with better absorption reported with intake of 40-80 mg once a day or alternate days and avoiding twice daily dosing among iron depleted young non-pregnant women (Moretti *et al.*, 2015). Higher doses potentially increase side effects due to excess unabsorbed iron remaining in the gastrointestinal tract (Pavord *et al.*, 2020).

Contrary to the findings from this study, the protective effect of seafood, such as fish, on the development of anaemia during pregnancy has been reported in a previous study. In a related study by Anlaakuu & Anto (2017) among antenatal attendants at the Sunyani Municipal Hospital, Ghana, they reported that consumption of fish/snails was found to be significantly associated with anaemia among pregnant women. Pregnant women who consumed fish or snails regularly were less likely to become anaemic compared to those who never consumed fish or snails (Anlaakuu & Anto, 2017). Although intake of red meat, particularly beef and liver, has been frequently reported as a good source of iron-rich food, it is also linked with the development of cancer, diabetes, cardiovascular diseases, and

an increased risk of premature death in adults (Agarwal, 2013). Hence, intake of seafood, such as fish and shellfish as an alternative iron-rich food should be considered. The non-significant association between intake of meat and anaemia in pregnancy may be related to the significantly higher proportion of those without anaemia.

Additionally, it is crucially important to have knowledge on the enhancers and inhibitors of iron absorption, such as ascorbic acid, which can significantly increase iron absorption, as well as phytate and calcium that may inhibit iron absorption (Shah *et al.*, 2003). However, many studies on the relationship between iron absorption and intake of certain types of drinks have been mainly conducted among children, with iron being well absorbed from a meal that includes either orange or apple juice (Shah *et al.*, 2003). At risk individuals who are being prescribed with iron supplementation either for prevention or treatment of anaemia should be consulted on its effective consumption methods.

## CONCLUSION

The moderately high prevalence of anaemia during pregnancy in this study suggested its role as an ongoing public health concern among pregnant women in Malaysia. Education and awareness on the detrimental impacts of anaemia on pregnant mothers and the foetus, as well as the protective role of an iron-rich diet, such as seafood, in replacement of red meat and iron supplementation are crucial, with special attention on young pregnant mothers urgently needed.

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### Authors' contributions

HSM, principal investigator, conceptualised and designed the study, prepared the draft of the manuscript and reviewed the manuscript; PT, led the data collection and analysis, and assisted in drafting of the manuscript.

### Conflict of interest

The authors declare no conflicts of interest.

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