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Prevalence and Aetiology of Anaemia in Pregnant Women Attending a Tertiary Care Unit in Sri Lanka, and its Effect on the Mother and Newborn

Iresh Chaminda Kandauda¹, Sampath Tennakoon², Pushpa Manel Rathnayake³, Kalana Maduwage⁴ and Thejana Gunathilake¹

¹Department of Obstetrics and Gynaecology, Faculty of Medicine, University of Peradeniya, Sri Lanka

²Department of Community Medicine, Faculty of Medicine, University of Peradeniya, Sri Lanka

³Department of Pathology, Faculty of Medicine, University of Peradeniya, Sri Lanka

⁴Department of Biochemistry, Faculty of Medicine, Faculty of Medicine, University of Peradeniya, Sri Lanka

Correspondence: Iresh Chaminda Kandauda
Senior Lecturer, Department of Obstetrics and
Gynaecology, Faculty of Medicine,
University of Peradeniya, Sri Lanka.
Email: chamindakandaudagynobs@gmail.com
<https://orcid.org/0000-0001-8727-0406>

Abstract

Introduction: Anaemia is a major complication during pregnancy and is a contemporary problem in the South Asian region.

Objectives: To identify the prevalence, and aetiology of anaemia in pregnancy, and determine its effects on maternal and neonatal outcome.

Methodology: This is a cross sectional study. 382 pregnant women were recruited from the antenatal clinic and the maternal wards of the Teaching Hospital Peradeniya, Sri Lanka from May 2017 to December 2017 in their first trimester and followed up until delivery to assess the maternal and neonatal outcome. Anthropometric measurements and blood investigations were done in 157 and 146 women in second and third trimesters respectively.

Results: 382 pregnant women were recruited at the booking visit. Among them 79 (20.7%) were anaemic in the first trimester, 43 (27.38%) in the second trimester and 42 (28.76%) in the third. A high prevalence of anaemia was seen in the Tamil community (34.78%) and women with a monthly income less than Rs.10,000. The prevalence of anaemia decreased in women who frequently consumed eggs and green leaves ($P < 0.00$). There was no significant association with the maternal and neonatal outcome in this cohort.

Conclusion: A high prevalence of anaemia is observed among the Tamil ethnic group and women with low monthly income. There was no association between anaemia in pregnancy and the maternal and neonatal outcome. Consumption of eggs and green leaves can minimize anaemia.

Keywords: Prevalence, Anaemia, maternal outcome, Neonatal outcome.

INTRODUCTION

Anaemia is defined as 'reduction in number of red cells and subsequent oxygen carrying capacity, in a manner that hinders an individual's ability to meet personal requirements for physiological functions [1]. The most common cause for anemia is iron deficiency. Nutritional deficiencies (Vitamin B₁₂, Folate, Vitamin A), parasitic infections (hook worm, Malaria), chronic and acute inflammations and haemoglobinopathies also cause anemia.

Anemia is a common complication during pregnancy and is considered a major health problem in the world. The worldwide prevalence of anaemia in pregnancy was estimated by the World Health Organization (WHO) to be 41.8% during the period 1992-2005. In Asia the prevalence was 41.6% and in Sri Lanka 29.3% [2]. According to the anaemia prevalence, WHO has categorized anaemia as being, no public health problem ($\leq 4.9\%$), mild public health problem (5.0-19.9%), moderate public health problem (20.0-39.9%) and severe public health problem ($\geq 40.0\%$) [2].

Several studies on anaemia in pregnancy in Sri Lanka considered a haemoglobin (Hb) level of 11 g/dl as the cut off limit as recommended by the WHO. A study from Anuradhapura showed a gestational age adjusted anaemia prevalence of 14.1% [3]. A prevalence of 14.4% and 8.2% in the Dankotuwa region and Northern province respectively have been reported [4,5].

Serum Ferritin assay is a commonly used tests to diagnose iron deficiency anaemia. This is because initially the serum ferritin level decreases with the depletion of iron stores in the body and the haemoglobin levels stay within the normal range until all the iron stores in the body are entirely exhausted. A study done in Sri Lanka in 1995 showed that 56 % of women attending the antenatal clinic, Teaching Hospital, Galle were anaemic with a haemoglobin level less than 11 g/l. In addition, 69% of the women had a serum ferritin level less than 12 ng/ml and were considered iron deficient [6]. Currently, guidelines by the British Committee for standards in Haematology (BCSH) are followed in Sri Lanka and pregnant women with serum ferritin levels $<30 \mu\text{g/L}$ are considered iron deficient [7].

Measures taken in Sri Lanka to prevent anaemia during pregnancy include, providing a food supplement (Thripasha) and Iron folate supplement free of charge to pregnant women. Despite this, anaemia in pregnancy is still prevalent in Sri Lanka.

Hence this study was done to determine the prevalence of anaemia among the pregnant women attending a tertiary care unit and identify the possible aetiologies, and assess its adverse effects on the mother and newborn.

METHODOLOGY

This was a cross sectional descriptive study conducted between May 2017 to December 2017 of pregnant women who attended the antenatal clinic and the maternal wards of the tertiary care unit, Teaching Hospital Peradeniya, Sri Lanka. 423 pregnant women were invited for the study and 382 consented to participate. All 382 women recruited at the booking visit were in their first trimester.

The prevalence of anemia among the pregnant population in the year 2013 was found to be 9.8% in Sri Lanka [8]. The pregnant population attending Teaching Hospital Peradeniya is estimated to be 7850 [8]. To achieve 3% precision and 95% confidence limit, the sample size needed for a prevalence study was calculated to be 384 [9]. The sample size was inflated by 10% to 423 for contingencies. The systematic sampling method was used. The inclusion criteria were; age between 16-40 years and clinically uncomplicated pregnancy except for anaemia. The exclusion criteria were; pregnant women with severe infections and foetuses with congenital anomalies.

Pregnant women with haemoglobin levels less than 11 g/dl was considered as anaemic and the severity of anaemia was categorized, as mild (Hb: 100-109 g/l), moderate (Hb:70-99 g/l), severe (Hb:40-69 g/l) and very severe (Hb: less than 40 g/l) as per the WHO guidelines [1]. Iron deficiency anaemia was diagnosed if the haemoglobin value was less than 11 g/dl and serum ferritin level was less than $30 \mu\text{g/L}$ simultaneously [10].

At the initial booking visit (at the end of first trimester) the name, age, parity, educational status, and occupation of the woman and husband, income, past medical and surgical problems, and a 24-hour dietary recall were recorded through a pre validated self-administered questionnaire. Subsequently, the height and weight were measured and the Body Mass Index (BMI) calculated. Venous blood samples were collected to assess the haemoglobin concentration (Hb), red blood cell (RBC) count, Haematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC),

Mean corpuscular haemoglobin (MCH) and the red cell distribution width (RDW). Serum ferritin levels were only measured in women who were diagnosed as anaemic at the time of the booking visit. The haemoglobin was also estimated at the end of the second trimester (24-26 weeks of gestation) and at the end of the third trimester (38-40 weeks of gestation). The duration of the hospital stay and whether blood transfusion had been required was also recorded. The 1min/5min Apgar score, birth weight and length, and Occipital Frontal Circumference (OFC) of the baby were recorded. Data was analyzed using Statistical Package of Social Science (SPSS) version 26.0 for Windows. Statistical tests used were chi-square, Independent samples T test and Mann Whitney U test. The study protocol was approved by the ethical review committee of the Faculty of Medicine, University of Peradeniya, Sri Lanka (2017/EC/42) in accordance with the declaration of Helsinki.

All the participants were given an information sheet according to their language preference (Sinhala, Tamil, English) and informed written consent was obtained before data collection.

RESULTS

Of 382 women, 79 (20.7%) were found to be anaemic in the first trimester. When disaggregated by severity, 66 (17.32%) were found to be mildly anaemic, 12 (3.14%) moderately anaemic and 1 (0.26%) severely anaemic. A higher proportion of anaemic women were observed among the Tamil ethnic group, as 8 (34.78%) of 23 were found to be anaemic. Among the 306 Sinhalese women 56 (18.62%) were anaemic. Of 45 Muslim women 12 (26.6%) were anaemic in the first trimester. Anaemia prevalence of the age categories decreased in the order of <20 years, 21-30 years and >30 years. There was no relation between the educational status and the prevalence of anaemia. The prevalence of anaemia among women who were educated up to grade 5, and up to A/L and above A/L were similar. (Table 1) However, there was a clear relationship between the monthly income and the occurrence of anaemia in pregnancy. The highest percentage was observed in pregnant women whose

monthly income was lower than Rs. 10,000 and a lower percentage was seen in the women whose monthly income was greater than Rs. 30,000. The prevalence of anaemia showed a tendency to decrease with the number of children borne by the woman.

Of 157 women in the second trimester 43 (27.38%) were anaemic. According to severity 27 (17.2%) were mildly anaemic, 15 (9.6%) moderately anaemic and 1 (0.6%) woman was severely anaemic.

Of 146 women assessed during the third trimester, 42 (28.76%) were anaemic (Table 1). Prevalence of mild anaemia and moderate anaemia in this group was 36 (24.65%) and 6 (4.10%) respectively.

The mean weight ($P < 0.05$) and the BMI ($P < 0.05$) of the anaemic women were significantly lower than in the non anaemic women.

Blood investigations revealed that the mean RBC count, HCT, MCV, MCHC, and MCH were significantly lower ($P < 0.05$) in anaemic pregnant women at the booking visit than the corresponding non anaemic pregnant women. The mean RDW of the anaemic pregnant women was higher than that of non-anaemic pregnant women.

There was no significant association of anaemia with the frequency of intake of red meat, milk and tea. However, there was a significant decrease in the tendency for anaemia with the intake of green leaves and eggs. The pregnancy outcome of the women reflected by the duration of post-partum hospital stay and the post-partum blood transfusion, was not affected by anaemia in pregnancy (Table 3).

The mean birth length of the babies delivered by the anaemic women was 52.49 cm and non-anaemic women was 51.81 ($P = 0.21$). The OFC of the babies delivered by anaemic and non-anaemic women were 32.93 and 32.94 respectively ($P = 0.98$). Birth length and OFC had no association with anaemia in pregnancy. (P value > 0.05 .) Figure 1.

Table 01: Socio Demographic Data

Demographic Data		Anaemia prevalence in 1 st trimester % (N)	Anaemia prevalence in 2 nd trimester % (N)	Anaemia prevalence in 3 rd trimester % (N)
Ethnicity	Sinhala	18.62 (57)	27.6 (34)	25.22 (28)
	Tamil	34.78 (8)	18.1 (2)	50.0 (6)
	Muslim	26.66 (12)	25.0 (5)	30.0 (6)
	Burgher	28.57 (2)	66.6 (2)	66.6 (2)
Age	< 20 years	25.00 (4)	33.33 (2)	0
	21 – 30 years	21.52 (48)	25.84 (23)	33..33 (27)
	> 30 years	19.01 (27)	29.03 (18)	25.42 (15)
Women's Education	Upto O/L	19.90 (44)	27.27 (24)	29.11 (23)
	Upto A/L	21.89 (30)	27.11 (16)	30.90 (17)
	More than A/L	21.73 (23)	30.0 (3)	16.66 (2)
Women's Occupation	Housework	20.17 (69)	27.08 (39)	29.45 (38)
	Occupied	25.64 (10)	20.0 (1)	25.00 (4)
Husbands education	Upto O/L	18.75 (48)	25.0 (27)	31.95 (31)
	Upto A/L	23.57 (29)	32.0 (16)	20.83 (10)
	More than A/L	100.0 (2)	0 (0)	100 (1)
Husband's Occupation	Unskilled	14.81 (15)	19.56 (9)	32.25 (10)
	Skilled	27.27 (39)	32.14 (18)	26.98 (17)
	Business	18.64 (11)	30.76 (8)	23.80 (5)
	Professional	18.18 (14)	27.58 (8)	32.25 (10)
Income	< 10,000	33.33 (2)	0 (0)	0 (0)
	10,000 – 30,000	21.10 (46)	28.43 (29)	28.94 (22)
	> 30,000	19.87 (31)	25.92 (14)	29.85 (20)
Dependents	No child	27.38 (23)	28.0 (14)	27.58 (8)
	1-4 children	19.62 (52)	27.35 (29)	30.47 (32)
	5-8 children	12.50 (4)	0 (0)	16.60 (2)

*Percentage of pregnant anaemic women within the categories is represented in the table

Table 02: Comparison of height, weight, BMI and haematological parameters in anaemic and non anaemic women at the end of the first trimester.

	Group	Mean	Std. deviation	P value
Height/m	Anaemic	1.54	0.07	0.95
	Non anaemic	1.54	0.06	
Weight/Kg	Anaemic	50.01	13.16	0.02
	Non anaemic	53.75	12.50	
BMI	Anaemic	21.11	5.18	0.01
	Non anaemic	22.72	5.06	
RBC	Anaemic	3.98	0.43	< 0.00
	Non anaemic	4.23	0.33	
HCT	Anaemic	31.33	2.34	< 0.00
	Non anaemic	36.02	2.69	
MCV	Anaemic	79.42	8.37	< 0.00
	Non anaemic	85.43	6.16	
MCH	Anaemic	26.30	2.99	< 0.00
	Non anaemic	28.67	1.66	
MCHC	Anaemic	33.11	1.46	< 0.00
	Non anaemic	33.63	1.65	
RDW	Anaemic	14.39	1.47	0.24
	Non anaemic	13.87	6.97	
Hb	Anaemic	10.22	1.16	< 0.00
	Non anaemic	12.09	0.71	

There was no association with anaemia in pregnancy and the birth weight of the child. Fig 2 (P = 0.99). Birth weights above 2.5 kg were reported in 35 anaemic women and 88 non anaemic women while birth weights below 2.5 kg were reported from 6 anaemic women and 15 non anaemic women.

The Apgar scores at 5 minutes was not affected by anaemia in pregnancy (Table 3).

52 (69.3%) of 75 anaemic women had ferritin levels less than 30 µg/L at the end of the first trimester, confirming iron deficiency anaemia.

DISCUSSION

Our study shows that the proportion of anaemic women in first, second and third trimesters who attended the Teaching Hospital Peradeniya in the central province was 20.7%, 27.38% and 28.76% respectively. According to the WHO, these values fall into the category of a moderate public health problem (20.0-39.9%) [2]. The prevalence observed in this

study is lower than the prevalence (56%) observed in the antenatal clinic, Teaching Hospital, Galle (southern province) in the year 1995 [10]. However the frequency of anaemic women observed in this study was higher than that observed in Anuradhapura (north central province) (14.1%) in the year 2012, Northern province (8.2%) in the year 2007 and Dankotuwa (14.4%) in the year 1999 [4,5,6]. These results show that the prevalence of anaemia in pregnancy differ according to the province. One reason for this could be differences of the socio-economic conditions within the districts of Sri Lanka.

There was a comparatively large proportion of anaemic women among the Tamil participants in our study (34.78%). The study done by Atukorala et al in 1994 also showed a high prevalence of anaemia in the first trimester in the plantation workers in Sri Lanka which ranges from 59.2% to 65.4% [11]. Nearly all of the workers in the tea plantation sector are Tamil and have a low monthly income and a low education level. Educational programs to acknowledge the importance of having a healthy diet

Table 3: Comparison of the Dietary intake with the incidence of anaemia in the first trimester and the pregnancy outcome with the incidence with anaemia in the third trimester

Dietary intake			
	Mean Rank		Asymp. Sig (2 tailed)
	Anaemic	Non anaemic	
Red meat	191.85	190.78	0.93
Milk	183.14	193.06	0.40
Tea	197.19	188.74	0.51
Green leaves	150.41	201.62	<0.00
Intake of eggs	159.93	199.13	<0.00
Pregnancy Outcome			
Duration of post-partum hospital stay	71.76	72.80	0.89
Post-partum blood transfusion rate	72.74	71.70	0.50
Apgar score at 5 minutes	74.40	71.03	0.61

Figure 1: Comparison of the neonatal outcomes of the women who were anaemic and non- anaemic in the third trimester

and regular attendance at the antenatal clinics where the haemoglobin level is frequently monitored in the high-risk pregnant women, is suggested to address this issue.

There was no significant association between anaemia in pregnancy with the intake of tea, red meat and milk. The staple food of Sri Lankans is rice and other food products are used in lesser quantities along with rice. These foods could be also thought of as

flavouring agents for the rice. Hence, people who claim they eat red meat take a lesser quantity which is insufficient to have an effect on health. Similarly, Sri Lankans take milk along with tea and only a small quantity of milk powder is added to the tea as a tea whitener and flavouring. Hence a significant association cannot be expected with the prevalence of anaemia and the intake of milk among Sri Lankans. Even though some studies have shown that the iron

Figure 2: Comparison of the birth weight of the babies delivered by the women who were anaemic and non anaemic in the third trimester.

absorption by the body is decreased with the intake of tea [12,13], such an association was not observed in this study. Since there was a significant association with the intake of eggs and green leaves, pregnant women could be encouraged to consume these items as they are affordable for all the social classes in Sri Lanka.

This study shows that there is a relationship between the prevalence of anaemia in the first trimester and a lower weight, BMI, and haematological parameters of the woman. Hence anaemia in pregnancy can be minimized by preconception investigation and intervention.

Currently there is no well-organized pre conception care in Sri Lankan hospitals [14,15] and this an issue to be addressed by the authorities. .

The main drawback of this study was not being able to collect blood samples of the complete study group in the second and the third trimesters. Hence the expected sample size was achieved only for the calculation of the prevalence of anaemia during the first trimester but not in the second and the third trimesters.

CONCLUSION

A high prevalence of anaemia in pregnancy is observed among the Tamil ethnic group who attended the Teaching Hospital Peradeniya, Central province, Sri Lanka while other ethnic groups showed a moderate prevalence. There is no association between anaemia in pregnancy and the maternal and neonatal

outcome. Consumption of eggs and green leaves can minimize the risk of anaemia. Since weight, BMI and other haematological parameters have a significant relationship with the onset of anaemia in pregnancy, pre conception care could minimize its occurrence.

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Author contributions

CK: Conceptualization, Methodology, Resources, Supervision, ST: Formal analysis, PMR & KM: Validation, Supervision, TG: Investigation (Data collection)

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Data is available on request from corresponding author

Ethics approval and consent to participate

Informed written consent has obtained from the patient

Competing interests

The authors declare no competing interests

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