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Review Article

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Single-Center Observational Study of Anaemia in Adolescents, Pregnant, and Lactating Women

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Abstract: The aim of this study was to evaluate the prevalence of anaemia among a target population comprising adolescent girls, pregnant women, and lactating women, by assessing their concentrations. The study also sought to identify the major socio-biological determinants that burden the healthcare system. Each group, the adolescent group and the pregnant/lactating group, consisted of 149 individuals. The study was conducted during a medical check-up oneday camp organized by the Dharmaram Association for Social Service in CSA LR Nagar slum, Bengaluru, India, between November 22, 2023, Subsequently, the data was collected, scored, and analyzed using statistical procedures, specifically calculating the mean and correlation.The findings of the study indicated that among the adolescent girls, 40% (N=40) exhibited low levels of anaemia, 31.4% (N=32) had moderate anaemia, and 27.5% (N=28) had severe anaemia based on their haemoglobin levels. Regarding pregnant and lactating women, the study revealed a prevalence of anaemia at a rate of 70% (N=28/48).

Key words: Anaemia prevalence; Socio-biological determinants; Adolescent girls' health; Pregnant and lactating women; Haemoglobin concentration analysis.

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1. INTRODUCTION

Anaemia is a major public health problem in India, clinically identified as a condition where the concentration of haemoglobin (Hb) and/or red blood cell (RBC) numbers are inadequate, preventing the body from meeting its physiological oxygen demand. This condition affects individuals of all ages and backgrounds, with particularly severe consequences for vulnerable populations like adolescent girls, pregnant women, and lactating women[1]. The prevalence of anaemia is a sign of poor nutrition, and the primary victims are often impoverished children and pregnant women [2]. Our study in the Bangalore slums revealed a significant percentage of anaemia among the sample size pregnant/lactating women and adolescent girls. Experts attribute this to the fact that around 16% of Bangalore's population lives in its 520 recognized slums, where the state has done little to lift residents out of the vicious cycle of poverty. These inequalities have only worsened during the pandemic, as policy shortcomings came to the fore[3]. As noted by Supriya Roy Chowdhury, a visiting professor at the National Institute of Advanced Studies in Bangalore, the dramatic economic growth in the city has been accompanied by the stubborn persistence of deep pockets of poverty. She attributes this urban poverty to the historical marginalisation of certain social groups [3]. Moreover, the growth of urban populations is often accompanied by the expansion of urban slums, posing a threat to the health of the urban population, especially children, who are more vulnerable to malnutrition and anaemia [4].

1.1. Global situation analysis

Of the issues "Regardless of its etiology, the World Health Organization (WHO) estimates that anaemia affects over 1.62 billion people worldwide. The most affected group is preschool-age children, with a prevalence of 47%, followed by pregnant women (41%), non-pregnant women (30%), school-age children (25%), and people older than 60 years of age (24%); men are the least affected group (12%). However, globally, the most numerous population group is non-pregnant women (468.4 million)" [5] on analysing our country in India the results prove that the half percentage of anaemic women live in the Indian subcontinent where 88% of them develop anaemia during pregnancy[5].

1.2. Reproductive health

The World Health Organization (WHO) identifies anaemia as a major indirect cause of maternal mortality, with the majority of deaths occurring in older age groups[6]. Pregnancy and childbirth have a profound impact on the physical, mental, emotional, and socioeconomic health of women and their families. While motherhood can be a joyful experience, for many women it is a period of suffering, poor health, and even death [7]. Improving maternal health remains a significant challenge in both developed and developing countries. A healthier pregnancy begins before conception, with good nutrition, healthy weight, pregnancy planning, and preventive care [8]. Women's nutrition has been highlighted as a global priority to ensure the health and well-being of mothers, children, and future generations. A balanced maternal diet that meets optimal macro- and micronutrient requirements is associated with improved maternal and child health, as well as reduced mortality rates. Social determinants of health, such as the social conditions in which people live and work, can influence the occurrence of health problems [9]. In the case of maternal anaemia, this can have adverse effects on lactating mothers, including decreased immunity, delayed wound healing, increased susceptibility to infections like mastitis and urinary tract infections, and diminished quality or volume of breast milk. And looking at the reproductive age of women Anaemia associated with severe complications of health out-comes, such as poor pregnancy outcomes, preterm birth, stillbirth, increased susceptibility, low birth weight, loss of productivity, fatigue, breathlessness, dizziness, maternal morbidity, and mortality. Moreover, anaemia can negatively impact infants' and children's cognitive and physical development[10]. The complex biases women face in society contribute to the major reasons why the healthcare system often fails to adequately serve women's needs or in other words Women`s health is profoundly affected by the way women are treated in society and the status they enjoy in the society, and they are often margined to the discrimination and this falls them to economic social and health disadvantages for women[7].

1.3. Social and biological determinants of iron deficiency anaemia

Although iron deficiency is common among women in developing as well as industrialized countries, studies show that it is more common in developing countries[15], it seems that in the case of India being a developing country it is identified as common determinant and their risk factors in the population, such as type of housing, income, lifestyle, the economic policy of the country in which they live, and others. Thus, health promotion requires intense action in the broad social determinants of health, ranging from interlocution between society's socioeconomic, cultural, and environmental policies to the creation of educational programs to change personal habits [8]. On the background of pregnant or lactating women and adolescent girls who are our one other concern who live in slums are characterized by poor health, especially it is imaged by poor housing, and environmental conditions, causing malnutrition and anaemia. And which pulls them to high risk.[4]

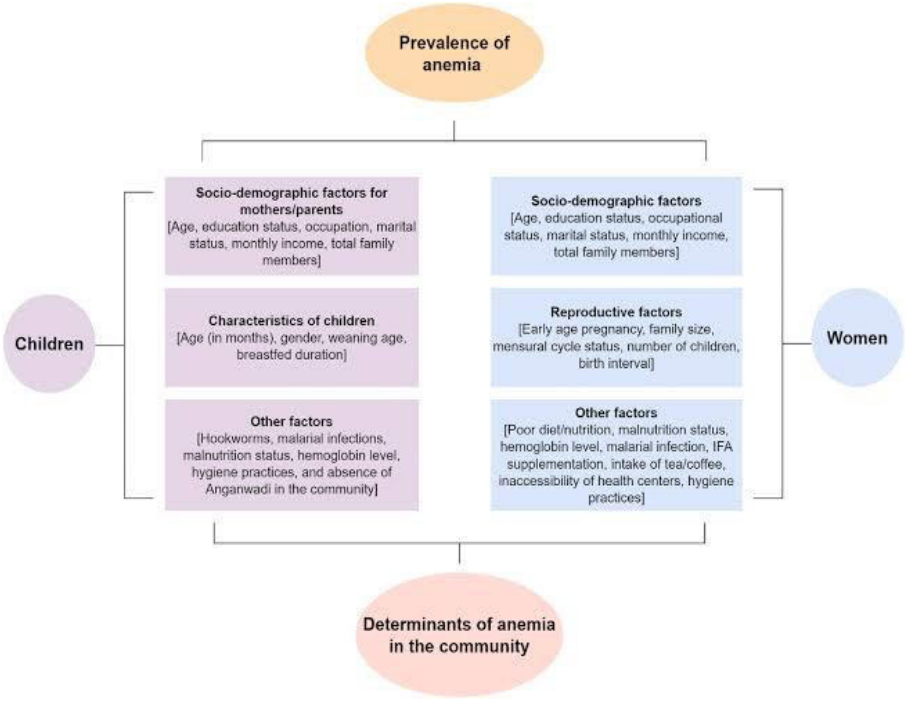

Fig 1: Conceptual framework by[11] on the prevalence of anaemia and the factors influence in the case of children and women.

1.4. Key Amendment by the Government of Karnataka to Address the Issue

The state governments are the key for India's progress for sustainable development goals. When the India government moves forward with the aim of anaemia Mukth Bharath being as a key pillar to the central goal "Karnataka State Government launched Anaemia Muktha Poustika Karnataka on the adopted guidelines of the national program. It consists of the basic principles of the national program tailored to the local context of the state and its communities. The programme is designed to provide care and management services through all stages of the life cycle. It has been specifically designed to promote the health and nutrition of women and children, with the aim to improve community awareness, screening, treatment, and monitoring"[6]. "Furthermore, Chief Minister Sri Siddharamaiah launched the Anaemia Muktha Poustika Karnataka on November 22, 2023, while highlighting that India's malnutrition index is rising. Out of the estimated population of 393 lakhs, 156.24 lakhs (40%) will be covered in Anaemia Muktha Poustika Karnataka while the remaining 236.76 lakhs, which includes children not registered in Anganwadis, students in private schools, out-of–school children, women in pre-conception age group (25–49 years) will undergo opportunistic screening and the data shall be captured in Health Management Information System (HMIS) /manual registers. The state will also take measures to ensure proper diet supplements, de-worming, and counselling services"[6].

1.5. Limitations of this healthcare system in the Bangalore slums

The healthcare system in the Bangalore slums faces significant limitations. Studies have shown that while efforts are made to control major issues like anaemia, there are still questions about universal accessibility and whether all residents fully benefit from these interventions. The slums of Bangalore are increasingly overcrowded, affecting the area's overall health both geographically and biologically. Our findings indicate that a substantial number of lactating and pregnant women, as well as adolescent girls, suffer from moderate to severe anaemia in these communities. The primary limitations stem from a lack of awareness - many slum residents are unaware of available healthcare services, their rights, and the importance of preventive care. Additionally, improper dietary habits, social customs, and taboos play a significant role. To resolve these issues, it is crucial to ensure proper awareness and education for women and children while maintaining adequate sanitation and housing facilities to promote a healthier lifestyle across the slum communities.

1.6. Population Vulnerability (Adolescent Girls, Pregnant, and Lactating Women)

Understanding the vulnerability of these populations is crucial for efforts to prevent and address anaemia. Taking into account the specific physiological, dietary, and lifestyle factors that contribute to increased susceptibility to this condition in children, adolescents, pregnant women, and lactating women is pivotal to the eradication of this potentially devastating condition.

1. Adolescent Girls: As with children, adolescents undergo rapid growth spurts, with subsequent increase in iron demand, it is theorized that during this period, the iron demands of the body equal or surpass the demand of an average menstruating woman [12]. Inadequate nutrition during this period can lead to anaemia and affect overall development. Unhealthy eating patterns and diets low in iron-rich foods can also contribute to the vulnerability of this population. Adolescent girls are particularly vulnerable due to menstrual blood loss[13].
2. Pregnant Women: Pregnancy induces an increase in blood volume to support the developing fetus. This can lead to a dilution of red blood cells, potentially resulting in anaemia if iron intake is inadequate to meet the increased demand[14]. Pregnant women with low pre-pregnancy iron stores are more susceptible to developing anaemia during pregnancy.

Among healthy human beings, pregnant women and rapidly growing infants are most vulnerable to iron deficiency [15].

3. Lactating Women: Lactating women have ongoing nutritional demands to support breastfeeding. The production of breast milk requires additional energy and nutrients, including iron. Inadequate intake can lead to postpartum anaemia. Lactation tends to deplete maternal iron stores, making lactating women vulnerable to anaemia if their nutritional needs are not adequately met [16].

1.7. Literature Review

Bharathi (2018): [17] This study focused on a smaller cohort of 60 adolescent girls at Siddanga PU College. Before any intervention, a staggering 81.7% had poor knowledge about reproductive health, with only 18.3% possessing average knowledge. The study underscored the critical need for educational programs to enhance awareness among adolescents.Priya K et al. (2022): [18] Expanding on this, the 2022 study assessed a larger sample of 800 adolescent girls across various educational levels. The results demonstrated a significant shift in knowledge post-intervention. Initially, 414 students had average knowledge, and 71 had good knowledge. After the intervention, the number of students with good knowledge rose dramatically to 723, leaving only 75 students at the average level. The studies collectively emphasize the effectiveness of reproductive health awareness programs in Bangalore. Bharathi (2018) highlighted the low baseline knowledge levels among adolescent girls, signaling the urgent need for educational interventions. Priya K et al. (2022) built on this by demonstrating that such interventions could lead to substantial improvements in awareness, reinforcing the importance of implementing and expanding these programs across educational institutions. The progression from the findings of the 2018 study to those of the 2022 study reflects a growing recognition of the necessity and efficacy of educational initiatives in improving reproductive health awareness. George et al. (2019) [19] conducted a cross-sectional survey in the Devarajeevanahalli slum of Bangalore to assess the prevalence of various health conditions using a mobile screening toolkit called THULSI (Toolkit for Healthy Urban Life in Slums Initiative). The study screened 3,693 individuals from 1,186 households and found that over 70% of the population lived below the poverty line. Only one-third had regular employment, with average daily incomes of $5.3 for men and $2.6 for women. The study revealed high prevalence rates of hypertension (35.5%), diabetes (16.6%), and anaemia (70.9%) in the screened slum population. Building on this, a more recent study by Husain et al. (2023), [20] examined the prevalence and associated factors of anaemia among school children aged 11-15 in Bengaluru. The study, which included a sample of 250 children, found that 21% were anemic. The researchers identified low socioeconomic status, dietary deficiencies, blood loss, and chronic infections as significant factors associated with the high prevalence of anaemia in this population. The study should examine relevant research from other states beyond Karnataka to gain a broader perspective. Mawani and Aziz Ali (2016) [5] conducted a study on iron deficiency anaemia (IDA) among women of reproductive age, which is an important public health problem. The study examined IDA based on data from the WHO and World Bank databases. The researchers identified multiple determinants of IDA in the literature, including genetic and environmental factors such as poor diet, low socioeconomic status, high parity, limited healthcare access, and genetic predisposition. Additionally, the study found that IDA can lead to various adverse outcomes, including fatigue, poor mental health, lack of concentration, stillbirth, preterm birth, and postpartum haemorrhage. Yasmeen MAjid Kahan and Asmat Majid Kahan, (2017) [21] The present study was conducted to find out prevalence of anaemia among non-pregnant non lactating women of Srinagar district coming to out- patient department of SKIMS Soura Srinagar. The survey was conducted on 175 non-pregnant and non-lactating women. The total sample of 175 women was from age group 19-55 years the data was expressed as mean and percentage. A very high overall prevalence of iron deficiency anaemia (98.87 %) was found in the study population. The women who had delivered more no. of children were severely anemic. Nutritional deficiencies may be prevented by consuming a diet rich in those deficient nutrients or by taking the appropriate supplements(Let et al., 2024) [10] the study was conducted and on the prevalence and determinants of anaemia among women of reproductive age (WRA): which is an analysis of NFHS 4 and NFHS 5. The study was conducted in in aspirational district of India. And the resulted the national prevalence of anaemia among WRA has increased from 53% in NFHS-4 to 57% in NFHS-5 whereas anaemia among WRA in Aspirational Districts has increased from 58.7% in NFHS-4 to 61.1% in NFHS-5. Between 2015 and 2021, over (Chandrakumari et al,2019) [22] emphasizes the rampant nature of anaemia in adolescent girls, the study also underlines the importance of addressing nutritional deficiencies and iron status to mitigate its effects on this group. Similarly, implications of anaemia during pregnancy, stressing the need for comprehensive antenatal care to prevent adverse outcomes for both the mother and the developing fetus.

1.8. Rationale

Understanding the overall prevalence of anaemia is fundamental for multi determinant factors. It provides a baseline assessment of the health status of the target population, helps identify potentially at-risk groups, and guides the development of targeted interventions to address anaemia within the specific context of the chosen center.

2. OBJECTIVES OF THE STUDY

2.1. Primary Objective

The main purpose of this research is to evaluate the magnitude of anaemia within the study populations - adolescents, pregnant women, and lactating women. This objective is driven by the need to understand the baseline prevalence of anaemia, which is essential for informing public health strategies, interventions, and resource allocation to combat Anaemia.

2.2. Secondary Objectives

To assess Anaemia among the adolescent group

Adolescence is an important period of nutritional vulnerability due to the increased nutritional demands for growth and development during this phase. The iron requirement is high because of intense growth and muscle development, increasing blood volume.[23] Deficient iron status or anaemia among girls is a major cause of growth and development among them, it affects mental health growth and development and it affects the future days on matters of delayed menarche, future poor reproductive outcomes etc. [24] Various socio-determinant factors affect the development of these their standards of living, ethnicity and cultural background etc affects this

development. Noticing anaemia in adolescents makes room for early intervention, potentially mitigating long-term developmental consequences. Schools-based and area, nutrition awareness programs and other proper monitoring and evaluation on the smooth running of various programs and interventions are a requisite to potentially mitigate these issues.

2.3. To Assess Anaemia among pregnant women

Pregnancy significantly increases the body's iron requirements to support fetal growth, making it a common period for developing anaemia [25]. Anaemia during pregnancy is associated with adverse maternal and fetal outcomes, making its assessment integral for maternal health[25]. Anaemia in mothers has detrimental implications for the health of the mother such as haemorrhage in the antepartum and postpartum period, and maternal sepsis, to name a few and stillbirth, low birth weight, and preterm birth in the fetus [26]. The research findings can be used to improve prenatal care practices and develop strategies to prevent and treat anaemia during pregnancy. Supplementation for mothers, guided by the study's information on anaemia prevalence, can help reduce related risks.

2.4. To assess Anaemia in lactating women

Assessing anaemia prevalence in lactating women contributes to postpartum health considerations. Findings can contribute to understanding the potential impact of maternal anaemia and abate adverse effects on an infant's overall health during breastfeeding. [27] Inform postpartum care plans and nutritional support for lactating women.

3. METHODOLOGY

This research adopts a cross-sectional study design to assess the prevalence of anaemia among two distinct groups: adolescent girls and pregnant or lactating women. The study took place at a medical check-up camp organized by the Dharmaram Association for Social Service on October 1, 2023, in CSA LR Nagar, Bengaluru, India. The medical camp was dedicated to providing essential medical care to adolescent girls, and lactating women. And This study will provide valuable insights into the prevalence of anaemia among adolescent girls and pregnant/lactating women in the study area. It will also identify the associated social determinants, which can inform targeted interventions to address anaemia and improve the overall health of the target population.

3.1. Study Population

3.1.1. Inclusion Criteria

Females within the age ranges of 10-25 were selected for the study. Adolescents were deemed to be females within the age ranges of 10-15, and 16-25 respectively. A second group of Pregnant or Lactating Women within the ages of 20-25 were also identified.

3.1.2. Exclusion Criteria

Individuals with known chronic illnesses affecting haemoglobin levels were excluded from the study. Those unwilling or unable to provide informed consent.

3.2. Data Collection

For this cross-sectional study, a total of 18 mothers (antenatal and postnatal) and 68 adolescent girls were enrolled. A haemoglobin assessment was conducted and the participants were classified as moderately anemic (Hb% 7- 10gm %) mild anaemia (Hb% 10-11.9gm %) and as severely anemic (Hb < 7 g %).

4. RESULTS

Table 1: presents the percentage of anaemia cases across different age groups.

AGE GROUP	Anaemia Level				Total
	Nil	Low anemaia	Modrate anemaia	Severe anaemia	
Age group of - 10-15	36	2	28	20	86
	41.9%	2.3%	32.6%	23.3%	100.0%
Age group of 15-20	4	0	6	10	20
	20.0%	0.0%	30.0%	50.0%	100.0%
Age group of - 20-25	8	0	4	2	14
	57.1%	0.0%	28.6%	14.3%	100.0%
Age group of - 25-30	4	0	2	2	8
	50.0%	0.0%	25.0%	25.0%	100.0%
Age group of 30 above	2	2	10	6	20
	10.0%	10.0%	50.0%	30.0%	100.0%

As per the above mentioned table based on the age group chart, with in the number of 149, of the adolescent girls age range of 10-15, Among the 86 girls in this age group, 23.3% (N=20) suffer from severe anaemia (Hb < 7 g%), 32.6% (N=28) have moderate anaemia (Hb 7-10 g%), and 2.3% (N=2) have low anaemia (Hb 10-11.9 g%). Meanwhile, 41.9% (N=36) were diagnosed as non-anemic.The adolescent girls with in the age range of 15 – 20, Out of 20 girls in this age group, 50% (N=10) have severe anaemia, 30% (N=6) suffer from moderate anaemia, while no cases of low anaemia were reported. Additionally, 20% (N=4) were diagnosed as non-anemic. In the 20- 25 age group of 14 women, 14.3% (N=2) have severe anaemia, 28.6% (N=4) suffer from moderate anaemia, and none were diagnosed with low anaemia. A majority, 57.1% (N=8), were found to be non-anemic.In the pregnant and lactating group, at the age group of 25-30 Among the 8 women in this group, 25% (N=2) suffer from severe anaemia, 25% (N=2) have moderate anaemia, and none were found to have low anaemia. Half of the women, 50% (N=4), were non-anemic. In the last age group of this table deals with the age group of lactating and pregnant women with in the age group of 30 above, 20 women,

30% (N=6) have severe anaemia, 50% (N=10) suffer from moderate anaemia, and 10% (N=2) were found to be non-anemic. Additionally, 10% (N=2) have low anaemia.

Table 2 presents the percentage of anaemia cases across category of the sample.

Category	Anaemia Level				Total
	Nil	Low anemaia	Modrate anemaia	Severe anaemia	
PR/L	14	2	18	12	46
	30.4%	4.3%	39.1%	26.1%	100.0%
Adolosecent Girl	40	2	32	28	102
	39.2%	2.0%	31.4%	27.5%	100.0%
Total	27	4	50	40	149
	36.0%	2.7%	33.6%	26.8%	100.0%

As per the above-mentioned table that gives result in differentiating from the total number of 149 as pregnant and lactating women from the age group of 20-30 above the total strength of pregnant and lactating women were (N=46) 32%% and the adolescent girls group consists of (N=102) which consists of rest 68% of the total sample. Among the pregnant and lactating women 26% were identified with severe anaemia (N=12), 39% were identified with moderate anaemia (N=18) and 30.2 were identified as non-anemic and finally 4.3 % among the category is identified with mild/low anaemia. And referring category of adolescent girls that referred from the age group of 10-20 to the as per the table of adolescent girls of the rest 68%, 40% is identified as non-anemic (N=40), 32% of the category id identified with moderate anaemia (N=32) and 28% of the group that belongs to the percentage with severe anaemia (N=28)

5. DISCUSSION

Our study results highlight a significant burden of anaemia among adolescent girls, especially those aged 10-20. In the 10-15 age group, 23.3% experience severe anaemia (Hb < 7 g%), while 32.6% suffer from moderate anaemia. Only 2.3% of the girls in this group have low anaemia, and 41.9% are non-anemic. For girls aged 15-20, the situation is more critical, with 50% suffering from severe anaemia and 30% having moderate anaemia, while no cases of low anaemia were recorded. Only 20% of this group were non-anemic. These findings reflect broader trends in developing regions, where adolescent anaemia rates are alarmingly high due to poor nutrition, menstrual blood loss, and limited access to healthcare[28,29]. The prevalence of anaemia in adolescence has long-term consequences on physical development, cognitive performance, and future maternal health (Kassebaum et al., 2014). Thus, targeted interventions such as iron supplementation, improved dietary practices, and better education about anaemia prevention are crucial to reducing its impact on this vulnerable population[30,31]. Addressing anaemia during adolescence is vital to breaking the cycle of malnutrition and ensuring a healthier adult population. In the 20-25 age group, which consists of 14 women, 14.3% (N=2) experience severe anaemia, while 28.6% (N=4) suffer from moderate anaemia. Surprisingly, no cases of low anaemia were detected, and the majority (57.1%, N=8) were non-anemic. In contrast, among 8 pregnant and lactating women aged 25-30, 25% (N=2) have severe anaemia, and another 25% (N=2) have moderate anaemia, with 50% (N=4) being non-anemic. The older age group of pregnant and lactating women (30+) shows a marked increase in anaemia, with 30% (N=6) of 20 women experiencing severe anaemia, and 50% (N=10) suffering from moderate anaemia. Additionally, 10% (N=2) were non-anemic, and 10% (N=2) had low anaemia. This data indicates a significant variation in anaemia prevalence across age groups, particularly with increasing severity in older pregnant and lactating women. These findings align with broader research showing that anaemia is a critical health issue among women, particularly during pregnancy and lactation, necessitating targeted interventions[32,33].

6. CONCLUSION

The issue of public health is complex, with many interrelated factors and challenges. The prevalent occurrence of anaemia poses a significant health challenge across diverse age groups, particularly among pregnant and lactating women. Alarming statistics reveal high rates of anaemia, especially among adolescent girls and pregnant/lactating women, underscoring the urgent need for targeted interventions and public health initiatives.To address these concerning figures and combat anaemia, the author suggests implementing strategic, multi-sectoral interventions. Successful anaemia prevention and control require a collaborative approach involving the health, education, nutrition, and social welfare sectors. Empowering communities, particularly women and girls, to participate actively in decision-making processes is crucial. By investing in social interventions and creating enabling environments, we can not only reduce anaemia rates but also improve the overall well-being and life chances of affected populations. Ultimately, combating anaemia is about more than just treating a deficiency; it is about addressing the underlying social inequalities that perpetuate this health crisis. Even a small sample from the target group could reveal the social urgency, with 60% found to be severely or moderately anaemic. This highlights the need to assess the effectiveness of current programs and ensure they adequately prevent and address the issue.

7. AUTHORS CONTRIBUTION STATEMENT

All authors have made a substantial, direct, and intellectual contribution to the work and approved it for publication. Fr. Jerin Joseph contributed to the conceptualization and supervision. Dr Ambika Akhoury, Dr Anieta Merin Jacob, Dr. Clement Prakash , Dr. John Abraham played a key role in reviewing and editing the manuscript.

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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