

# Prevalence, Aetiology, Maternal and Neonatal Outcome of Term Mothers with Anaemia, Presenting to a Tertiary Care Unit for Confinement in Sri Lanka

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## Abstract

**Objective:** To describe the proportion of women presenting with undiagnosed anaemia at confinement and to explore associations between anaemia and socio economic factors, dietary pattern and compare maternal and neonatal outcome among term mothers with anaemia compared to non-anaemic pregnant women at a tertiary care centre in Sri Lanka. **Method:** A comparative cross-sectional study was performed by recruiting anaemic and non-anaemic term mothers who delivered at the Teaching Hospital Peradeniya during the period March 2018-March 2019. Pregnant mothers whose haemoglobin level was less than 10.5 g/dl were considered as anaemic and compared with the mothers whose haemoglobin level was above this level. With written consent, demographic data, etiological factors, maternal and neonatal outcomes of term mothers were evaluated by an interview and blood samples were withdrawn to carry out anaemia related investigations. **Results:** Among 2854 pregnancies, a total of 234 (8.19%) term pregnant mothers were anaemic and they were and compared with 199 non-anaemic mothers. Out of the anaemic mothers (Hb < 105 g/l), 133 (56.76%) had moderate anaemia, 100 (42.79%) had mild anaemia and 1 mother (0.45%) had severe anaemia. Low monthly family income was significantly associated with the incidence of anaemia. Anaemia was also associated with low weekly consumption of red meat (OR 8.994; 95% CI, 5.74 - 14.09, p < 0.05) and high weekly tea intake (OR 0.217;

95% CI 0.144 - 0.327,  $p < 0.05$ ). Among anaemic mothers, 215 (67.44%) had low serum ferritin ( $<30$  ng/mL) while most of them were diagnosed with iron deficiency anaemia (58.24%) ( $n = 113$ ) based on haemoglobin. Most anaemic mothers had undergone elective caesarean section (46.26%) while vaginal deliveries (33.33%) were common among non-anaemic group. **Conclusions:** A moderate prevalence of anaemia among term pregnant women in Peradeniya, Sri Lanka was observed and was associated with low socio economic status, low consumption of tea and poor nutrition lacking in red meat.

## Keywords

Term Mothers, Prevalence, Anaemia, Maternal Outcome, Neonatal Outcome

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## 1. Introduction

Anaemia in pregnancy is a long known major health problem in developed and developing countries. Prevalence of anaemia in pregnancy varies from 15% in developed countries [1] and 33% to 75% in developing countries [2]. World health organization (WHO) defines a haemoglobin concentration of 110 g/l as the cut off level to diagnose anaemic during pregnancy. It is subcategorized as mild (10.0 - 10.9 g/dl), moderate (7.0 - 9.9 g/dl) and severe ( $<7.0$  g/dl) anaemia [3]. According to the UK guidelines for haematology and the RCOG NICE guidelines, anaemia in pregnancy is defined as haemoglobin concentration (Hb)  $< 110$  g/l in first trimester and  $<105$  g/l in second and third trimesters and  $<100$  g/l immediately postpartum [4] [5]. Sri Lankan college of haematologists recommends the cut of values given by the UK guidelines and it is currently used in Sri Lanka to diagnose anaemia in pregnancy.

During the period of pregnancy, blood plasma volume begins to increase physiologically at the beginning of the first semester and plateaus in the third semester. This occurs at a higher rate than the red blood cell and haemoglobin production, which causes a haemodilution effect and the resulting condition is referred to as physiological anaemia [4]. Hence, during the second and third trimesters of pregnancy, Hb  $< 105$  g/l is considered as anaemia while a normal person is diagnosed as anaemic when the Hb  $< 110$  g/l. Due to the haemodilution effect, the risk of developing anaemia is higher during pregnancy. It is associated with adverse maternal outcomes, such as puerperal sepsis, antepartum haemorrhage, postpartum haemorrhage, and more [6]. Apart from maternal risks, it is also responsible for premature delivery, low birth weight babies and high perinatal mortality [7]. The causes of anaemia in pregnancy are Folate and vitamin B12 deficiency, inflammatory disorders, thalassemia, haemolysis and blood loss and the most common nutritionally related iron deficiency anaemia [4]. There is a huge demand for iron during the period of pregnancy as the frequency of maternal erythropoiesis is high due to increased plasma volume and the utilization of iron for the fetal growth. Iron-deficiency anaemia occurs when

there is shortage of iron stores, transport and functional iron, resulting in reduced haemoglobin in addition to low serum ferritin, low transferrin saturation and increased erythrocyte protoporphyrin concentration [4]. Beside poor nutrition, late booking, low financial status, multiparity, abortion, frequent pregnancies, infections, consuming excess tea or coffee after meals determined as the predictors of anaemia in pregnancy [8].

Due to high prevalence and known complications of anaemia in pregnancy, every mother is checked for anaemia at booking visit, at 28 weeks of gestation and on admission for confinement in most of the countries. The Sri Lankan maternal health programme contains several strategies to prevent anaemia during pregnancy. They are oral iron, vitamin C, folate and food supplementations provided at antenatal clinics for every pregnant woman free of charge.

In Sri Lanka, where there are wide variations in socioeconomic status, dietary patterns and different cultural taboos, the prevalence of anaemia could vary in different geographical areas. WHO estimated that prevalence of pregnancy associated anaemia is around 29% in Sri Lanka [9]. In 2007, a demographic and health survey (DHS) reported an overall prevalence of 34% with 20.7% mild and 13.3% moderate to severe anaemia [10]. In 2009, there was a survey, which showed 17% prevalence of anaemia during pregnancy in Sri Lanka, with 7% in Kurunegala district to 29% in Colombo district [11].

Although several studies had been conducted to identify the prevalence of anaemia among pregnant women in Sri Lanka, there are only few reports available on the prevalence of anaemia among term pregnant mothers. A survey study conducted in Anuradhapura district in 2012 had found that the prevalence of anaemia in first, second and third trimesters was 7.6%, 19.7%, and 19.3% respectively [12]. Even though several studies show a wide range of prevalence, all these show lower estimations than WHO records. A reliable estimate of the prevalence of anaemia in Sri Lanka is needed as it will enable a proper evaluation of the public health of the country. Hence, the present study was conducted to describe the prevalence of anaemia among term mothers in Peradeniya, Sri Lanka and to describe the aetiology, socio economic factors, and dietary pattern and maternal and neonatal outcomes among term mothers with anaemia.

## 2. Materials and Methods

This comparative cross sectional study was conducted between March 2018 to March 2019 on term pregnant anaemic mothers and term pregnant non anaemic mothers presenting to the antenatal ward for confinement at Teaching Hospital Peradeniya, Sri Lanka.

The minimum required sample size was 239 for each group calculating for a prevalence of low birth weight of 12.5% at precision of 0.05 and a confidence level of 90% (Iwanga and lemeshow). Inclusion criteria for the anaemic group was defined as follows; pregnant women between 18 - 40 years, term mothers (37 weeks to 42 weeks of gestation) with a haemoglobin (Hb) level less than 10.5

g/dl on admission for confinement. Women with chronic cardiac diseases, renal diseases and fetuses with congenital anomalies were excluded. All anemic women who met inclusion and exclusion criteria were invited to take part in the study until the required sample size was achieved. The non-anemic group was selected through a systematic sampling method to spread the sample throughout the study period. Selected women were evaluated in detail regarding their diet. Haemoglobin concentration, red blood cell indices, erythrocyte sedimentation rate and the blood picture were performed under the supervision of a consultant haematologist, Teaching Hospital Peradeniya. Due to the unavailability of the serum ferritin assay in the hospital laboratory, ferritin assay was done at the biochemistry laboratory, Lanka Hospital, Kandy. Samples were analyzed using electrochemiluminescence immunoassay (ECLIA) using Cobas e 411 fully automated immunoassay analyzer.

Mode of delivery, number of blood transfusions, booking, and postpartum haemoglobin concentration, red blood incident, haematocrit (HCT), mean corpuscular haemoglobin (MCH), mean corpuscular volume (MCV) were recorded to relate the maternal outcome to the severity of anamia. The neonatal outcomes were assessed by 5 min and 10 min Apgar scores, birth weight, cord blood haemoglobin, and red blood incident. Cord blood samples were collected at the time of delivery and sent for full blood count. WHO criteria were used as cut off values for ferritin (<30 ng/mL). Cut off levels of <13.6 g/dl for cord blood haemoglobin and <10.0 g/dl for postpartum haemoglobin were used. Corrected reticulocyte count was calculated using reticulocyte% X (patient haematocrit/normal haematocrit).

The data were collected and analyzed using the Statistical Package of social science (SPSS) version 13.0 for windows. Results were reported in the form of simple frequency and mean and standard deviation (SD). Categorical variables were compared using the Chi-square test and Independent sample t test was used to compare quantitative variables between anaemic and non-anaemic mothers. A p value of <0.05 was considered statistically significant. Monthly income and dietary habits were included in the regression model as dichotomous variables. The results were presented in odd ratios (OR) and 95% confidence intervals.

The study protocol was approved by the ethical committee Faculty of Medicine, University of Peradeniya (2017/EC/42), Sri Lanka. Informed written consent was obtained from each participant after explaining the study procedure. An information sheet was provided in all three official languages (Sinhala, Tamil, English) as to include all ethnic groups. Participants had a chance to clarify their doubts and only those consented for the research had been included in the study. The confidentiality of the research data was well maintained. The benefits from this study to the health sector and to the society were explained.

### 3. Results

Out of total 2854 pregnant women admitted for confinement, 234 term women

were found to be anaemic as their haemoglobin level was less than 105 g/l. They were compared with 199 term non anaemic women. The median age of anaemic women was  $28.66 \pm 5.73$  years and in non anaemic group, it was  $28.80 \pm 5.35$  years. ( $p = 0.08$ ). Out of 234 anaemic women, the majority 126 (56.76%), had moderate anaemia (Hb 9.9 - 7.0 g/dl), 95 (42.79%) had mild anaemia (Hb 10.5 - 9.9 g/dl) whereas 1 (0.45%) was severe anaemic (Hb < 7.0 g/dl). Majority of anaemic women were Sinhalese, 113 (50.0%), followed by Muslims, 91 (40.27%) and Tamil, 22 (9.9%). Of these women, 119 (52.42%) were between 21 - 30 years, while 89 (39.65%) were 31 years or above and 18 (7.92%) were 20 years or less. There was no statistically significant difference between anaemia and women's age. ( $p = 0.583$ ) The proportion of anaemia was higher among those women whose monthly income was less than Rs. 30,000 (51.32%). There was a significant difference between anaemic and non anaemic mothers in relation to the monthly family income (OR 3.9; 95% CI, 2.6-6.1,  $p < 0.05$ ). Among anaemic mothers, 196 (83.34%) were housewives while 24 (10.57%) were professional employees. Of the term anaemic mothers, 64 (28.19%) had no dependents and 137 (60.35%) had 1 - 3 children while with non anaemic mothers 101 (48.09%) had no dependents and 97 (43.30%) had 1 - 3 children ( $p < 0.05$ ) (**Table 1**). The comparison of these parameters is given in **Table 1**.

In analysing the dietary habits among anaemic women, 183 (81.7%) had low consumption (less than 4 times per week) of red meat. Among non-anaemic group, 133 (66.8%) had an adequate amount of red meat and only 33.2% had low consumption of red meat. Therefore, there is a significant relationship between anaemia and red meat consumption among anaemic and non anaemic women (OR, 8.994; 95% CI, 5.74 - 14.09,  $p < 0.05$ ). Mothers who consumed tea more than two times per week were considered as high tea consumers and the mother who consumed tea twice or less than that per week were considered sufficient tea intakes. Of the anaemic mothers, 158 (70.5%) had high weekly tea intake (OR, 0.217; 95% CI, 0.144 - 0.327,  $p < 0.05$ ) while 29.5% had sufficient tea intake. Moreover, the percentage of tea intake was higher among (53.79%) the women with lower income (<Rs. 30,000) per month.

Serum haemoglobin level (Hb) was available only for 222 anaemic mothers on admission. The mean value for the anaemic group for Hb was  $9.51 \pm 0.74$  g/dl and for the non-anaemic group was  $11.95 \pm 1.06$  g/dl. Out of the non-anaemic group, only 182 had reports on red blood cell count (RBC), HCT, MCV, MCH, mean corpuscular haemoglobin concentration (MCHC) and red cell distribution width coefficient of variation (RDW- CV). Except the mean RDW value, all other values were lower in anaemic women comparing with non anaemic women. As seen in **Table 2** the mean Hb, HCT, and MCV were significantly lower and RDW-CV was significantly higher among anaemic and non anaemic group ( $p < 0.05$ ). Among anaemic mothers, 221 had low HCT value (<37%) and only one had a higher value (>54%). Regarding MCV 142 women had lower values (<80 fL), four of them had higher values (>100 fL) and the rest of them were in normal range (80 - 100 fL).

**Table 1.** Socio demographic characteristics.

Socio demographic characteristics	Anaemic mothers		Non-anaemic mothers		P value
	No. of anaemic mothers	Percentage	No. of non-anaemic mothers	Percentage	
<b>Ethnicity</b>					
Sinhala	113	50.00%	146	74.11%	<0.05
Tamil	22	9.73%	3	1.52%	
Muslim	91	40.27%	46	23.35%	
Catholic	0	0	2	1.02%	
<b>Age</b>					
20 years	18	7.93%	12	6.03%	0.583
21 - 30 years	119	52.42%	113	56.78%	
31 years	90	39.65%	74	37.19%	
<b>Women's Education</b>					
Up to Grade 5	4	1.76%	1	0.5%	<0.05
Grade 5 - Ordinary Level	25	11.01%	32	16.08%	
Ordinary Level	94	41.41%	36	18.09%	
Up to Advance Level	88	38.77%	107	55.77%	
Undergraduate	3	1.32%	0	0.00%	
Graduate	13	5.73%	23	11.56%	
<b>Women's Occupation</b>					
Housework	196	86.34%	154	77.39%	<0.05
Unskilled	1	0.44%	3	1.51%	
Skilled	3	1.33%	2	1.01%	
Business	3	1.33%	39	19.60%	
Professional	24	10.57%	1	0.50%	
<b>Husband's Education</b>					
No school attendance	1	0.44%	2	1.01%	<0.05
up to Grade 5	2	0.88%	0	0.00%	
Grade 5 - Ordinary Level	41	18.06%	45	22.61%	
Ordinary Level	96	42.29%	39	19.60%	
Up to Advance Level	76	33.48%	102	51.26%	
Undergraduate	1	0.44%	0	0.00%	
Graduate	10	4.41%	10	5.03%	
Post Graduate	0	0.00%	1	0.50%	
<b>Husband's Occupation</b>					
Housework	2	0.88%	2	1.01%	<0.05
Unskilled	59	25.99%	37	18.59%	

**Continued**

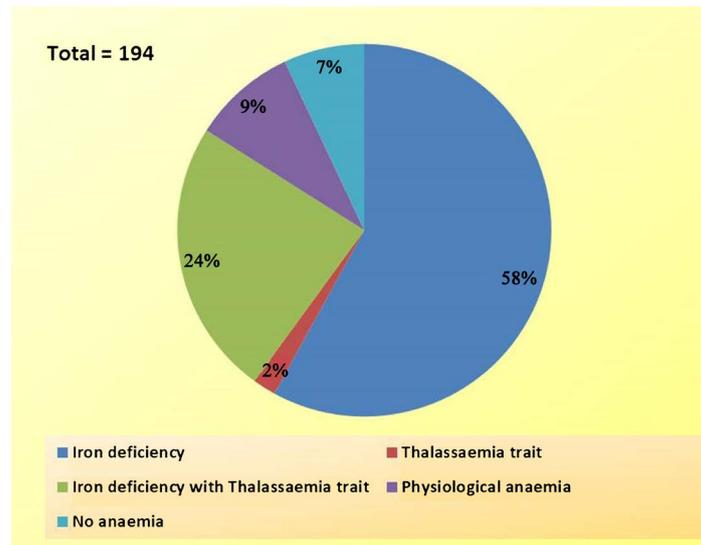
Skilled	55	24.23%	23	11.56%	
Business	64	28.19%	65	32.66%	
Professional	47	20.71%	72	36.18%	
<b>Income</b>					
<30,000	116	51.33%	42	21.11%	<0.05
>30,000	110	48.67%	157	78.89%	
<b>No of dependents</b>					
No child	64	28.19%	101	48.09%	<0.05
1 - 3 Children	137	60.35%	97	43.30%	
4 - 7 Children	26	11.45%	26	11.61%	

**Table 2.** Comparison of haematological parameters among anaemic and non anaemic women on admission.

	<b>Group</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Std. Error Mean</b>	<b>P Values</b>
Hb	Anaemic	9.516	0.7460	0.0501	<0.001
	Non Anaemic	11.954	1.0643	0.0754	
RBC count	Anaemic	3.9339	0.54546	0.03661	0.395
	Non Anaemic	4.5167	2.74154	0.20322	
HCT	Anaemic	29.915	3.3257	0.2232	0.003
	Non Anaemic	37.394	3.3869	0.2511	
MCV	Anaemic	76.176	11.4126	0.7660	< 0.001
	Non Anaemic	86.572	8.8025	0.6525	
MCH	Anaemic	24.673	3.7055	0.2487	0.080
	Non Anaemic	28.186	5.6669	0.4201	
MCHC	Anaemic	31.964	1.6194	0.1087	0.159
	Non Anaemic	32.090	5.0554	0.3747	
RDW	Anaemic	15.979	3.5873	0.2413	0.001
	Non Anaemic	14.328	2.6141	0.1938	

Of the 215 subjects who had Hb level less than 10.5 g/dL, 145 (67.44%) had low serum ferritin < 30 ng/mL while others were in a normal range. Based on the characteristics of the blood picture among the study population, most of them 113 (58.24%) were diagnosed as iron deficiency anaemia, 5 (2.57%) had thalassaemia trait and 46 (23.71%) had both (**Figure 1**). Around 4.5% of the study population had higher (>2.5%) corrected reticulocyte count and only 1.8% had a lower count (<0.5%). Additionally, among the participants, 198 (19.19%) had undergone at least one blood transfusion.

Of the anaemic women, 188 postpartum blood reports were compared with 98 non anaemic mothers. As observed in **Table 3**, there was a significant difference



**Figure 1.** Haematological diagnosis based on blood picture.

**Table 3.** Comparison of postpartum haematological parameters among anaemic and non anaemic women.

	Group	Mean	Std. Deviation	Std. Error Mean	P Values
Postpartum Hb	Anaemic	9.429	1.0001	0.0729	0.003
	Non Anaemic	11.331	1.2199	0.0878	
Postpartum RBC	Anaemic	4.0773	2.90458	0.21184	0.513
	Non Anaemic	4.1069	1.11052	0.11218	
Postpartum HCT	Anaemic	29.522	2.9368	0.2142	0.002
	Non Anaemic	34.964	3.8713	0.3911	
Postpartum MCV	Anaemic	76.756	10.3912	0.7579	0.087
	Non Anaemic	86.471	11.0262	1.1138	
Postpartum MCH	Anaemic	24.707	3.6887	0.2690	<0.001
	Non Anaemic	28.018	2.8080	0.2836	
Postpartum MCHC	Anaemic	31.848	1.2780	0.0932	0.168
	Non Anaemic	31.454	2.2714	0.2294	
Postpartum RDW-CV	Anaemic	16.270	3.2187	0.2347	0.001
	Non Anaemic	14.631	3.1323	0.3164	

in postpartum Hb, HCT, MCH, and RDW-CV. Out of all the haematological values, Anaemia group had lower mean values for HCT and MCH in comparison with the non-anaemic group. Majority around 137 (72.87%) had low (<10.0 g/dl) postpartum haemoglobin among anaemic women.

Even though maternal postpartum Hb is less among anaemic women, cord blood Hb is normal for 54 babies (79.41%) (n = 68). There were 14 babies (20.58%) who had cord blood Hb < 13.6 g/dl. Regarding the mode of delivery of baby among term anaemic mothers, most of them were undergone elective cae-

sarean section 94 (46.26%) followed by vaginal delivery 67 (33.33%), emergency caesarean section 39 (19.40%), and vacuum delivery 1 (0.99%) respectively. Among the non-anaemic group, 61.92% have undergone vaginal delivery. Therefore, there was a significant difference in the method of delivery among anaemic and non-anaemic mothers. Nevertheless, there was no statistical difference in the birth weight of the baby ( $p = 0.238$ ). Nevertheless, there was a significant difference in APGAR score at 5 minutes. Average APGAR score at 5 minutes, 10 minutes for anemic group was  $9.67 \pm 0.48$  and  $10 \pm 0.07$  whereas  $10 \pm 0.00$ ,  $10 \pm 0.00$  for non-anaemic mothers. Also non had Apgar scores below seven at 5 and 10 minutes.

#### 4. Discussion

Sri Lanka is one of the countries in the world that provides the highest quality of free health care despite its low economic development. Over the past few decades, it has provided optimal antenatal care in comparison to the other South Asian Countries. Though several steps were taken to prevent anaemia such as preconception care for early detection, but still there are women who present for deliveries with anaemia.

The prevalence of anaemia in this study was 8.19% among term pregnant women: it was less than the prevalence that was reported in third trimester mothers in the Anuradhapura district [12]. As we have taken only the term mothers our finding did not correlate with the result reported by WHO, DHS and with the Senadheera *et al.* study [5] [6]. The prevalence of anaemia in our study was lower than those reported from Tanzania (47%) [13] and South Nigeria 30.03% [14], but was similar to the study from Iran conducted in 2009 [15].

Expectedly, as in the study from India, most of the anaemic patients in this study presented with moderate anaemia [7], whereas 0.45% were noted with severe Anaemia unlike in Nigeria where no case of severely anaemic pregnant mothers were present [16]. Socio economic status is a known factor for anaemia in pregnancy. In this study, anaemia was more prevalent among women who had low monthly family income similar to the study conducted in Turkey [8]. Anaemia was more prevalent in women with one to three living children than women with no child. However, we did not observe a homogeneous increase in anaemia with regard to the increase in maternal age. Hence, further studies are required to explain its effect on anaemia in pregnancy.

This data also highlights the fact that prevalence of anaemia was high in women with low consumption of red meat and high tea intake. It is stated in the literature that tea consumption and low intake of red meat are associated with anaemia [17] [18] [19]. Some studies reported that iron absorption is reduced by frequent tea intake [20] [21] [22] [23]. Compared to the developing countries, meat consumption is high in developed countries [24]. Major reason for this is, in developing countries there is a large fraction of people with limited means, who are unable to purchase meat to include in their meals compared with the

wealthy in developed countries.

Even though Sri Lanka provides a good health care system, the number of maternal death caused due to haemorrhage and anaemia is high. This raises a question on the current practices used to screen anaemia during pregnancy and the quality of screening in Sri Lanka. A study done by Prathapan *et al.* showed that only 4% of the pregnant women in Sri Lanka were provided with information regarding the behavioural and nutritional habits that should be followed during pregnancy [25]. Therefore, education about nutrition should be developed according to the guideline for antenatal care. Findings of this research will motivate antenatal care providers toward early detection of anaemia and promote the necessary management of anaemia in pregnancy.

As in the prevalence study from Turkey [8], all haematological values were low at booking in anaemic group compared with the non-anaemic group except the mean RDW-CV value. Our study also concludes that 67.44% of anaemic women had serum ferritin < 30 ng/mL. This is important because it is the most appropriate method for the diagnosis of iron deficiency anaemia. But in routine antenatal care in Sri Lanka serum ferritin is not assessed due to its high cost.

In this study, iron deficiency anaemia was predominant among anaemic pregnancies, as in Senadheera *et al.* study [26]. But the prevalence of iron deficiency anaemia is higher compared to the Senadheera *et al.* study 36.9% [26]. Hence, this study shows number of areas to be improved in pre-conceptional care specially in Iron and folic acid supplementation. Results of the study found that 20.58% had low cord blood haemoglobin. Nevertheless, it needs further investigation as the present study did not assess the cord blood Hb of babies delivered by non-anaemic mothers. Moreover, there was a significant difference in APGAR score at 5 minutes. Other parameters, however, did not find any association between maternal anaemia and adverse pregnancy outcome.

The major drawback of the study was regarding ferritin assay. It was carried out only for the anaemic mothers at the booking visit. Therefore, we could not compare the serum ferritin values in between anaemic and non-anaemic pregnancies. In addition, we had used only the blood picture to diagnose thalassemia, as the facility to use HPLC is not freely available in the Sri Lankan health sector. Also due to a data loss, only 234 anaemic mothers and 199 non anaemic mothers were taken for the study, even though the calculated sample size was 239 for each group.

## 5. Conclusion

In conclusion, there was a moderate prevalence of iron deficiency Anaemia in pregnant women in Peradeniya, Sri Lanka. Devastating effects of anaemia associated with pregnancy could be prevented by early registration, close antenatal follow up, early detection and treatment of anaemia with proper guideline according to the haematologist and nutritionist before delivery. All of these would help to guarantee safe motherhood and babyhood.

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## Authors Contribution

I.C Kandauda participated in the design of the study, performed the data collection and served as the lead author of the manuscript. S.L Manatunga performed data collection, participated in drafting the manuscript and helped to performed statistical analysis. K Maduwage participated in design of the study, helped to draft the manuscript and performed statistical analysis. P.M Rathnayake participated in design of the study and did all the haematological analysis. S. Tenakoon participated in design of the study and performed statistical analysis. All authors read and approved the final manuscript.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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