

## Antenatal Iron Deficiency in an Urban Malaysian Population

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### ABSTRAK

Kekurangan zat besi adalah punca utama penyakit anemia semasa kehamilan. Kajian ini dibuat untuk menilai kelaziman anemia dan kekurangan zat besi dalam wanita mengandung dalam populasi Malaysia dan hubung kaitnya dengan sosio-demografi dan profil obstetrik. Kajian keratan rentas dibuat di sebuah klinik kesihatan bandar dalam jangka masa enam bulan. Satu sampel darah diambil daripada wanita mengandung yang kelihatan sihat pada lawatan pertama antenatal dan dihantar ke makmal untuk penilaian pengiraan darah lengkap dan feritin serum sebagai alat saringan untuk anemia dan status zat besi. SPSS versi 19.0 digunakan untuk analisis statistik. Daripada sejumlah 250 subjek, 43.6% menghidap anemia dan 31.6% menghidap kekurangan zat besi. Sejumlah 47.7% daripada subjek yang menghidap anemia juga mengalami kekurangan zat besi, manakala 19.1% daripada subjek yang kekurangan zat besi tidak pula menghidapi anemia. Ferritin serum mempunyai korelasi negatif dengan kematangan kandungan pada lawatan pertama antenatal ( $p < 0.001$ ), dengan seramai 77.6% daripada kumpulan wanita ini tidak mengambil zat besi tambahan sebelum itu. Ferritin serum juga rendah antara wanita yang beranak lebih daripada lima ( $p = 0.01$ ). Kekurangan zat besi sangat ketara ( $p = 0.024$ ) dalam kalangan kaum India (42.5%) berbanding dengan kaum Melayu (33.5%) dan Cina (13.0%). Kesimpulannya, oleh kerana ramai wanita mengandung mengalami kekurangan zat besi, bukan sahaja yang mengalami anemia tetapi juga yang mempunyai nilai hemoglobin normal, kesinambungan praktis memberi tambahan zat besi kepada semua wanita mengandung di Malaysia adalah wajar.

**Kata kunci:** anemia, feritin, mengandung

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## ABSTRACT

Iron deficiency anemia is the most common form of anemia in pregnancy. The present study was carried out to determine the prevalence of antenatal anemia and iron deficiency in the Malaysian population and its correlation with socio-demographic and obstetric profile. It was a cross-sectional study conducted at an urban health clinic over a period of six months. A single blood sample was drawn from apparently healthy pregnant mothers at antenatal booking and sent for laboratory assessment of full blood count and serum ferritin as screening tools for anemia and iron status. SPSS version 19.0 was used for statistical analyses. The results showed that out of 250 subjects, 43.6% had anemia and 31.6% had iron deficiency. Whilst 47.7% of subjects with anemia were iron deficient, 19.1% of subjects without anemia were also iron deficient. Serum ferritin correlated negatively with period of gestation at booking ( $p < 0.001$ ), with 77.6% of these women not having prior iron supplements. Serum ferritin was also significantly lower among grandmultiparae ( $p = 0.01$ ). Iron deficiency was significantly ( $p = 0.024$ ) more common among Indians (42.5%) compared to Malays (33.5%) and Chinese (13.0%). In conclusion, continuation of the current practice of routine antenatal iron supplementation is still warranted and justifiable in Malaysia as there is high prevalence of iron deficiency in pregnancy not only in the presence of anemia but also in the presence of normal hemoglobin values.

Keywords: anaemia, ferritin, pregnancy

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## INTRODUCTION

Iron is mandatory for normal foetal development, including the brain. Antenatal iron deficiency may have deleterious effects on intelligence and behavioral development of the offspring. Therefore, it is important to prevent foetal iron deficiency by preventing maternal iron deficiency. Besides, iron deficiency anemia is a risk factor for preterm birth and low birth weight (Milman 2006).

In Malaysia, routine antenatal iron supplementation is the norm but the practice is not evidence based due to lack of current data on the prevalence of iron deficiency. The most recently published data on anemia in pregnancy

in Malaysia dates back 15 yrs ago and only surveyed rural areas of one of the poorer states (Zulkifli et al. 1997).

On the other hand, iron supplementation has a negative influence on absorption of other divalent metals and increases oxidative stress in pregnancy, for which reason the minimum effective iron dose should be advised in pregnancy (Milman 2006).

In many parts of Malaysia, urbanization has taken place and standards of education and living have improved. As such, the current socio-economic and health status have improved with declining prevalence of grandmultiparity and maternal mortality rates (Wong 1999). It is therefore possible that the country may

have joined the ranks of developed nations in issues as basic as iron deficiency and anemia in pregnancy. The present study therefore aimed to assess the current antenatal iron status in Malaysia.

## MATERIALS AND METHODS

A cross-sectional study was conducted over a six-month period on pregnant women who booked for antenatal care at an urban community health clinic located within a kilometer of a state hospital. A single blood sample was drawn from each subject and sent for laboratory assessment of full blood count and serum ferritin at the time of booking to assess for maternal anemia and iron status. All laboratory assays were conducted at the hematology and biochemistry laboratories of the state hospital.

Iron deficiency is defined as serum ferritin < 12 µg/l (Brittenham et al. 1981). Anemia is defined as hemoglobin < 11g/dl (World Health Organization 1968).

Based on Kish's formula for prevalence study (Kish 1965)

$$n = (Z_{1-\alpha})^2 \frac{P(1-P)}{D^2}$$

where  $P = 0.212$ ,  $D = 0.05$  and  $Z_{1-\alpha} = Z_{0.95} = 1.96$  (normal distribution table), the sample size required was 256.7, i.e. 257. Quota sampling was applied. Women with known chronic illness such as systemic lupus erythematosus, renal disease, thalassaemia or any other blood disorder, and those who refused to participate in the study,

were excluded. All data obtained were analyzed using SPSS version 19.0.

## RESULTS

A total of 250 pregnant mothers participated in the study, i.e. the response rate was 97.3% (250/257), of which 149 (59.6%) were Malays, 39 (15.6%) Chinese, 47 (18.8%) Indians, and 15 (6%) were of other ethnicities (Table 1). Out of the total number, 247 (98.8%) were married and 3 (1.2%) were single. Their age ranged from 20 - 49 yrs with a mean of  $30.24 \pm 1.16$  yrs (mean  $\pm$  standard deviation, SD). Most of the women (178, 71.2%) attained secondary school education, followed by 37 (14.8%) with tertiary education, 27 (10.8%) with primary education, and a minority (8, 3.2%) without any formal education. Most women (81.2%) were in the poverty bracket, with a family income of less than RM1000 per month. Majority of the women were primigravidae (33.6%), followed by gravidae 2, 3 and 4 (23.6%, 15.2% and 10.8% respectively), whilst 42 (16.8%) were grandmultiparae. Forty-two percent commenced antenatal care during the first trimester, 54.8% during the second trimester and 3.2% during the third trimester. Only 2% were multiple pregnancies and 1.6% vegetarian. Most women (77.6%) did not take vitamin supplements prior to pregnancy. Only 13.6% practiced contraception.

The overall prevalence of anaemia was 43.6% whilst the prevalence of iron deficiency was 31.6% (Table 2). The prevalence of anaemia and iron deficiency was highest among the

Table 1: Sociodemographic and obstetric profile versus serum ferritin level

Profile	Frequency n (%)	Se Ferritin (ng/ml) Mean (SEM)
<b>Age (years)</b>		
< 40	208 (83.2)	37.98 (2.52)
≥ 40	42 (16.8)	30.94 (4.98)
<b>Ethnicity</b>		
Malay	149 (59.6)	37.41 (3.07)
Chinese	39 (15.6)	41.43 (5.59)
Indian	47 (18.8)	27.17 (4.03)*
Others	15 (6.0)	48.76 (10.27)
<b>Parity</b>		
< 5	208 (83.2)	38.01 (2.45)
≥ 5	42 (16.8)	25.31 (3.99)*
<b>Pregnancy spacing</b>		
< 2 years	79 (47.6)	42.13 (4.14)
≥ 2 years	87 (52.4)	34.14 (2.67)
< 2 years	79 (47.6)	42.13 (4.14)
≥ 2 years	87 (52.4)	34.14 (2.67)
<b>Gestation (trimester)</b>		
1 <sup>st</sup>	105 (42.0)	49.23 (3.97)
2 <sup>nd</sup>	137 (54.8)	29.74 (2.67)
3 <sup>rd</sup>	8 (3.2)	19.95 (6.80)*
<b>Educational level</b>		
Nil	8 (3.2)	41.52 (7.01)
Primary	27 (10.8)	22.33 (7.85)
Secondary	178 (71.2)	36.17 (6.78)
Tertiary	37 (14.8)	36.56 (2.61)

\*p&lt;0.05

Indians (46.8% and 42.5%, respectively), followed by the Malays (43.6% and 33.5%, respectively) and the Chinese (38.4% and 12.8%, respectively). Interestingly, overall, 19.1% of women with normal hemoglobin levels had iron deficiency (Table 2).

The overall mean hemoglobin was  $11.00 \pm 1.46$  g/dl (mean  $\pm$  SEM) whereas the mean serum ferritin was  $36.80 \pm 2.26$   $\mu$ g/l. The mean serum

ferritin was statistically significantly lower among Indians ( $27.17 \pm 4.03$   $\mu$ g/l) compared to other ethnic groups (Table 1). Grandmultiparae had significantly lower serum ferritin ( $25.31 \pm 3.99$   $\mu$ g/l) compared to women of lower parity. Late booking (in the third trimester) was associated with significantly lower serum ferritin ( $19.95 \pm 6.80$   $\mu$ g/l) compared to earlier booking for antenatal care. Women with primary

Table 2: Relationship between anemia and iron deficiency, two by two table

Hb (g/dl)	Serum Ferritin ≥12 ng/ml n (%)	Serum Ferritin < 12 ng/ml n (%)	Total n (%)
≥ 11	114 (80.9)	27 (19.1)	141 (56.4)
< 11	57 (52.3)	52 (47.7)	109 (43.6)
Total, n (%)	171 (68.4)	79 (31.6)	250 (100.0)

education had significantly lower serum ferritin ( $22.33 \pm 7.85 \mu\text{g/l}$ ) compared to other levels of education.

## DISCUSSION

Anaemia and iron deficiency are most prevalent in Africa, the Middle East, Asia, and Western Pacific (de Benoist et al. 2008). In Africa, the prevalence of anaemia in pregnancy is about 57% (de Benoist et al. 2008). The exact prevalence of anaemia and iron deficiency varies from country to country, as does the cut-off values for hemoglobin and serum ferritin used in these countries. The contribution of iron deficiency to anaemia in each country also differs, depending on other locally prevalent causes (Berger et al. 2011). The prevalence of anaemia and iron deficiency in our population (43.6%) was similar to those found in the regions with the worst anaemia prevalence. In WHO terms, an anaemia prevalence of 40% and above, as seen in our study, is considered to be much severe public significance (World Health Organization 2012). It is obvious that the anaemia prevalence in Malaysia has not improved much for the past 15 yrs, as the prevalence amongst a rural population in Kelantan, one of the poorest states, was 47.5% in 1997 (Zulkifli et al. 1997). More

recently published work on anaemia in Malaysia supports this perception, with prevalence rates ranging between 33% (Soh et al. 2015) and 57.4% (Nik Rosmawati et al. 2012). This was emphasized by Milman (2015) in his recent review on the seriousness of the situation in Malaysia and certainly calls for urgent remedial measures nationwide.

The cut-off value of serum ferritin used in our study ( $12 \mu\text{g/l}$ ) was low compared to some other studies. This level correlates with iron-deficient erythropoiesis, just before anaemia sets in at serum ferritin  $<10 \mu\text{g/l}$  (Coad & Conlon 2011). The normal serum ferritin level is  $40\text{-}160 \mu\text{g/l}$ , and levels below  $25 \mu\text{g/l}$  indicate early negative iron balance, whereas levels below  $20 \mu\text{g/l}$  indicate depletion of iron storage (Coad & Conlon 2011). Therefore, the statistics obtained in our study of 31.6% was certainly alarming.

The overall mean hemoglobin was  $11.00 \pm 1.46 \text{ g/dl}$ , which means that the mean hemoglobin in this population of pregnant women just scrapes through the WHO criteria for anaemia (World Health Organization 1968). The mean serum ferritin was  $36.80 \pm 2.26 \mu\text{g/l}$ , which is well below the level corresponding to normal iron stores (Coad & Conlon 2011). Looking at the groups with the worst levels, the figures

are much more worrying. For example, the mean values of serum ferritin among Indians and grandmultiparae almost touch the level indicative of early negative iron balance, and the serum ferritin level of women who book late in the third trimester without prior antenatal care is below the level indicative of storage iron depletion.

Is the high prevalence of antenatal anaemia a reflection of anaemia prior to marriage and embarking on child bearing? An interesting study by Chang et al. in (2009) showed that the prevalence of anaemia among apparently healthy adolescent girls in an urban Malaysian population was 28.3%, which was significantly lower than the matching prevalence among women of childbearing age within the same population, 41.7%. Nevertheless, both the figures are way above the anaemia prevalence in industrialized countries. Anaemia amongst adolescent girls is logically a strong predisposing factor for the subsequent occurrence and worsening, of anaemia in adult women of child bearing age. Correcting anaemia amongst adolescent girls is indeed vital towards reducing the magnitude of the problem amongst adult women.

Evidence from current medical literature advises caution in prescribing routine iron supplements in pregnancy because of its negative influence on gastrointestinal absorption of other divalent metals such as calcium, and increased oxidative stress (Milman 2006). Nevertheless, the existing guidelines suggest that iron supplements should not be given only if the serum ferritin exceeds 70 µg/l (Milman 2006).

Therefore, the observations obtained in this study provide a strong basis in favor of routine iron supplementation in pregnancy among the urban poor in Malaysia. For serum ferritin levels of 30-70 µg/l, the recommended daily dose is 40mg ferrous iron, whereas for women with levels below 30 µg/l as in the high risk groups observed in this study, a much higher dose of 80-100 mg ferrous iron daily, is advised. A case could be made to call for routine assessment of serum ferritin amongst the group of pregnant women who are at especially high risk of having the worst iron status. Patient education on the importance of compliance to iron supplements cannot be overemphasized, as reluctance of women to consume routine iron supplements in pregnancy is common knowledge, as a result of an unwavering myth that it might lead to macrosomia and a difficult delivery. This myth must certainly be dispelled if a programme of routine antenatal iron supplementation is to succeed.

## CONCLUSION

In conclusion, anaemia and iron deficiency in pregnancy are still serious issues amongst the antenatal population in Malaysia. Findings from this study calls for imperative measures to ensure continued provision of routine iron supplement in pregnancy. Routine checks on serum ferritin levels in certain high risk groups that recorded markedly low serum ferritin in this study should be considered, so that the appropriate higher daily dose of antenatal iron could be prescribed in order not to compromise the short and long term

health of the mother and baby.

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