Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 29s (2025)
https://www.jneonatalsurg.com

Prevalence Of Anemia and Nutritional Status Comparison in Urban and Rural Areas Among Underfive Children

Dr.Vaishali Muchalambi[1]

[1]Assistant Professor, Dept.of Child Health Nursing, KAHER, Institute of Nursing Sciences, Belagavi, Karnataka, India.

Cite this paper as: Dr.Vaishali Muchalambi, (2025) Prevalence Of Anemia and Nutritional Status Comparison in Urban and Rural Areas Among Underfive Children, *Journal of Neonatal Surgery*, 14 (29s), 452-459

ABSTRACT

Background: The prevalence of anemia stays high across various research studies which emerge from different regions. Anemia which results from low blood hemoglobin levels operates as a severe global public health matter. Public health initiatives need to identify cases of anaemia. Global data from 2011 indicates that anemic conditions affected 273 million young children worldwide particularly from iron deficiency triggers about 50% of that number. IDA functions as an important determinant for the deaths of mothers and newborns and increases their susceptibility to stillbirth and premature delivery along with low birth weight. The condition directly leads to premature deaths along with disability. The research examined the differences in urban-rural hemoglobin levels and anthropometric measurements together with child nutritional status and anemia frequency. About 25.8% of participants had mild anemia whereas moderate anemia affected 10.8% and severe anemia affected 3.3% among the study population. Mild anemia stands as the leading type of anemia which appears within the studied group. Public intervention programs need to recognize multiple anemia-related factors before studying interventions for reducing anemia prevalence. For anemia prevention strategies to be most effective they need integrated implementation at the targeted and coordinated system level. Successful reduction of child anemia requires cohesive efforts between local communities government organizations and non-government organizations as well as additional groups

Keywords: *Anemia, nutritional status, hemoglobin, anthropometric measurements*

IMPACT:

- Low blood hemoglobin concentration, or anemia, is a serious worldwide public health issue, and identifying anemia is essential to public health interventions.
- DCC is an easily implemented, low- to no-cost intervention that can reduce newborn mortality rates and early infantile anemia.
- Iron-rich blood flow to the newborn and placental transfusion are facilitated by delayed cord clamping (DCC) until 1-3 minutes after birth

1. INTRODUCTION

Population groups should maintain Hb levels at the normal ranges expected for their age and gender to be free from anemic conditions.1, 2 Anemia refers to conditions when the Hb levels are below expected thresholds.1, 2 Anemia develops when the circulating red blood cells fail to fulfill physiological and tissue oxygen requirements.1, 2 Population groups require different thresholds of hemoglobin. Whatever the definition, Hb levels below a predetermined cut-off value reduce RBCs' ability to carry oxygen.

The resulting tissue hypoxia has detrimental effects on cognitive and physical development, leading to fatigue and reduced work capacity. [3, 4] Health problems arise together with nutritional deficiency when someone develops anemia. Anemia exists as a problem that affects one-quarter of people who also includes pregnant women and preschool children between ages 0–4.99 as the most vulnerable populations. According to estimates from the World Health Organization (WHO), approximately 50% of the 273 million young children under the age of five who are anemic are thought to have iron deficiency.2,5In order to support physical growth, rapid brain development, and early learning capacity, there is a high demand for dietary iron during infancy and preschool.6, 7 Early detection and treatment of anemia improves population health outcomes overall, as well as physical activity performance and well-being, all of which boost economic productivity.

Effect of IDA on infant mortality and under 5 year mortality

Before 1990 to 2015 the death rate of children younger than five years dropped by 53 percent from 12.4 million to 5.9 million.9. The neonatal period with 28 days still retains the highest mortality rate though worldwide death rates are falling. Preterm birth complications along with intrapartum complications together contribute to 25.9% of all newborn deaths resulting in 1.627 million deaths (10.5% and 15.4% respectively).10

The two most frequent infectious diseases responsible for childhood deaths among under-fives amount to 3.257 million cases (51.8%). The prevalence of child mortality increases due to anemia in both South-East Asian and African countries because anemia triggers malnutrition and infections.8

Scientific reports indicate that anemia occurs in seventy percent of children from the Indian population who are aged six to fifty-nine months. Child anemia data indicates that 3 percent have severe anemia yet 40 percent show moderate anemia alongside 26 percent presenting with mild anemia. The percentage of child anemia rose from 69.0% in NFHS-II to 119.7% according to NFHS-III data. Doctors can provide full treatment for anemia which mostly develops because of insufficient micronutrients. Research indicates that iron deficiency manifests as 58.1% of anemia cases but folic acid deficiencies contribute to 2.3% and vitamin B12 deficiencies to 1.2% among patients with micronutrient deficits leading to anemia..

Risk factors and causes of IDA

Blood loss either rapidly or over time combined with diseases and inflammation and nutrient deficiencies and inherited blood cell disorders constitute the reasons behind anemia. Worldwide the leading cause of anemic conditions emerges from deficiencies of iron in the body.7.Anemia stands as a widespread public health problem particularly affecting nations with lower and middle incomes. To successfully lower anemia rates people need to understand what causes and puts people at risk for this condition. Infant IDA has perinatal and infancy-related risk elements as two of its main contributing factors. The principal perinatal risk factors for infant anemia include premature birth in combination with maternal iron deficiency along with perinatal hemorrhagic events which include fetal-maternal bleeding and twin-twin transfusion. The risk group most prone to IDA includes specimens of low birth weight and diabetetic maternal infants and small-gestational-size newborns. Iron deficiency anemia risk factors in children can lead to tiredness and poor eating in addition to infection recurrence along with breathlessness and learning problems and impaired growth. Medical treatment of anemia becomes essential since symptoms can negatively affect both child health and societal growth as well as their future potential.

Consequences of Iron deficiency in infants and young children

The disorder of anemia causes significant damage to children's brain growth. The brain damage caused by iron deficiency cannot be reversed after the first half-year of life starts. During childhood a weakened immune system will keep a person with this condition vulnerable to infections. Psychomotor tests results show children with iron deficiency perform below children without this anemia. The highest chance of iron deficiency develops between six and twenty-four months in breastfed infants during their last brain growth period before they learn movement and critical thinking skills.

Prevention of IDA

The following four methods should be utilized to prevent IDA: nutritional instruction along with dietary quality enhancement through breastfeeding promotion and medications and food fortification and prevention of infections. Several elements need evaluation for choosing infant diets in order to achieve elevated body iron levels. Single exclusive breastfeeding needs to continue through the four to six month infancy period before starting dietary feeds that contain high iron amounts. Children need to consume a wide array of dietary substances that include nutritionally high iron content from foods with strong iron absorption capacity. Medicinal supplementation establishes an excellent strategy for both controlling and stopping anemia.

Objectives of the study

1. To assess the nutritional status of children with Anthropometric measurements.
2. To assess the prevalence of Anemia.
3. To compare the anthropometric measurements and haemoglobin and in urban and rural areas.

Materials and methods

A descriptive investigation followed children between ages two to six who resided in Belagavi urban and rural settings. The research analyzed 120 participants who equally divided into urban and rural members. Research investigations received ethical permission authorization from the Institutional Ethics Committee before its commencement. The study participants included parents who provided their written consent for participation. A convenient sampling approach was used to gather the necessary information. The research used inclusion and exclusion standards to select samples that conducted from February through December in 2024.

Inclusion criteria:

- Children residing in rural and urban areas of Belagavi.

- Age group between 2-6 years.
- Children and their mothers who were willing to participate in the study.

Exclusion criteria:

- Children already on Iron supplements.
- Mothers who were not willing to give consent.

Process flow

History & Anthropometry

The assessment of child nutritional status required measurements of body height in centimeters and weight in kilograms combined with midarm circumference in MAC. The researchers evaluated their results through references to NCHS (National Centre for Health Statistics) and ICMR (Indian Council of Medical Research) standards. The vertical measuring rod with floor-level placement used centimeter calibration for height measurements of children. The kilogram and gram calibration on the weighing balance determined the measurements of respondents.

Screening by Researcher

The researcher checked each child in the study for hemolytic anemias and indicators of protein energy malnutrition.

Blood sample collection & analysis

Every child who signed up for the study had a sample taken, and their hemoglobin and iron levels were evaluated. The researcher examined the results to determine whether anemia was present.

Criteria for severity:

According to WHO, anemia is classified as

- Mild Anemia: Hb< 10.9-9 gm% /100 ml blood
- Moderate Anemia: Hb< 8.9-7 gm% /100 ml blood
- Severe Anemia: Hb< 7gm% /100 ml blood

Children having hemoglobin <11 gm% were referred to the pediatrician. Samples were sent to the laboratory for the analysis by the expert. Based on the laboratory values, children having hemoglobin <11 gm% were referred to the paediatrician for the further treatment.

2. RESULTS

Table 1: Distribution of participants by socio demographic characteristics (N=120)

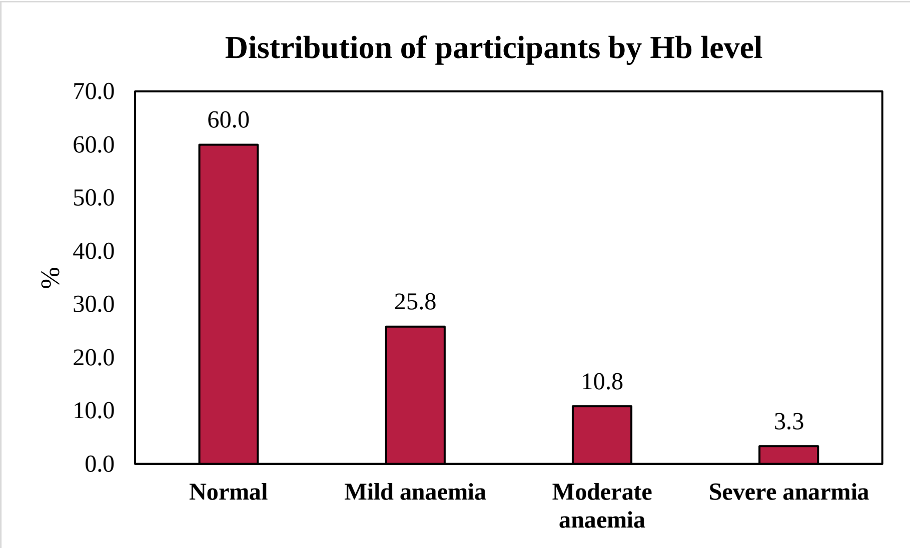
Socio demographic variable		n	%
Region	Urban	60	50.0
	Rural	60	50.0
Age	2	38	31.7
	3	23	19.2
	4	18	15.0
	5	15	12.5
	6	26	21.7
Sex	Male	77	64.2
	Female	43	35.8
Status of health	Healthy	72	60.0
	Unhealthy	48	40.0
Hb level	Normal	72	60.0

	Mild anaemia	31	25.8
	Moderate anaemia	13	10.8
	Severe anaemia	4	3.3

The sociodemographic details of a research population of 120 people are shown in this table. Half of the participants come from both urban and rural regions, which are equally distributed in the population. Two-year-olds make up the largest percentage of participants (31.7%), followed by six-year-olds (21.7%). Five-year-olds are the least represented age group (12.5%). This implies a sample that is comparatively younger, having a higher proportion of members in the lower age group.

There may be a gender imbalance in the sample because men make up a bigger percentage (64.2%) than women (35.8%).Of those that participated, 60% were classified as healthy, and 40% as unwell. This implies that a sizeable section of the populace is dealing with health problems.

Graph 1: Prevalence of Anemia



Forty percent of the subjects suffered from anaemia, whereas sixty percent had normal haemoglobin levels. In particular, 3.3% suffered from severe anaemia, 10.8% from moderate anaemia, and 25.8% from light anaemia. This demonstrates how frequent anaemia is in the group, with mild anaemia being the most prevalent.

Table 2 : Descriptive statistics of anthropometric measurements

	Median	IQR	Minimum	Maximum
Height (cm)	93.00	29.75	48.00	135.00
Weight (kg)	13.00	5.6	5.00	34.70
MUAC (cm)	14.00	2	12.00	17.00
Hb	11.00	2.1	5.70	17.30
MCV	80.00	10.35	1.00	104.70
MCH	25.40	4.95	14.60	86.50
MCHC	29.90	4.35	21.50	38.20

Many different anthropometric and haematological traits are present in the research population. Age-related growth variations are probably reflected in the median height of 93.00 cm, which has a wide range from 48.00 cm to 135.00 cm and a noticeable dispersion (IQR: 29.75 cm). With a median weight of 13.00 kg (IQR: 5.6 kg) and values ranging from 5.00 kg to 34.70 kg, weight also ranges greatly, indicating a range of nutritional states. With a median of 14.00 cm and an IQR of just 2 cm, the mid-upper arm circumference (MUAC) distribution is very narrow, suggesting that participant arm circumference variance is minimal.

Variations in red blood cell indices are shown by haematological measures. With readings ranging from 5.70 g/dL to 17.30 g/dL, haemoglobin (Hb) levels indicate a median of 11.00 g/dL (IQR: 2.1 g/dL), suggesting that although many people have normal Hb levels, others may have mild to severe anaemia. With a median of 80.00 fL and a wide range of 1.00 fL to 104.70 fL, mean corpuscular volume (MCV) indicates the existence of either macrocytic or microcytic fluctuations.

Although the population shows normal development trends overall, differences in haematological measures point to possible health or nutritional issues, especially with regard to anaemia and red blood cell shape.

Table 3: Comparison of anthropometric measurements in urban & rural area

	Urban		**Rural**		**Sig.**
	Median	**IQR**	**Median**	**IQR**	
Height (cm)	93.00	24.00	93.50	30.50	0.795
Weight (kg)	13.00	5.00	12.20	7.00	0.710
MUAC (cm)	14.00	2.00	14.00	2.00	0.416
Hb	11.00	2.70	11.30	2.55	0.133
MCV	80.30	8.70	79.80	14.95	0.392
MCH	25.70	4.95	25.00	5.10	0.727
MCHC	29.80	4.45	30.00	4.35	0.789

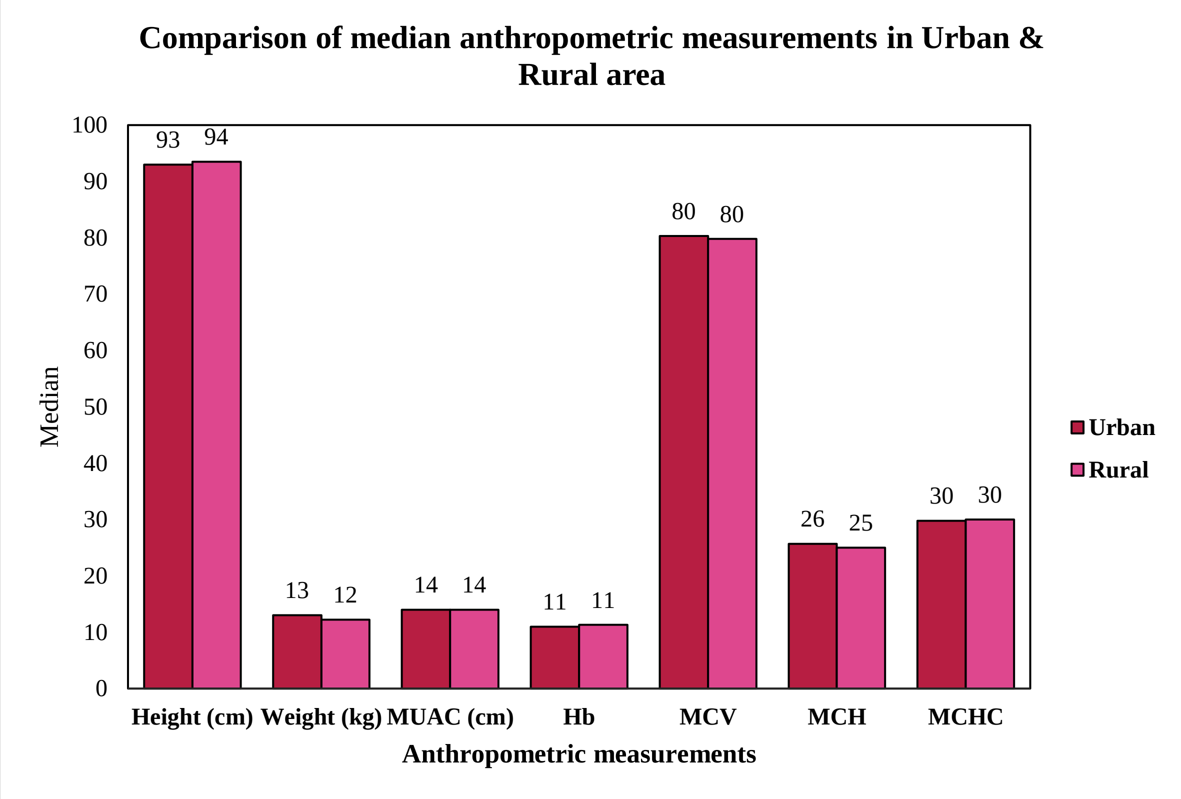
*<0.05 Significance is obtained by independent sample Man Whitney U test

Anthropometric and haematological characteristics do not differ statistically significantly between individuals in urban and rural areas. With a median height of 93.00 cm for urban participants and 93.50 cm for rural participants, there is no discernible difference in height between the two groups (p = 0.795). Similarly, children in urban areas weigh somewhat more (13.00 kg) than children in rural areas (12.20 kg); but, the rural group's variance is larger (IQR: 7.00 kg vs. 5.00 kg), and there is no significant difference (p = 0.710). A p-value of 0.416 indicates that the two groups' mid-upper arm circumferences (MUAC) are identical (median: 14.00 cm, IQR: 2.00 cm), indicating consistency in nutritional status.

Haemoglobin (Hb) levels in urban participants are somewhat lower than those in rural participants (median: 11.30 g/dL) in terms of haematological parameters; however, this difference is not statistically significant (p = 0.133). The two groups also had comparable median values for mean corpuscular haemoglobin (MCH) and mean corpuscular volume (MCV), with median values of 25.70 pg vs. 25.00 pg (p = 0.727) and 80.30 fL vs. 79.80 fL (p = 0.392), respectively. Similarly, there is no discernible difference in mean corpuscular haemoglobin concentration (MCHC) between participants from urban and rural areas (median: 29.80 g/dL vs. 30.00 g/dL, p = 0.789).

Overall, the results show no discernible changes in blood parameters and growth measures between children in urban and rural areas, pointing to comparable nutritional and health circumstances in both environments.

Graph 2: Comparison of median anthropomentric measurements in Urban & Rural area



3. DISCUSSION

Medical practitioners identify anemia as the main form of malnutrition which impacts children under five years old. Public health throughout our nation requires attention to this problem. Anemia affects male and female children who reside in both urban regions and rural communities throughout the nation. The malnutrition of protein energy leads to anemia as a result. Two main anemia causes among children under five years stem from iron deficiency anemia and the megaloblastic form which develop because of insufficient folate intake.

The study demonstrates that urban participants exhibit more cases of moderate and severe anemia than rural participants (69.2% and 75.0% vs 30.8% and 25.0%) yet rural participants show higher numbers of participants with mild anemia (61.3% vs 38.7%). Illiteracy along with open-air defecation joins poverty and poor healthcare access and low awareness among the population to explain the difference in data between urban and rural regions. The suboptimal nutritional state of most rural children drives up their anemia levels.

WHO lists our study areas as communities of severe public health importance and research shows urban schoolchildren had less anemia than those in rural areas in 2002 Chandigarh.9

The staff members presented varying results regarding the frequency of anemia among them. Research by Bansal R et al. demonstrated an anemia incidence of 77.8% whereas Gomber et al. reported a value of 76% while Motghare DD 13 observed a rate of 69.23% in preschool-aged children. Anemia was detected in 52.2% of children from 1 to 5 years of age based on data collected by Viswewara Rao K 14. Anemia affects half of children residing in developing countries according to World Health Organization statistics.15 Research conducted by Sindhu S16 determined anemia presence in 55% of the 0–6 year old child population. The distribution of children categorized as normal, milk or moderate, severe, and those with no anemia was 45%, 25.7%, 19.3% and 10% respectively.

The various research reports indicated that anemia existed frequently among children under five years old. The results proved the essential need to include preschoolers in the risk category to enhance their iron status. To address this problem intervention programs must be developed which will improve hemoglobin levels in these children through dietary modification and helminth elimination programs and prophylactic treatments..

4. CONCLUSION

According to the current study, the prevalence of anemia was 38.7% in rural areas and 61.3% in urban areas.

Anemia

The study group included 60% participants with normal hemoglobin results combined with three percent severe anemic patients and 25.8% with mild anemia and 10.8% with moderate anemia.

The research included forty percent of ill children who matched forty percent of healthy children.

The study group included 71% of children with normal hemoglobin levels as well as 29% of children with anemia consisting of 84.2% mild anemia cases and 14.6% moderate anemia cases and 1.2% severe anemia cases. The anemic status is evaluated using peripheral smear for microcytic hypochromic anemia and measurement of hemoglobin levels before other causes such as folate and vitamin B12 deficiency and hemolytic anemia are eliminated through clinical examinations.

Nutritional Status

There is no appreciable difference in height between the urban and rural populations, and neither anthropometric nor haematological traits differ statistically significantly between them. Similarly, children in urban areas weigh a little more than those in rural areas, but there is no significant difference and the variance is greater in the rural group. Mid-upper arm circumferences (MUAC), on the other hand, are the same, suggesting a constant nutritional state.

Overall, the findings indicate that children in urban and rural areas have similar nutritional and health conditions, with no appreciable differences in blood parameters and growth measures between the two groups. The study highlights the urgent need for multicentric studies in larger sample sizes that include both rural and urban children belonging to different socioeconomic groups in order to assess the prevalence of anemia in the community and to form appropriate guidelines on iron supplementation in the Indian context. This is because the study was conducted in a small geographic area with a smaller sample size.

5. RECOMMENDATIONS

1. Results from the study showed anemia prevalence levels to be considerably reduced. Children need iron supplementation because breast milk contains minimal iron and parents lack understanding about iron deficiency and because it takes a long time for anemia symptoms to become noticeable in children. Multicentric interventional research projects utilizing large sample sizes should evaluate both urban and rural populations across socioeconomic categories because the Indian context needs proper guidelines for iron supplementation and anemia prevalence measurement.

2. The large quantity of iron in daily foods requires an immediate increase in population knowledge about how iron helps children's body development and brain health as well as the value of proper nutrition to stop malnutrition. The awareness campaign for iron should initiate with pregnant women and progress to schoolchildren and later cover the entire community. A program exists to inspire and involve school teachers as well as anganwadi workers and primary health center employees to educate people about treating and preventing iron deficiency anemia.

3. Children should always have screening exams on a regular basis to identify issues like anemia and malnutrition, among many other significant childhood concerns. Additionally, it will give the doctors a chance to teach the parents and kids the value of a balanced diet and healthy lifestyle. Therefore, it is important to promote routine health screening examinations at all levels in order to detect issues much earlier.

4. Finally, due to the high rate of malnutrition, particularly in developing nations like India, all infants must be exclusively breastfed for six months, even though human milk has a low iron content.

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