# Original Article
# Prevalence, knowledge and selected associated factors of anaemia among non-pregnant females of reproductive age in a tea estate community in Hantana, Kandy district, Sri Lanka

Fathima A Sheriff[1], Ruchira K Dissanayake[2], Chatura Wijesundara[3], Kalpani O Bandaranayaka[4,5], Gayashan Chathuranga[2]

[1]Management and Science University, University Drive, Off Persiaran Olahraga, Shah Alam 40100, Malaysia; [2]Department of Medical Laboratory Sciences, Faculty of Allied Health Sciences, University of Sri-Jayewardenepura, Sri Lanka; [3]Ministry of Health, 385, Ven. Baddegama Wimalawansa Thero Mawatha, Colombo 10, 01000, Sri Lanka; [4]Management and Science Institute, No. 300, Galle Road, Colombo 03, 00300, Sri Lanka; [5]Department of Para-clinical Sciences, Faculty of Medicine, Sir John Kotelawala Defence University, Ratmalana 10390, Sri Lanka

**Abstract:** Anaemia among non-pregnant females of reproductive age remains a common public health problem globally, as well as in Sri Lanka. The objective of the study was to determine the prevalence of anaemia, asses the knowledge and the associated factors of anaemia among non-pregnant females of reproductive age in a tea estate community in Hantana, Kandy district, Sri Lanka. A descriptive cross-sectional study was conducted among 236 randomly selected non-pregnant females of reproductive age within the tea estate community belonging to two MOH (Medical Officers of Health) areas. The proportion of anaemia was determined by measuring haemoglobin (Hb) concentration using Mindray five-part automated blood analyser. The cut-off value to determine anaemia was set at 12.0 g/dL and respondents were categorized into three anaemia categories based on their Hb value. The common risk factors and knowledge regarding anaemia were assessed using a pre-tested interviewer administered questionnaire. Data was analysed with SPSS version 25. Chi-square test was used to conduct a bi-variate analysis. Prevalence of anaemia was 33.1%, among whom 53.8% had mild anaemia, 39.7% had moderate anaemia and 6.4% had severe anaemia. Anaemia was significantly associated with being employed, delivery of a baby within the past 4 years, advancing age, low income (less than 20,000 LKR) and prolonged menstrual bleeding for more than 3 days. Majority (58.5%) had poor knowledge regarding anaemia with a mean score of 5.69 (SD ± 2.42) out of 12. Since anaemia is a multifactorial condition it requires a combination of interventions such as health education and promotion activities. This study aids in assessing the prevalence of anaemia among estate workers identify the significant factors contributing to anaemia.

Keywords: Anaemia, risk factors, tea estate community, female, reproductive age

## Introduction

Anaemia is a global health issue. It is a result of decreased haemoglobin level and leads to an inadequacy of oxygen to meet the bodies needs [1]. General cut-off level of haemoglobin for the diagnosis of anaemia is 12.0 g/dL for a non-pregnant female of 15 years and above. However, factors such as gender, age, ethnicity, pregnancy, smoking behaviour, altitude and geography may alter the level of the normal cut-off [2, 3]. It is estimated that around 24.8% of the world's population suffers from anaemia [2]. Anaemia in women of reproductive age (WRA) is increasing alarmingly (33% prevalence). Its significance was highlighted in the Sustainable Development Goal 2.2, where heightened emphasis is placed on the nutritional needs of lactating mothers, pregnant females and girls who have reached adolescence [3]. The time period after menarche and before menopause poses a greater risk of anaemia due to the loss of blood during menstruation [4].

According to the WHO, the prevalence of anaemia in Sri Lanka is 29% [2]. The only national survey on anaemia conducted in 2006 show-

ed that the prevalence of anaemia among females was 34% with 20.7% having mild anaemia and 13.3% having moderate-severe anaemia. Around 32.6% of WRA suffer from anaemia as of 2006 [5].

Anaemia is a multi-factorial condition and these factors can be categorized as proximal and distal [3]. Proximal factors are those that are directly responsible for causing anaemia such as iron deficiency; low levels of vitamin A, imbalanced body mass index, inflammation and infections such as malaria. Education, Water, Sanitation and Hygiene (WASH) and demography are some of the identified distal risk factors [6].

Poverty is a major determinant of health and nutrition, and poor socioeconomic position is linked to a greater risk of anaemia among women [7]. In Sri Lanka the depth and severity of poverty is highest among the estate sector. This has created vast socio economic differences between the estate sector and other parts of the country. A higher prevalence of child and maternal malnutrition is observed in the estate sector comparably to other communities within the country [8]. Similarly, a low education level is also associated with a greater risk of anaemia [7].

While there are studies conducted in Sri Lanka assessing the prevalence of anaemia they mostly focus on school children and pregnant females [9-12]. An even fewer number of studies focus on the causes leading to anaemia [13]. Given the vast socio economic difference between the communities the findings of these studies cannot be directly applied to the estate sector. The aim of this study was to understand anaemia's varied and complex aetiology for developing effective interventions that address the context-specific causes of anaemia and for monitoring anaemia control programs. The findings of the study can be applied to similar estate communities present in other countries in the South Asian region such as India and Bangladesh giving it a global relevance [14, 15].

**Materials and methods**

A descriptive cross-sectional study was performed to determine the prevalence and contributory factors to anaemia among non-pregnant females of reproductive age in a tea estate community in Hantana, Kandy district, Sri Lanka.

*Ethics statement*

Ethical clearance for the study was obtained from the National Institute of Health Science (NIHS), Sri Lanka (Reference Number: NIHS/ERC/18/7JR). Informed written consent was obtained from all the participants using a standard consent form with an information sheet giving particulars of the study including nature of the study, expected risks and benefits.

*Sample size*

A sample frame was developed using the health records of the public health midwife (PHM) of that region. The Lwanga and Lemeshow equation was used to determine the sample size required [16]. Confidence interval was set to 95% therefore the standard deviation is 1.96. Accordingly, a sample of 236 females of reproductive age, were drawn from the population of non-pregnant females of reproductive age using the simple random sampling technique. Random numbers were generated through the blind draw method.

*Inclusion criteria*

The study population consisted of non-pregnant females of reproductive age in a tea estate community in Hantana, Kandy district, Sri Lanka. Non-pregnant females who have attained menarche but have not reached menopause (15-49 years) residing in the estate community were included in the study.

*Exclusion criteria*

Non-pregnant females of reproductive age with a documented past history of haematological disorders (i.e., sickle cell trait, thalassemia trait) were excluded Individuals who did not give consent were also excluded.

*Study instruments*

Two study instruments were used for this study; a test to estimate the haemoglobin level of the subjects and a questionnaire to assess the knowledge of the subjects and to identify the sociodemographic factors that can cause anaemia.

*Haemoglobin estimation:* A volume of 2 ml of venous blood was drawn from each participant into EDTA (ethylenediaminetetraacetic acid) containers for haemoglobin measurement by a licensed phlebotomist. Universal guidelines were followed during blood collection, transportation, storage, and disposal. A Mindray® five-part automated blood analyser was used to measure the Haemoglobin concentration.

The cut-off for anaemia was taken as 12.00 g/dL. The prevalence was obtained using the number of participants having anaemia from the total sample. The haemoglobin values were categorized into 3 groups namely: moderate (8.00-10.99 g/dL), mild (11.00-11.99 g/dL) and severe (< 8.00 g/dL) [6].

*Questionnaire:* A pretested interviewer administered questionnaire was used to collect information from the sample. The questionnaire was developed in English and was translated to Sinhala and Tamil languages by professional translators. Further validation of the questionnaire was done by a consultant haematologist. A trained data collector who speaks the native language administered the questionnaire. The questionnaire was designed to collect information on the socio-demography, reproductive health and the participants' knowledge on anaemia.

The tone and method of questioning from each participant by the interviewer was kept constant. Interviewer was strictly instructed not to probe the participants. The grouping basis of females of reproductive age into different categories in the questionnaire (E.g. Married and single) was based on findings of previous studies [17-19].

*Statistical analysis*

IBM SPSS Statistics software package version 25 was used to process and analyse the data.

All questions in Part I and Part II of the questionnaire were assessed as separate independent variables (Example-Age, employment status... etc.). The Chi-square test was used to determine the relationship between the said variables and the prevalence of anaemia. *P* values less than or equal to 0.05 was considered statistically significant.

In Part III of the questionnaire (knowledge), all statements were given scores where a correct answer was given "1" mark and a wrong answer was given "0". Scores of each subject was summed up and given out of a total of 12. The total score of each subject was then categorized as "good" (≤ 6 out of 12) or "poor" (≥ 7 out of 12) knowledge. The Chi-square test was used to determine the relationship between the knowledge and the prevalence of anaemia. *P* values less than or equal to 0.05 was considered statistically significant.

**Results**

*Prevalence of anaemia*

Mean haemoglobin level was 12.2 g/dL (SD ± 1.42) with a range of 5.2-14.7 g/dL. Using the cut-off of 12.0 g/dL the proportion having anaemia was 33.1%. Within the anaemic population, 53.8% (n=42), 39.7% (n=31) and 6.4% (n=5) had mild, moderate and severe anaemia respectively.

*Sociodemographic factors of study participants*

The mean age of the study sample was 36 years (± 11.7 years) with a range of 15-49 years. Among them, 201 (85.2%) were married. The majority of the participants were housewives (n=138, 58.5%). Approximately one fourth of the participants had parents who are blood relatives. More than half of the participants (57.6%) had their highest education level at Ordinary Level and above. Most of the participants belonged to a low socioeconomic class where around 60% earned less than 20,000 rupees per month.

*Dietary habits of the study population*

Nearly half the population (n=122, 51.7%) followed a regular eating pattern. Among those that skip meals (n=35, 14.8%), majority skipped lunch (n=25, 10.6%). Among the participants, 90.7% (n=214) were non-vegetarians and most of them (n=209, 88.6%) consumed fish while only a small proportion (n=47, 19.9%) consumed beef. A vast majority (98.7%) of the females stated that they consumed tea as a habit, most of which were consumed just before meals (n=206, 87.3%). The mean number of cups of tea consumed

**Table 1.** Associations between sociodemographic factors and proportion of anaemia

| Risk factors | Number of respondents (%) | | $\chi^2$ | p value |
| --- | --- | --- | --- | --- |
| | Anaemic** | Non-Anaemic | | |
| Age | | | | |
| Less than 34 years | 29 (37.2) | 83 (52.5) | 4.9 | 0.026* |
| More than 35 years | 49 (62.8) | 75 (47.5) | | |
| Marital status | | | | |
| Married | 65 (87.8) | 136 (87.7) | 0.0 | 0.983 |
| Unmarried | 9 (12.2) | 19 (12.3) | | |
| No. of children | | | | |
| Less than 2 | 37 (47.4) | 83 (52.5) | 0.5 | 0.461 |
| More than 3 | 41 (52.6) | 75 (47.5) | | |
| Parents kinship | | | | |
| Relative | 20 (29.9) | 45 (32.8) | 0.2 | 0.666 |
| Non-relative | 47 (70.1) | 92 (67.2) | | |
| Employment status | | | | |
| Employed | 35 (44.9) | 39 (24.7) | 9.9 | 0.020* |
| Unemployed | 43 (55.1) | 119 (75.3) | | |
| Religion | | | | |
| Hindu | 65 (83.3) | 126 (79.7) | 0.4 | 0.509 |
| Others | 13 (16.7) | 32 (20.3) | | |
| Monthly income | | | | |
| Less than 20,000 | 57 (73.1) | 90 (57) | 5.8 | 0.016* |
| More than 20,000 | 21 (26.9) | 68 (43) | | |
| Education status | | | | |
| Below O/L | 39 (50) | 61 (38.6) | 2.8 | 0.096 |
| O/L and above | 39 (50) | 97 (61.4) | | |

*Significance at 0.05 level **Cut-off of 12.0 g/dL.

ceptives within the past two months. The most common contraception method was ligation and resection of tubes (17.8%, n=42). Most the females have regular menses (74.6%) and no passage of clots (83.1%) during menses. The mean number of days period lasts was calculated to be 4.0 (SD ± 1.46) days.

*Knowledge of anaemia among study participants*

Most of the participants (85.6%, 202) have not heard of the word anaemia and 211 individuals (89.4%) did not know the cause of anaemia. Only 20 (4.2%) individuals knew it was caused by iron deficiency. About 70% knew the types of food rich in iron. Majority did not know that anaemia could be associated with delivery complications. The highest number of correct responses (78.4%) was obtained when participants were asked if iron supplements were necessary during pregnancy.

The mean total score for knowledge was 5.69 (SD ± 2.42) out of 12. More than half of the participants had poor knowledge (n=138, 58.5%) while the rest had good knowledge (41.5%).

per day was 2 (SD ± 0.82) with the maximum number of 6 cups per day. Among the participants, 89% used a Vitamin C component in the preparation of green leafy vegetables. Out of 236 participants, 158 rarely consumed fruits/fruit juice.

*Reproductive health of the study participant*

Out of the women who have previously had children, 18.2% (n=43) have had miscarriages/abortions. From the entire population, 42 (17.8%) participants have never been pregnant. The majority of the women have delivered in a medical institution (81.8%, n=193) where 64% of the population (n=151) delivered their last child via normal vaginal birth. A small proportion delivered through a caesarean section (16.5%, n=39) and assisted vaginal delivery (1.7%, n=4). The average duration of breast feeding was 32 months (SD ± 14.55). Among the participants, 39.4% (93) have used contra-

*Associations between risk factors and anaemia*

*Associations between sociodemographic factors and anaemia:* A greater percentage of females aged 35 and more had anaemia in comparison to younger females while those who were unemployed were more likely to be non-anaemic.

Participants with more than 3 children, married, positive parent kinship and/or being Hindu showed no significant association with anaemia. Even though a large proportion of non-anaemic patients had an education level at Ordinary Level and above there is no statistical significance for the association. There was a statistically significant association between anaemia and monthly income where those that earn less than 20,000 LKR had a higher prevalence of anaemia (**Table 1**).

**Table 2.** Association between duration of menstruation and anaemia

| Duration of menses | Number of Anaemic respondents (%)** | | $\chi^2$ | p value |
|---|---|---|---|---|
| | Mild | Moderate-severe | | |
| 1-3 days | 33 (78.6) | 16 (44.4) | 9.7 | 0.002* |
| More than 3 days | 9 (21.4) | 20 (55.6) | | |

*Significance at 0.05 level **Cut-off considered is 12.0 g/dL.

**Table 3.** Associations between reproductive health and anaemia

| Risk factors | Number of respondents (%) | | $\chi^2$ | p value |
|---|---|---|---|---|
| | Anaemic** | Non-anaemic | | |
| Number of pregnancies | | | | |
| 1-2 | 30 (38.5) | 76 (48.1) | 2.0 | 0.161 |
| 3 and more | 48 (61.5) | 82 (51.9) | | |
| Miscarriages | | | | |
| 1 | 61 (78.2) | 122 (77.2) | 0.0 | 0.864 |
| More than 1 | 17 (21.8) | 36 (22.8) | | |
| Last delivery date | | | | |
| Before 2014 | 63 (80.8) | 105 (66.5) | 5.2 | 0.022* |
| After 2015 | 15 (19.3) | 53 (33.5) | | |
| Method of last child delivery | | | | |
| Normal vaginal birth | 53 (82.8) | 98 (77.8) | 0.7 | 0.417 |
| Caesarean | 11 (17.2) | 28 (22.2) | | |
| Birth spacing | | | | |
| 1 year | 11 (22.9) | 14 (15.4) | | |
| 1-3 years | 24 (50.0) | 49 (53.8) | 1.2 | 0.542 |
| >4 years | 13 (27.1) | 28 (30.8) | | |
| Age of first childbirth | | | | |
| Less than 24 years | 33 (50.0) | 70 (54.7) | 0.4 | 0.535 |
| More than 25 years | 33 (50.0) | 58 (45.3) | | |
| Menses regular | | | | |
| Yes | 54 (69.2) | 122 (77.2) | 1.8 | 0.185 |
| No | 24 (30.8) | 36 (22.8) | | |
| Passage of clots | | | | |
| Yes | 17 (21.8) | 23 (14.6) | 1.9 | 0.163 |
| No | 61 (78.2) | 135 (85.4) | | |

*Significance at 0.05 level **Cut-off value considered is 12.0 g/dL.

*Associations between dietary habits and the proportion of anaemia:* None of the tested dietary habits showed any significant association with anaemia (P>0.05).

*Associations between reproductive health and proportion of anaemia:* Parity ($\chi^2$=5.2, P= 0.161) and the number of miscarriages ($\chi^2$= 0.0, P=0.864) was not associated with the prevalence of anaemia. However, there is a relationship between delivery of a child within

the past 5 years and prevalence of anaemia ($\chi^2$=5.2, P=0.022). There is an evident association between duration of menstruation and developing anaemia ($\chi^2$=4.9, P= 0.026). Further assessment showed that severe anaemia is more likely to develop when menstruation duration is more than 3 days ($\chi^2$=9.2, P=0.02) (**Table 2**). Participants Hb level was unaffected by the varying birth spacing ($\chi^2$=1.2, P= 0.542) and age of first child delivery ($\chi^2$=0.4, P=0.535). The method of delivery of the last child ($\chi^2$=0.7, P=0.417) doesn't contribute to the difference in Hb level either. Both regularity of menses ($\chi^2$=1.8, P=0.185) and passage of clots during menstruation ($\chi^2$=1.9, P=0.163) showed no statistical significance with the prevalence of anaemia (**Table 3**).

**Discussion**

This study was designed with the objective of producing generalizable data regarding prevalence, knowledge and associated factors of anaemia in the tea estate community.

According to the findings of this study the prevalence of anaemia in this tea estate community in Hanthana, Kandy district is 33.1%. This is much higher when compared with the regional prevalence of anaemia in non-pregnant women aged 15-49 years in Kandy (20-29%) [5]. Since the study population is within the Kandy district, it indicates the presence of unknown factors leading to the increased prevalence of anaemia in this distinct population.

This study found an association between the advancing age (more than 35 years) and development of anaemia. According to the "WHO" the advancing age is a risk factor and this has

been supported by other studies as well [3, 20]. The main reason for this association could be the high chance of contracting diseases that cause high morbidity and give rise to anaemia. It could simply be due to the body's metabolic requirements as well. The association between advancing age and anaemia could be linked with pregnancies as well. 42% of the study population were under 35. The study also showed that the average age of child birth in this community was 24.9 (SD ± 5.2). As a result mothers in this age range are in constant contact with the Public Health Midwife and are taking iron supplements while the rest are slightly detached from the health system.

The monthly income of the subjects also showed a significant association with the presence of anaemia. In support of the current findings, Samarasinghe (1993) showed that 62.3% of females in the tea estate sector were having a monthly income of less than 20,000 LKR [21]. Lower income families can find it difficult to afford high quality/quantity of food to compensate with their iron requirement thus increasing the risk of anaemia.

The majority of those that were unemployed were non-anaemic (75.3%). The only possible explanation could be that unemployed women stay at home, which gives them easy access and control over their food intake. Those that are employed can only consume meals at given intervals during work hours.

This study was unable to find an association between ethnicity and anaemia. But this may be due to the fact that the majority of the study sample was Hindus. Further no significant associations were revealed between the prevalence of anaemia and marital status, parental kinship, the number of children, and education status.

None of the tested dietary habits have shown any significance. According to this study 98.7% of study population consume tea. If tea is consumed immediately before and after the main meals iron absorption will be reduced due to tannin [22]. Since 87.3% have mentioned that they drink tea immediately before meals, the risk of anaemia can be assumed to be much less than when they drink tea immediately after meals. Other indicators such as regularity of meals, vegetarian or non-vegetarian and consumption of fruit juices show no significant

association. But proof to support good dietary practices is limited because the frequency of consumption of fish and green leafy vegetables was not obtained. The most ideal method to obtain the frequency of food is via a dietary recall. However, dietary recall was not exercised because of time constraint and limited resources.

When considering the reproductive health the menstrual duration had a significant effect. The duration of menstruation was significantly associated with anaemia with women who have menses for more than 3 days being more likely to get moderate to severe anaemia. This is because an increased duration gives rise to an increased blood loss thus lowering the Hb level. Further, when this low Hb is not compensated by dietary intake, it will ultimately lead to anaemia [2, 3]. However past studies are present which both contradict and support the association between anaemia and menstrual duration [24, 25]. Other reproductive health factors such as the number of pregnancies, any miscarriages, birth spacing, regularity of menses, the method of delivery, the passage of clots and contraception showed no association with anaemia.

More than half the study population (58.5%) had poor knowledge of anaemia. Low level of knowledge about anaemia could result in the making of incorrect dietary decisions therefore reducing the chances to mitigate anaemia [26]. But the study also revealed that there was no significant association between the level of knowledge and the prevalence of anaemia.

The limitations of this study were the inability to obtain BMI (Body Mass Index) and dietary recall. BMI has a correlation with the protein adequacy and productivity which is useful in associating dietary practices to anaemia [27]. Therefore obtaining of BMI and dietary recall would have helped enhancing the association and understanding between anaemia and dietary practices. Moreover, research shows that 50% of anaemia is caused by IDA [28]. Therefore obtaining the serum ferritin levels of the patients could have also helped in identifying the underlying cause of anaemia.

### Conclusions

According to the findings of this study around one third of the non-pregnant females of re-

productive age in this estate community in Hantana, Sri Lanka are anaemic. More than half of the anaemic population has mild anaemia. When assessing the knowledge of the participants it was clear that they had very little understanding on anaemia. However this doesn't seem to be contributing significantly to the increase in anaemia patients. The study indicates that certain sociodemographic factors like age, income and employment have a direct impact on the prevalence of anaemia. Their dietary habits did not show a significance with regard to the prevalence of anaemia. Reproductive health related factors seems to play a major role with both the delay in delivery during child birth and the duration of menses contributing significantly to the presence of anaemia.

The findings suggest that we have to invest more in educating the tea estate community with regard to anaemia and its consequences. The health authorities should be more attentive when it comes to the reproductive health of females of reproductive age in the estate community since several factors associated with reproductive health have shown to have a significant effect on the prevalence of anaemia. Resources must be directed towards improving their living conditions and sources of income since the study clearly indicates that a lower income has a significant effect on the prevalence of anaemia.

### Disclosure of conflict of interest

None.

Address correspondence to: Gayashan Chathuranga, Department of Medical Laboratory Sciences, Faculty of Allied Health Sciences, University of Sri-Jayewardenepura, Sri Lanka. E-mail: chathuranga@sjp.ac.lk

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