"PREVALENCE OF NUTRITIONAL ANAEMIA AMONG LATE ADOLESCENT GIRLS IN RURAL AREA OF BELAGAVI"

Submitted by

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02

LIST OF ABBREVIATIONS USED

S.No.	Abbreviations	Expansion of the abbreviations
1.	WHO	World health organization
2.	SES	Socioeconomic Status
3.	PHC	Primary Health Centre
4.	NFHS	National family health survey
5.	COVID	Coronavirus Disease
6.	ASHA	Accredited Social Health Activist
7.	PR	Pulse rate
8.	BP	Blood pressure
9.	RR	Respiratory rate
10.	BMI	Body mass index
11.	OBC	Other backward caste
12.	ST	Scheduled tribe
13.	SC	Scheduled caste
14.	χ 2	Chi – square
15.	MCT	Monte Carlo Test
16.	OR	Odds Ratio
17.	IEC	Institutional Ethics committee

18.	UNICEF	United Nations International Children's Emergency Fund
19.	ICRW	International Center for Research on Women
20.	NNAPP	National Nutritional Anaemia Prophylaxis Programme
21.	WIFS	Weekly Iron Folic Acid Supplementation
22.	IFA	Iron Folic Acid
23.	RHTC	Rural Health Training Centre
24.	UHTC	Urban Health Training Centre
25.	HB	Hemoglobin
26.	BPL	Below Poverty Line
27.	PG	Post Graduate

ABSTRACT

BACKGROUND AND OBJECTIVES

Adolescence is an interim phase of growth and development between childhood and adulthood and is a susceptible period in the human life for various problems. Anaemia was identified as the most significant nutritional problem. Globally, anaemia affects around 1.62 billion people. The prevalence of anaemia among adolescent girls in India according to National Family Health Survey - 5 was 59.1% and 49.4% in Karnataka. Even though several initiatives are implemented by government to tackle this issue, outcome of the various studies indicated that still, anaemia is prevalent in many rural areas of India. This cross-sectional study determines the prevalence of anaemia and the knowledge level in late adolescent girls to estimate the actual burden of anaemia.

METHODOLOGY

This cross-sectional study was carried out among 365 late adolescent girls in the area of Vantamuri, which is the rural field practice area of Department of Community Medicine, J. N. Medical College, KAHER, Belagavi during January 2021 to December 2021 to know the prevalence of nutritional anaemia in late adolescent girls in rural area of Belagavi. Data was collected using pre designed questionnaire which including sociodemographic data, knowledge, attitude and practice of the participants along with the estimation of haemoglobin level of venous blood sample.

RESULT

Distribution of participants was maximum in age group between 16 to 17 (71.78%) and Majority of the study subjects (91.23%) were Hindus. 90% of the

participants comes under below poverty line. The prevalence of anaemia of our study was 42.2%. Most of the participants in our study have mild anaemia (51.3%), followed by moderate anaemia (37.6%) and severe anaemia (11.1%), as per WHO guidelines. Study shows one third of the participants had an idea about Anaemia and 20% of them known that anaemia is a health problem. The availability of iron folic acid in schools and the consumption of iron folic acid decreases the prevalence of anaemia in the study population. Although this study indicates dietary habits have no significance on anaemia, excluding milk products and egg which shows a beneficial effect on anaemia. Likewise, in the study population there is a statistically significant decrease in the weight and BMI of participants having anaemia.

CONCLUSION

Anaemia is a major public health problem among adolescent girls in rural areas. Special importance should be given for developing corrective measures against nutritional anaemia among adolescent girls. As anaemia is a multifactorial causation, regular check-up of anaemic status, evaluation, treatment and prevention plays a pivotal role in strengthening health in adolescent girls.

KEYWORDS: Anaemia, Nutrition, Iron, Folic acid, Adolescent girls

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INTRODUCTION

Adolescence is an interim phase of growth and development between childhood and adulthood.[1] WHO defined this age group between 10-19 years, in which the early adolescent person belongs to 10 to 14 years and the late adolescent person between 16 to 19 years[2]. This age is a unique stage of human development; in this phase, a human being experiences rapid physical, cognitive and psychosocial growth.[3] So age-appropriate comprehensive sexuality education, opportunities to develop life skills, acceptable, equitable, appropriate, adequate health services, and safe and supportive environments is inevitable.[3] The 2011 census data establishes that 253 million adolescents in this age group comprise more than one-fifth of India's total population.[4]

Adolescence is a susceptible period in the human life cycle for infectious diseases, violence, injuries, malnutrition, mental disorders and substance abuse etc.[5] In developing countries, nutritional challenges are the primary health concern among the adolescent groups and adolescent anaemia is a substantial problem.[6]

Anaemia was identified as the most significant nutritional problem by a study carried out by the International Centre for Research on Women (ICRW). According to the WHO, anaemia is a disorder in which the amount of red blood cells or the concentration of haemoglobin within them is lower than usual. Haemoglobin is required to transport the oxygen in the blood vessels. The capacity of the blood to deliver oxygen to the body's tissues will be reduced if you have too few or malformed red blood cells or inadequate haemoglobin.[7] It is defined as a haemoglobin concentration of less than 120 g/L (12 mg/dl) in a teenage girl, according to WHO

guidelines. Severe, moderate, and mild anaemia are indicated by haemoglobin concentrations of less than 80 (8 mg/dl), 80 to 100, and 100 to 119 g/L, respectively.[8]

The anaemic condition can result in both short term and long-term complications. Fatigue, weakness, headache, dizziness and shortness of breath are the short-term complications and long-term complications include high chances of infections due to low immunity, cardiac problems (cardiomegaly, arrhythmias).[9] In pregnant women it is responsible for post-partum haemorrhage, premature delivery, delivering low birth weight babies and intrauterine growth retardation. In children it causes poor cognitive and motor development.[10]

In the adolescence female, anaemia causes diminished performance like reduced concentration in work and education and also carries foremost threat to upcoming good motherhood.[11] Anaemia in these age group causes menstrual disorders also. A girl who come in the reproductive age with anaemia and becomes pregnant throughout the adolescence or later is at a greater risk of delivering a preterm and low birth weight baby. Then that baby will also start his or her life with anaemia and due to poor child feeding practices that child is more likely to go to adolescence with anaemia. Thus, this vicious cycle of iron deficiency anaemia continues.[12]

Globally, anaemia affects 1.62 billion people, corresponding to 24.8% of the population. In 2019, global anaemia prevalence was 29.9% in women of reproductive age and 36.5% in pregnant women. Anaemia prevalence in children was 39.8% and 60.2% in children.[13] The prevalence of anaemia is reported to be disproportionately high in developing countries, that is, 55% in India, 42% in Nepal, 32% in Cameroon and 48% in Guatemala.[14]

Anaemia is a continuously rising threat to present and future generations, and Indians are at high risk.[15]The National Family Health Survey-4 2015-16 (NFHS-4) indicate the prevalence of anaemia among women aged 15 to 49 years as 53.1% The numbers seem to only increase over time. The National Family Health Survey 2020-21 (NFHS-5), indicate the prevalence of anaemia among women aged 15 to 49 years as 57%.

India had reported a high prevalence of anaemia among adolescent girls, which is higher when compared with the other developing nations.[6] The census conducted by United Nations International Children's Emergency Fund (UNICEF) in the year 2002 and National Family Health Survey (NFHS-3) in 2007 proclaim the prevalence of anaemia as 55% and 52.88% in adolescent girls in India, respectively.[16] The prevalence of anaemia among adolescent girls aged 15 to 19 years according to National Family Health Survey 4 and National Family Health Survey 5 was 54.1% and 59.1 respectively.[17,18]

According to the NFHS-5(2020-21), 48% of women in Karnataka have anaemia, including 22% with mild anaemia, 23% with moderate anaemia, and 3% with severe anaemia. Anaemia among women has slightly increased by three percentage points since NFHS-4. Anaemia is exceptionally high among rural women, women aged 15-19, and scheduled caste women. In Karnataka prevalence of anaemia in adolescent girls aged 15 to 19 years are 49.4% in 2020 whereas it was 45.3 in 2015 according to NFHS data. [19]

Belagavi district, also known as Belgaum district, is a district in north of Karnataka where the National Family Health Survey 2015-16 (NFHS-4) reported a lower prevalence of anaemia of 41.2%. In Belagavi, about one-third of the women are

underweight, the majority had inadequate intake of micro and macronutrients, and one-fourth were food insecure.[20] the prevalence of anaemia among school children was 47.9% (57% in girls and 40.5% in the boys) in Belgaum.

Nutritional deficiencies, notably iron deficiency, are the most common causes of anaemia. However, folate, vitamins B12, and vitamin A deficiencies are other causes.[7] Low intake of iron, poor dietary absorption of iron from diets high in phytates or oxalates, hookworm infestation, undernutrition, blood loss from menstruation, and teenage pregnancy are contributing factors to anaemia among adolescents.[21]

Socioeconomic status combined with inadequate nutrition, less hygiene, worm infestation and infections are the major factors driving nutritional anaemia. Sociodemographic factors like poor maternal level of education, and less access to good health care services are the other hurdles.[22] A significant association between severe anaemia and poor education was also observed. Factors like age, education, family size, religion, economic status, sanitation facility and region of residence were also significant determinants of anaemia. Adolescent's nutritional and health needs are more due to increased physical activity, especially in adolescent girls, which marks the beginning of the menstrual cycle. Earlier studies pointed out that adolescents gain almost one-third of their adult weight and more than one-fifth of their adult height between adolescence (10- 19 years), which we can say as "expansion bursts".

In developing countries like India, many social beliefs and customs are stacked against adolescent girls. The girl child is relatively neglected in their families. They are provided lesser priority for household distribution of food and education. Moreover, she is considered an extra working hand for household work. Heavy blood flow during menstruation, early marriage practices and teenage pregnancy are additional contributors for anaemia.[16]

A flagship program to address anaemia was launched in the 1970s as "The National Nutritional Anaemia Prophylaxis Programme (NNAPP)" by Ministry of health and family welfare. Later in 1991 it was revised into Nutritional Anaemia Control Programme. Then in 2007 “12 by 12” initiative was launched. Further the government of India launched the National Weekly Iron and Folic acid Supplementation (WIFS) Programme in 2012. In 2013 National iron plus initiative brought all the programs for iron deficiency anaemia under one umbrella. Apart from that, Anaemia Mukth Bharath (translated as anaemia Free India) was launched in 2018 to achieve a 50% reduction of anaemia in women of reproductive age by 2025, including developing a joint implementation framework, strengthening the supply chain, establishing a reporting mechanism, strengthening service provider capacities, and media engagement to raise public awareness about anaemia and its prevention. It is built upon the existing framework of the National Iron Plus Initiative [23]

Even though several initiatives by our government are there to tackle this issue, outcome of the various studies indicated that still, anaemia is prevalent in many rural areas of India. The prevalence of anaemia in women of reproductive age group according to NFHS-2 (1998-99) is 51.8% [24] and in NFHS-4 (2015-16) its 54.1% and lastly in NFHS 5 (2020-21) its 59.1%.[25] There is a steady increase in the prevalence

anaemia among women of reproductive age group which demands the awareness about health and nutrition among them, especially adolescent girls. Improving anaemia and awareness among adolescent girls can improve maternal morbidity and mortality, especially during pregnancy.[26]

Given the above, In India, many strategies have been in place for the past 50 years, but 50% of women in their reproductive age group are still anaemic. A community-based approach to detecting anaemia is the need of the hour. This cross-sectional study will help detect the prevalence of anaemia and the knowledge and awareness level in late adolescent girls to estimate the actual burden. It will also successfully fill the gaps in the existing initiatives.

OBJECTIVES

1. To assess the prevalence of nutritional anaemia in late adolescent girls in rural area of Belagavi.

2. To assess the knowledge about nutrition in late adolescent girls.

3. To assess the current dietary practices in households of adolescent girls.

REVIEW OF LITERATURE

Background

The most prevalent type of malnutrition in the world is iron deficiency anaemia and is seventh most common ailment among girls and mothers. Anaemia affects both developed and underdeveloped nations. According to World Health Organization (WHO) anaemia is the condition where haemoglobin levels is below 12 g/dl. This global public health issue has significantly negative effects on human health.[32]

India is a developing nation where anaemia is very common and affects people of all ages and genders. Adolescent girls in India, who make up a sizeable portion of the population, are a vulnerable group and are more likely to suffer from morbidity and death. The female youngster is likelier to be ignored in a home with minimal finances. Too frequently, the crisis is triggered by the additional load of menstrual blood loss (normal or atypical). A brief review is done to understand the burden of anaemia globally and its risk factors.

Prevalence of anaemia

In a community trial by the Department of Christian Medical College and Hospital, a survey was carried out in the project area in Vellore District, Tamil Nadu, India. 155 and 161 adolescent girls aged 13-19 years from Kuppam block and Gudiyatham block were selected. The prevalence of anaemia was 44.8%, with severe anaemia being 2.1%, moderate at 6.3% and mild anaemia at 35.5%. The prevalence of

anaemia was 40.7% in premenarchal girls compared with 45.2% in post menarche girls.[33]

In two higher secondary schools, a study was carried out in rural Rajnandgaon, Chhattisgarh. Two hundred thirty-two adolescent girls studying in standards 9 to 12 were included. The prevalence was found as 76.29%. A higher prevalence was noted in the early adolescent girls (14 to 16 age group) compared to late adolescent girls (17 to 19 years). In another retrospective observational study on conducted 200 participants in Bihar at a tertiary care centre showed, 78.7% were anaemic in late adolescent age group (15 – 19)[34,35]

To assess anaemic status among pregnant women and adolescent girls from 16 districts of 11 states of India. The survey data reported that 84.9% of pregnant women (6923) were anaemic, 13.1% had severe anaemia, and 60.1% had moderate anaemia in adolescent girls (4,337). The overall prevalence of anaemia (defined as haemoglobin < 120 g/L) was 90.1%, with 7.1% having severe anaemia (haemoglobin < 70 g/L). [36]

A cross sectional survey was conducted to examine the prevalence of iron deficiency anaemia and risk antecedents among 1010 adolescent females from rural Maharashtra, India. As per the survey, the prevalence of mild anaemia was 17%, moderate anaemia was 65% and severe anaemia was 5% respectively. Anaemia prospects have been inflated enormously with age (OR: 1.41 per year). The study showed that the prevalence of anaemia was extremely high among the adolescent females of the rural areas of Maharashtra. The identified risk factors could be used for targeting interventions and this demands an urgent need of comprehensive preventative interventions for the whole adolescent girl population.[37]

Comparison of anaemia in different groups

A cross-sectional study conducted among adolescent girls has selected girls attending 7 to 10 standards from Government schools (on WIFS) and private schools (not on WIFS). The sample size was 104. The prevalence of anaemia in government schools was 51%, and in private schools, it was 64.4%. The mean haemoglobin level was 11.77 ± 1.41 and 11.34 ± 1.49 in government and private school girls, respectively, statistically significant (p=0.013). [38]

A school-based cross-sectional study was done for one year (December 2014 to November 2015) among adolescent high school girls (650) of Davangere city and the field practice area of JJM Medical College, Davangere, Karnataka. The prevalence of anaemia was 84.46%, more in rural areas (96.88%) than in urban areas (72.42%). Study showed that the prevalence of mild, moderate, and severe anaemia is 53.69%, 17.54%, and 13.23%. The severity of anaemia was highest in rural adolescent girls attending high school compared to urban adolescent high school girls.[39]

A school-based cross-sectional study is conducted in the field practice areas of the medical college of Gautam Buddha Nagar District. The study was on 684 adolescent females (251 from RHTC and 433 from UHTC) for a period of 3 months. The prevalence of anaemia in the whole population was 42%, 54.5% in rural and 35.5% of adolescents in urban areas are anaemic the study.[40]

Association

A cross sectional study conducted on 880 adolescent girls (10-19 years old) in 88 Anganawadi (AWC) centres which covers three blocks - rural, urban and tribal blocks of U.S Nagar, Uttarakhand, India. By examining the study, Iron folic acid

supplement consumption, age of participant, current school hygiene and status, availability of nutritional education on anaemia, illiterate mother, presence of children in the family, truncal obesity, tendency to skip meals, number of meals per day, duration and type of menstrual flow are significantly associated with adolescent girl having anaemia. About 83.18% adolescent girls were affected by anaemia in that study.[41]

A study was conducted on 300 adolescent girls (10 to 19 years) by asking about their last 24 hours' dietary habits in Ranchi and its surrounding areas. Among 300 girls, 39% were vegetarians, and 61% were non-vegetarians. Maximum girls (78%) were in the frequent consumption of junk foods. Consumption of milk was associated with reduced prevalence of anemia (23 of 128, 17.9%) when compared to those who drank milk less (85 of 295, 28.8%). Anemia was less seen in those who ate dates frequently (55 of 264, 20.8%). There was no significant association of anaemia with intake of butter, cheese, fruits, vegetables and tea or coffee.[42]

The haemoglobin level of 1600 boys and girls from classes 5 to 9 in 32 randomly selected schools in the Kollam district were examined. Among anaemic, 35.3%, 22.3% and 45.3% reported that they were not in the habit of consuming meat, green leafy vegetables and citrus fruits, respectively, at least once a week. Anaemia among school-going children was associated with irregular consumption of weekly iron-folic acid supplementation tablets and regular intake of tea/coffee with main meals. The prevalence of anaemia among the students was estimated to be 31.4%. [43]

A study of 300 adolescent girls of Nidoni, Bijapur, and Karnataka revealed that the prevalence of anaemia among adolescent girls was 80%. There was an association between anaemia prevalence and the selected demographic variable. i.e.,

among adolescents 14 years of age, girls had the highest prevalence of anaemia [42.5%]. 66.25% of the prevalence of anaemia was found in well-nourished girls, 87.5% belonged to girls who had regular menstruation, and 61.25% was in adolescent girls who had menstrual bleeding for five days or more. [44]

Knowledge attitude practice

A cross sectional survey was carried out in November 2015 to December 2015 at the Rufaida college of Nursing, New Delhi. The main objective of the campaign was to evaluate the knowledge of iron deficiency anaemia among adolescent girls. It was also found that 64% of them had knowledge of the disease on an average level and 36% percent had excellent knowledge. None of the participants had poor knowledge. It was found that 70% of the adolescent girls were having low HB levels. The prevalence was too high despite of having knowledge about anaemia and its prevention. This states, there are so many other factors other than knowledge that can lead to anaemia.[45]

A cross sectional study to assess the knowledge, attitude, and practices related to anaemia in adolescent girls was conducted in Delhi in the year of 2019. It is observed that only 60 out of 210 girls (28.5%) have heard about this term anaemia and 50 girls (83.3%) of them considered it as a health problem. The study observed that hardly any girls were able to answer questions related to the symptoms, prevention and treatment of anaemia. It was also noticed that most of them (80.9%) were using soap to wash their hands and the remaining students (19%) were using plain water. Only 52% of the girls used soap to clean their hands before consuming food. 160 (76.2%) girls regularly trimmed the nails and 28.5% girls developed a practice of walking barefoot outside their home. It was noted that the adolescent girls

had enough knowledge on the matter but no required attitude and practices were developed. The conclusion demands a proper propagation of detailed nutritional knowledge regarding diet and iron supplements should be mandatory.[46]

A cross-sectional study was done to assess the burden of anaemia and to study knowledge, attitude and practice among young women regarding the use of Iron Folic Acid (IFA) tablets related to anaemia in the region of north Gujrat. A total of thousand women were included in this study. The slightest knowledge was found about inhibitors and enhancers. 54% of respondents like to consume iron-rich food. Only 32.6% of respondents had a positive attitude towards IFA tablets. 39% knew the importance of complementary food along with breastfeeding. 32% of respondents used to consume citric food. 28.7% of school-going girls consumed IFA tablets weekly, and only 26% of girls used to go for deworming annually. In non-going school girls, only 16% of young women used to consume IFA tablets. Only 10.4% of respondents used to/preferred to consume iron enhancers with IFA tablets. [47]

Signs and Symptoms

Signs and Symptoms can be present due to underlying cause or due to anaemia itself. Symptoms like fatigue, dyspnea faintness, palpitation, headache, tinnitus, anorexia and angina if preexisting coronary artery disease. Signs may be absent even in severe anaemia but pallor is the most common sign, in severe anemia there will be hyperdynamic circulation which may cause tachycardia, murmurs cardiac enlargement and retinal hemorrhage [48]

In a study conducted in Columbus, USA on 11-17 years old menstruating females presenting to adolescent clinic. They evaluated degree and effect of blood

loss during menstruation. Out of 160 participants 48 adolescents had HMD 102 were healthy. Iron deficiency anemia and evaluated fatigue score were noticed among heavy menstrual bleeding participants. [49]

In a study conducted by M.M Wood and P.C Elwood, they interviewed all persons at their home. The age between 15-74 years attending their clinic in their area were included. There was an association between haemoglobin concentration less than 10g (DL) and symptoms. However mild anaemia has neither no association or other ailments has effectively masked the relationship which exist.[50]

Haemoglobin assessment methods

To detect anaemia a fast, effective and reliable, estimation of haemoglobin is vital. Direct cyanmethemoglobin method has been the gold standard for haemoglobin estimation and it is inexpensive too. Many methods are there such as haemoglobin colour scale, Sahli technique, Lovibond-Drabkin technique, copper-sulphate method, HemoCue, Tallqvist technique and automated haematology analysers. Each method has a different working principle and its own advantages and drawbacks. There are simple techniques to measure hemoglobin, but they are very expensive and they require commercial reagents along with technically skilled person for interpretation [51]

In a study hemoglobin concentration was determined in 2 different ways for 121 mothers in Indonesia and compared both methods when indirect cyanmethemoglobin method was used the prevalence of anemia was 31 – 38 % when direct cyanmethemoglobin or HemoCue method was used the prevalence was 14-18% in the same population. Indirect method has the highest coefficient of variation and

standard deviation (10-12g/dl indirect vs 4g per l in direct) study concluded direct cyanmethemoglobin had highest sensitivity (82.4%) and specificity (94.2%) when compared with indirect method. [52]

In a hospital-based study conducted among adult patients in rural health training Centre of AIIMS, revealed HemoCue method estimated higher mean hemoglobin level as compared to cyanmethemoglobin method in capillary and Venous blood samples. The study indicated there should be a correction factor of minus 1.2, 1.5 g/dl for Venus and capillary blood samples by HemoCue method.[53]

A descriptive cross-sectional study conducted in the rural field practice area of the Rural Health Training Centre (RHTC), Department of Community Medicine, Bharati Vidyapeeth Medical College Pune. This study included Seven hundred forty senior secondary school girls studying in class 6^{th} to 12^{th} (10 to 19 age group). HB level was measured by Sahli′s hemoglobinometer. The haemoglobin level of girls reveals that the majority, 648 (87.6%), were anaemic. 305 (47.06%) and 340 (52.48%) were suffering from mild and moderate anaemia, while 3 (0.46%) had severe anaemia. A significant association was found with BMI for age.[54]

Interventional studies

A randomized control trial was conducted on 280 tea estate female workers on Bangladesh to know the effect of WIFS on iron deficiency anaemia. The study showed that individuals in supplemented group with low level of HB has an improvement while normal haemoglobin participants had a decrease in haemoglobin level 62.2% of women in supplemented group reported they felt more energetic compared to 51% in placebo group.[55]

An intervention study was conducted among adolescent school girls in Delhi. The study was conducted among 106 adolescent girls in Delhi schools among 11th standard. By administering a pre-tested questionnaire based on four domains knowledge, attitude, practices and health-seeking behavior regarding anaemia. Only 34.9 per cent of girls had heard about anaemia, and 38.9 per cent felt that anaemia is a health problem. When asked for the reasons for anaemia, around 8 (7.5%) could answer correctly. There was a change in knowledge, practices and health-seeking behavior after the intervention, which was statistically significant. [56]

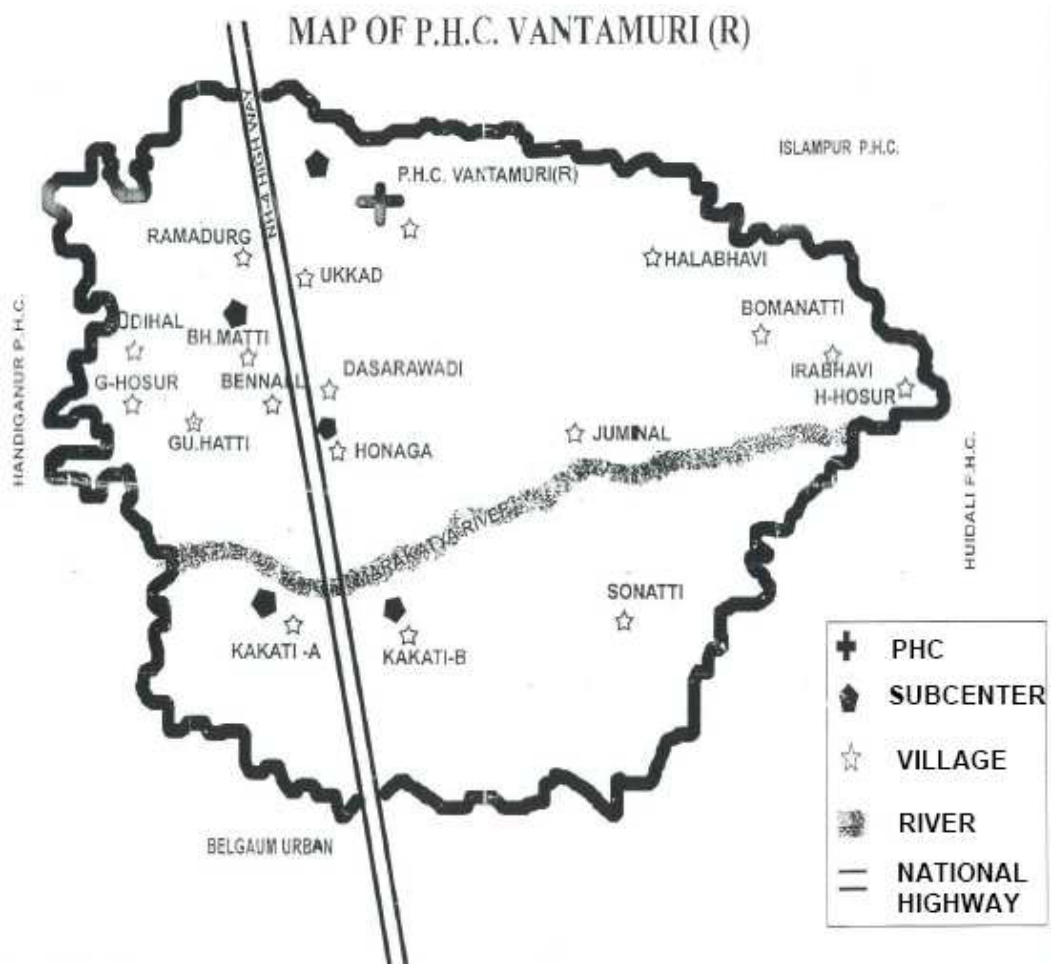
In a study conducted in gov school east Delhi, 250 adolescent girls aged between 10-17 participated. HB level fluoride content in urine and drinking water also calculated result depicted after an intervention of diet counselling to participants, parents and teachers, there was a significant improvement in the haemoglobin level and decrease in urine fluoride levels in 1st month. At 6 months follow-up out of 244 girls those who had severe anaemia decreased from 3% to 1% and moderate anaemia decreased from 97% to 58%.[57]

An intervention study conducted among 104 adolescent girls in navi Mumbai to study the effect of interventions like dietary changes iron supplementation on reduction if iron deficiency anaemia. The result showed there was an increase in the haemoglobin level of girls in intervention group and slight decrease in haemoglobin level of girls in control group. Also, a significant weight gain of 2.66 kilogram was noted in intervention group.[58]

METHODOLOGY

TOPOGRAPHY

Karnataka, India's southernmost state, is located at the Western and Eastern Ghats confluence. It is India's 8th biggest state, with 5.8% of its total land area. It has 30 districts and is India's 9th most populated state in terms of population.



Belgaum, also known as Belagavi, is the city located in northern part of Karnataka along the Western Ghats.[85] It is the administrative headquarters of the Belgaum division and Belgaum district. This district has the largest community in Karnataka

covering area of 13,415 km^2 (5,180 sq mi). It is bounded by Kolhapur District and Sangli district of Maharashtra state on the west and north, on the northeast by Bijapur district, on the east by Bagalkot district, on the southeast by Gadag district, on the south by Dharwad and Uttara Kannada districts, and on the southwest by the state of Goa. The city of Belagavi is the district headquarters in north Karnataka. It houses the second legislative building, where the Karnataka Legislature will meet once a year. A famous sweet is Kunda. According to the 2011 Census of India, it has a population of 4,779,661, of which 24.03% live in urban areas, making it the second-most populous district in Karnataka (out of 30) after Bangalore.[86]

STUDY DESIGN: A community-level Cross-sectional study

STUDY PLACE: The present study was conducted in two sub-centres randomly selected among five sub-centres of Primary Health Centre Vantamuri in the Rural Field Practice Area of the Department of Community Medicine, Jawaharlal Nehru Medical college, KAHER Belagavi.

Vantamuri and Bhutramnahatti were the two sub-centres chosen for the attainment of sample size under PHC Vantamuri,

STUDY DURATION: This study was conducted over one year, i.e., 1st January 2021 to 31st December 2021

SAMPLE SIZE: The sample size for this study was estimated using an anaemia prevalence of 52.24% for late adolescents (16 to 19 years) in rural areas of Tamil Nadu, India.[87]

Based on this, a required sample was calculated with 10% absolute precision and a confidence level of 99% using the formula as follows:

$n = 4PQ/d^2$

Where n = sample size required

Taking 99% confidence interval

p: Prevalence of anaemia (52.24%)

q: $1 - p = 47.6$

d: absolute precision (10% has been considered here) = 5.22

Substituting the variables in the formula,

Sample size, ***n*** = $4*52.24*47.6/ (5.22)^2$

= $363.4 \approx 365$

STUDY POPULATION: Adolescent girls aged between 16 to 19 years.

SAMPLING TECHNIQUE:

A list of all adolescent girls aged between 16 to 19 years, prepared by Accredited Social Health Activist (A.S.H.A.) as a part of the National deworming program conducted in September 2020, was used as a master list. The participants were selected by **Systematic Random Sampling.**

Assent was collected from adolescent girls aged between 16 and 17 along with the consent from their parents for the study.

Only consent was collected for the girls aged between 18 and 19.

Inclusion Criteria:

- Late adolescent girls who were willing to participate.
- Participants who were permanent residents of subcentre Vantamuri and Bhutramnahatti.

Exclusion criteria:

- Adolescent girls aged between 10 to 15.
- Participants with bleeding disorders, congenital heart disease, kidney disorders and on medications or steroids.

Study setting and method of Data collection

- Ethical clearance was obtained from Institutional Ethics Committee for Human Subjects' Research of Jawaharlal Nehru Medical college, KAHER dated 12/02/2021 vide under letter MDC/DOME/77

  Pilot study was conducted in Rukmini Nagar urban health centre

Questionnaire

A questionnaire was prepared to get information in four domains: socio-demography, anaemia knowledge, food habits and cultural practices.

Socio-Demographic Data

All participants in the Vantamuri and Bhutramanhatti were given a pretested semi-structured questionnaire containing details about socio-demographic variables such as age, sex, religion, place, educational status, occupation of parents after receiving the ethics committee approval from J.N.M.C.

Sex	Only female participants were selected.
Educational status	The educational status of the subjects was categorized as- ▪ Illiterates (those who cannot read or write even in one language or who have not even undergone pre-schooling) ▪ Primary Education (Completed class I to IV) ▪ Secondary Education (completed class V to VII) ▪ High School Education (completed class VIII to X) ▪ P.U.C./Diploma (completed Pre-University course or Diploma course) ▪ Graduate (Completion of a degree course) ▪ Postgraduate (Completion of post-graduation)
Educational status of Parents	The educational status of the subjects was categorized as- ▪ Illiterates (those who cannot read or write even in one language or who have not even undergone pre-schooling) ▪ Primary Education (Completed class I to IV) ▪ Secondary Education (completed class V to VII) ▪ High School Education (completed class VIII to X) ▪ P.U.C./Diploma (completed Pre-University course or Diploma course) ▪ Graduate (Completion of a degree course) ▪ Postgraduate (Completion of post-graduation)
Occupation of parents	▪ Unemployed: who doesn't have any employment ▪ Unskilled: who does operations that involve the performance of simple duties and task ▪ Semi-skilled: one who does work generally of a general specified routine nature. ▪ Skilled: one capable of working efficiently and exercising considerable independence and judgment can be made. ▪ Retired: Stopped working permanently because of age
Religion	▪ Participants were categorized as Hindu, Muslim, Christian, and others based on their religion.
Type of family	The participant's family was classified into: **Nuclear Family:** Family consisting of Married couples and their unmarried children. **Joint Family:** It consists of the number of married couples, where the male members are related by blood and females are wither, wives, sisters, widows of male members and their children who live together in the same household and share a common kitchen. **Three Generation Family:** It is a household where there are representatives of three-generation related to each other by direct descent.

Socio-Economic classification[88]

The modified BG Prasad scale measures the socioeconomic status of families.
Its classification was based on per capita income (Rs/month).

Modified BG Prasad social classification

S.No	Social Class	Per Capita Income
1	I	7008 and above
2	II	3504-7007
3	III	2102-3503
4	IV	1051-2101
5	V	1050 and below

Assessment of Anaemia

The haemoglobin level of participants was assessed using cyanmethglobin method in the department of Biochemistry J.N.M.C, for this 2-cc blood was drawn from the anterior cubital vein on the right arm and collected in EDTA (Ethylenediamine Tetra Acetic acid) vacutainer.

10 micro litre of Blood was mixed with 10.5ml of Drabkin's solution with pipette. Then kept it for 10 min for incubation under room temperature. The red blood cells get lysed and potassium ferricyanide transforms haemoglobin into methaemoglobin, and methaemoglobin combines with potassium cyanide to produce cyanmethemoglobin. Cyanmethemoglobin was measured photometrically after 10 minutes at 520 nano meter in calorimeter (PHOTOCHEM)

$$\text{HB concentration} = \frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times \text{concentration of the standard}$$

Haemoglobin with a concentration of less than 12 mg/dl in an adolescent girl was considered anaemia. Similarly, haemoglobin concentrations of less than 8 mg/dl, 8 to 10 mg/dl and 10 to 11.9 mg/dl were considered to indicate severe, moderate and mild anaemia respectively.

The anaemic status of the girl was shared with them, and was referred and treated as per the standard of care in Primary health centre Vantamuri.

Data on Food Culture

This included questions regarding food culture followed in the family, such as Types of cereals, pulses and vegetables used in the household. Information regarding their preferred meat and milk products and data on the consumption of fruits and nuts were obtained. Data regarding salt intake and cleaning of vegetables were also collected.

Family Practices

The questionnaire was structured to include the most frequent and significant risk factors for anaemia. Respondents were asked regarding their consumption and availability of Iron Folic Acid and deworming schedule.

Following instruments were used after standardization in general and anthropometric examination:

- Automatic Digital Blood Pressure Monitor (Omron HEM-7124)
- Stethoscope (Littmann classic II)
- Weighing machine (Apollo Pharmacy Digital Personal Weighing Scale)
- Height stand and measuring tape

General Physical Examination

As a part of general physical examination, the presence of pallor, icterus, the position of spine, joints of oedema and thyroid were examined. The presence of

pachyonychia/ koilonychia and lymphadenopathy were also examined. The skin's appearance, blood pressure, heart rate, and pulse rate were also monitored.

Anthropometric Measurements [89]

Anthropometric measurements include:

Height in cm: The study subject stood straight without footwear, with heels, buttocks and back touching the wall and arm handing by sides. The height was measured from head to heel. The reading was measured in "cms" (nearest 0.1cm).

Weight in kgs: Body weight was measured with minimal clothing. Weight in "kgs" (nearest 0.1kg).

B.M.I. Calculations

- WHO standards were used to measure the Body Mass Index of a person
- It is categorized as underweight, normal, overweight and obese.

Calculations	**B.M.I.**
Under weight	**Below 18.5**
Normal	**18.5 to 24.9**
Overweight	**25.0 to 29.9**
Obesity	**30 and above**

Statistical Methods:

Anaemia was considered as primary outcome of interest. Demographic, clinical and knowledge related parameters were considered as study relevant variables.

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagram, pie diagram.

The association between categorical explanatory variables and quantitative outcome was assessed by comparing the mean values. The mean differences along with their 95% CI were presented. Independent sample t-test/ ANOVA was used to assess statistical significance. The association between explanatory variables and categorical outcomes was assessed by cross tabulation and comparison of percentages. Chi square test, Fisher's Exact Test and Monte Carlo Simulation test was used to test statistical significance

Data was analyzed by using SPSS software, V.22. (1)

RESULTS:

A total of 365 subjects included into the final study.

Table 1: Distribution of participants based on the age (N=365)

Age	Frequency	Percentage
16-17	262	71.78%
17-18	74	20.27%
18-19	29	7.95%

The majority of the participants are in the age group of 16 (71.8%) and least in 18 (7.95%) (Table-1).

Table 2: Distribution of participants based on number of schooling years completed(N=365)

Number of years completed schooling	Frequency	Percentage
9	277	75.89%
10	80	21.92%
1st PUC	7	1.92%
2nd PUC	1	0.27%

75.8% of the participants in the current study had completed 9^{th} standard and 21.92% completed 10^{th} standard. Very few participants completed 1^{st} and 2^{nd} PUC (Table-2).

Table 3: Distribution of participants based on present schooling status (N=365)

Present schooling status	Frequency	Percentage
Studying	364	99.73%
Drop out	1	0.27%

Table 3 shows that 99.73% of the participants in the current study are studying in schools.

Table 4: Distribution of participants based on religion (N=365)

Religion	Frequency	Percentage
Hindu	333	91.23%
Muslim	23	6.30%
Christian	1	0.27
Jain	4	1.10%
others	4	1.10%

The majority of the participants in the current study belong to the Hindu religion (91.23%), followed by Muslims (6.3%), Jain (1.1%), and Christians (0.2%) (Table-4).

Table 5: Distribution of participants based on the type of family (N=365)

Type of family	Frequency	Percentage
Nuclear	236	64.66%
Joint	123	33.70%
Broken	6	1.64%

Table-5 shows that the majority of the participants belong to nuclear families (64.66%) and most of the families have 6 members.

Table 6: Distribution of participants based on BPL card (N=365)

BPL card	Frequency	Percentage
Yes	325	89.04%
No	40	10.96%

In our study, 9 out of 10 adolescent girls belongs to below poverty line

Table 7: Distribution of participants based on socio-economic class (N=365)

Socio economic status	Frequency	Percentage
Class 1	24	6.06%
Class 2	38	10.47%
Class 3	77	21.21%
Class 4	130	35.81%
Class 5	96	26.45%

In our study, the majority of the participants belong to social economic class four, i.e., 35.81%, followed by social economics class five, i.e., 26.45%, and very few belong to social, economic class I, i.e., 6.06%

Graph 1: Bar diagram showing the socioeconomic status of participants (N=365)

Table 8: Distribution of participants based on the education of mother and father(N=365)

Education of mother	Frequency	Percentage
Illiterate	124	34.07%
Read and write	39	10.71%
1-4 standard	67	18.41%
5-8 standard	67	18.41%
9-12 standard	51	14.01%
Diploma	5	1.37%
Degree	10	2.75%
PG	1	0.27%
Education of father		
Illiterate	92	25.21%
Read and write	47	12.88%
1-4 standard	84	23.01%
5-8 standard	48	13.15%
9-12 standard	65	17.81%
Diploma	10	2.74%
Degree	17	4.66%
PG	2	0.55%

The education status shows most of the mothers are illiterate, i.e., 34.07%, and very few have degrees and diplomas, i.e., 2.7% and 1.37%. Only 0.27% of mothers are postgraduates.

25.21% of the fathers are illiterate, and 12.8% can read and write. 4.6% have degrees, followed by diplomas (2.7%) and postgraduates (0.5%).

Graph 2: Bar diagram showing the education of mother and father (N=365)

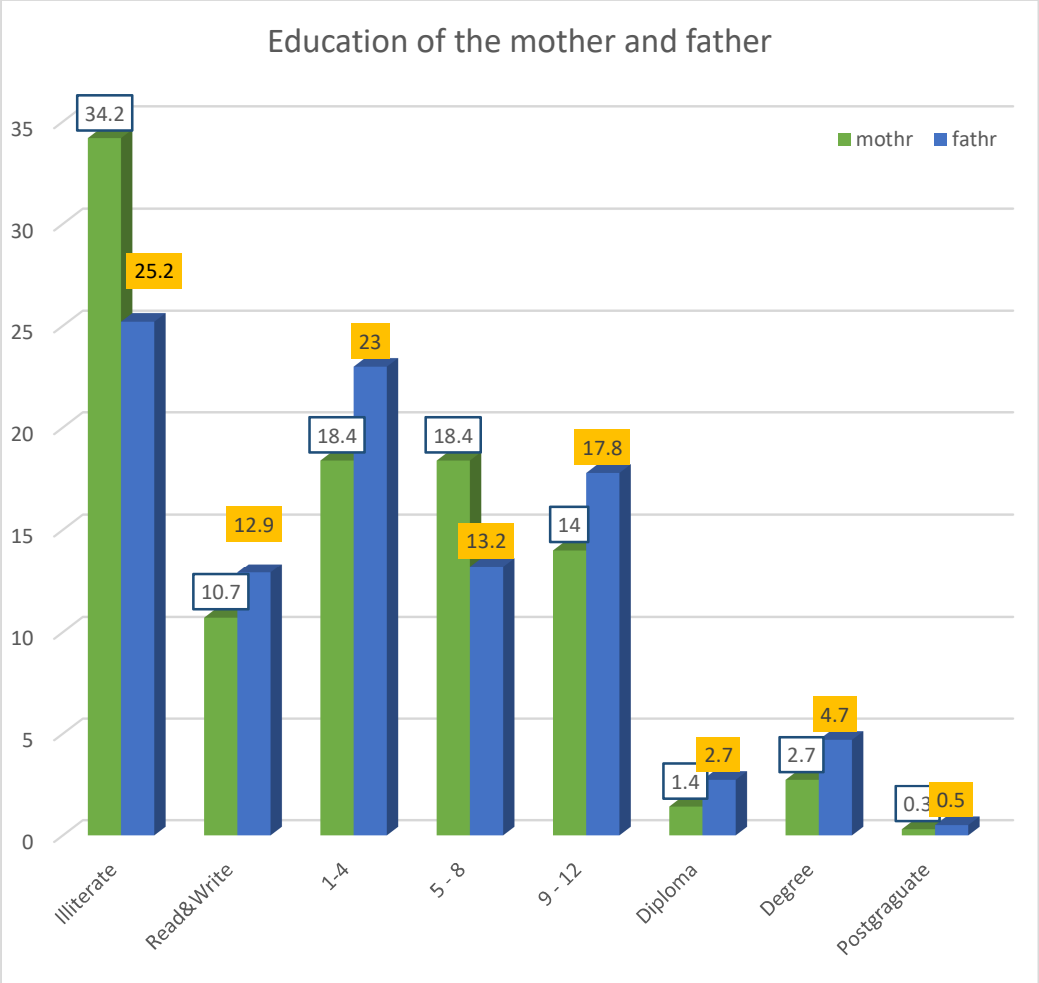


Table 9: Distribution of participants based on occupation of mother and father (N=365)

Occupation of mother	**Frequency**	**Percentage**
Farmer	176	48.22%
Home maker	69	18.90%
Self-employed	26	7.12%
Pvt employee	23	6.30%
Govt employment	32	8.77%
Labour	36	9.86%
Retired/pensioner	3	0.82%
Occupation of father		
Farmer	173	47.40%
Home maker	7	1.92%
Self-employment	57	15.62%
Pvt employment	43	11.78%
Govt employee	39	10.68%
Labour	43	11.78%
Unemployed	3	0.82%

The occupation status of mothers and fathers of the study participants depicts that most of the mother work in farm, i.e., 48.22%, followed by homemakers, i.e., 18.9%, and self-employed, i.e., 7.12%. The most of the fathers are farmers (47.4%), followed by self-employment (15.62%), and 0.82% of them were unemployed.

Table 10: Distribution of participants based on type of house (N=365)

Type of house	Frequency	Percentage
Semipucca	67	18.36%
Kacchar	108	29.59%
Pucca	174	47.67%
Others	16	4.38%

47.67% of the participants have Pucca houses, 29.59% of Kaccha houses, and 18.36% have semi-Pucca houses.

Table 11: Distribution of participants based on ownership of the house (N=365)

Ownership of house	Frequency	Percentage
Own	335	91.78%
Rented	25	6.85%
Other	5	1.37%

91.78% of the participants in the current study have their own houses, and very few live in rented homes (6.85%).

Table 12: Distribution of participants based on usage of sanitary latrine (N=365)

Sanitary latrine	Frequency	Percentage
Present & in use	328	89.86%
Present & not in use	6	1.64%
Community latrine	7	1.92%
Shared latrine	5	1.37%
Open defecation	19	5.21%

Results show that 89.86% of the participants in the current study stated that sanitary latrines are there in their houses and being used. Very few participants said they have a sanitary latrine but they are not in use. 5.21% of the participants would prefer open defecation. 1.92% or using community latrines, and 1.37% were sharing their latrines.

Table 13: Distribution of participants based on source of drinking water (N=365)

Source of drinking water	Frequency	Percentage
Tube well	97	26.58%
Sanitary well	161	44.11%
Tap water	78	21.37%
Water kiosk	7	1.92%
Packed water	3	0.82%
Unsanitary well	11	3.01%
Other	8	2.19%

44.11% of the participants in the current study stated that they are using sanitary well as a source of drinking water, followed by Tube well at 26.58%, tap water at 21.37%, and very few of them using packed water (0.82%). Interestingly 3.01% of the participants use an unsanitary well as the source of drinking water.

Table 14: Distribution of participants based on electrification of their house (N=365)

Electrification of the house	Frequency	Percentage
Yes	361	98.9%
No	4	1.10%

98.9% of the participants mentioned that their houses are being electrified, and only 1.1% said they don't have an electricity connection.

Table 15: Distribution of participants based on type of cooking fuel mostly used (N=365)

Type Of Cooking Fuel Mostly Used	Frequency	Percentage
LPG	243	66.58%
Kerosene	18	4.93%
Fire wood	88	24.11%
Biogas	14	3.84%
Electricity	2	0.55%

LPG is the most common cooking fuel used in the study participants' houses which is 66.58%, followed by firewood 24.1%, kerosene 4.93%, biogas 3.8%, and electricity 0.5%(Table-15).

Table 16: Distribution of participants those having separate kitchen (N=365)

Separate kitchen	Frequency	Percentage
Present	336	92.05%
Absent	29	7.94%

92.05% of the participants mentioned that, they have separate kitchen in their home and 7.94% said they don't have a separate kitchen.

Table 17: Distribution of participants based on menarche (N=365)

Attained menarche	Frequency	Percentage
Yes	345	94.52%
No	20	5.48%

Majority of the participants (94.52%) stated that they have attained menarche, and only 5.4% of them didn't attain menarche.

Table 18: Descriptive analysis of age at first period in the study population (N=345)

Name	Mean ± S D	Median	95% CI	
			Lower CI	Upper CI
Age at first period	13.22 ± 2.55	14.00	12.96	13.49

Results of the study state that most of the participants had their first period at the age of 14.

Table 19: Distribution of participants based on those who have regular periods (N=345)

Regular periods	Frequency	Percentage
Yes	286	82.89%
No, they have never been regular	49	14.20%
No, they have been irregular for few months	10	2.74%

In our study, out of 365, 82.89% of participants mentioned that they have regular periods and 14.2% of them said they don't have regular periods, and 2.74% mentioned that they had had irregular periods for a few months.

Table 20: Distribution of participants based on usual interval between periods (N=345)

Usual interval between your periods (days)	Frequency	Percentage
Less than 21 days	91	26.3%
21-45 days	239	69.2%
More than 45 days	05	1.44%
Don't know	10	2.89%

The usual interval between the periods among the study participants in our study is 21 to 45 days, i.e., 69.2%, followed by less than 21 days, i.e., 26.3%, and more than 45 days, i.e., 1.44%.

Table 21: Distribution of participants based on average length of flow (N=345)

Average length of flow (days)	Frequency	Percentage
2 days	67	19.42%
3-8 days	269	77.97 %
More than 8 days	9	2.6%

77.97% of the participants mentioned that the average length of the flow is about 3 to 8 days. 19.42% of the participants mentioned it is for 2 days or less

Table 22: Distribution of participants having history of passing clots or heavy bleeding during menstrual cycle (N=345)

History of passing clots or heavy bleeding during your menstrual cycle	Frequency	Percentage
Yes	54	15.65%
No	287	83.18%
Don’t know	4	1.15%

83.18% of the participants in the current study mentioned that they don't have any passing clots or heavy bleeding during the menstrual cycle, and 15.65% of the participants said that they have passing clots and heavy bleeding during their menstrual cycle (Table-22).

Table 23: Descriptive analysis of average pad used in each cycle (N=345)

Name	Median	Minimum	Maximum
On an average how many pads do you use in each cycle	4.00	0.00	15.00

Participants in the current study mentioned that, on average, they would use 1 to 15 sanitary pads in each cycle with a median of four (Table-23).

Table 24: Distribution of participants based on knowledge of anaemia (N=365)

Knowledge of anaemia	Know	Don't know
Have you heard about anaemia	132 (36.16%)	233(63.84%)
Is anaemia a health problem	77 (21.1%)	288 (78.9%)
Causes of anaemia	114 (31.2%)	251(68.8%)
Symptoms of anaemia	118(32.3%)	247(67.7%)
Effects of anaemia	118(32.3%)	247(67.7%)
How do you prevent anaemia	118(32.3%)	247(67.7%)
How anaemia can be treated	121(33.2%)	244(66.8%)

This table shows the knowledge of anaemia in the study population. 36.16% of the participants heard about anaemia, 21.1% of them known that anaemia is a health problem and 31.2% of the participants know the causes of anaemia. 32.3% know symptoms of anaemia, effects of anaemia and how to prevent anaemia. 33.2% of participants know what are the treatments for anaemia. (Table 24).

Table 25: Distribution of participants based on attitude and practice (N=365)

Attitude and practice about anaemia	Yes	No
Are iron folic tablets given in school/ Anganwadi/ASHA	140(38.36%)	225(61.64%)
Are deworming tablet given in your school/Anganwadi/ASHA	136(37.26%)	229(62.74%)
Do you consume the iron folic tablets	162(44.38%)	203(55.62%)
Do you consume the deworming tablets	175(47.95%)	190(52.05%)

Table 25 shows that 38.36% of the participants know that folic acid tablets are being given in the school or Anganwadi centres through Asha workers. 44.38% of the participants consume the iron and folic acid tablets. 47.95% of the participants mentioned that they used to consume deworming tablets.

Table 26: Distribution of participants based on whether diagnosed anaemia in Past 6 Months (N=365)

Past 6 months have you ever diagnosed with anaemia	Frequency	Percentage
Yes	20	5.52%
No	338	92.55%
Don’t know	7	1.93%

Only 5.52% of the participants in the current study have been diagnosed with Anaemia in the last six months, and 92.5% are not diagnosed with anaemia (Table-26).

Table 27: Distribution of participants based on consumption of Tea/Coffee (N=365)

Consumption of Tea/Coffee within one hour of food consumption	Frequency	Percentage
Yes	124	34.07%
No	241	65.93%

Two third of the participants in our study mentioned that they don't commonly consume tea or coffee within an hour of food consumption, and 34.07% consume tea or coffee within an hour of food consumption.

Table 28: Distribution of participants based on consumption of junk foods (N=365)

How often in a week do you eat these foods	Frequency	Percentage
Fried Foods		
Daily	68	18.63%
Alternate Day	59	16.16%
Once In a Week	192	52.60%
Fortnightly	31	8.49%
Once In a Month	7	1.92%
Rarely	5	1.37%
Never	3	0.82%
Puffs		
Daily	101	27.75%
Alternate Day	15	3.85%
Once In a Week	178	48.90%
Fortnightly	60	16.48%
Once In a Month	6	1.65%
Rarely	2	0.55%
Never	3	0.82%
Cake		
Daily	87	23.90%
Alternate Day	77	21.15%
Once In a Week	86	23.37%
Fortnightly	45	12.36%
Once In a Month	64	17.58%
Rarely	3	0.82%
Never	3	0.82%
Cold Drinks		
Daily	83	22.74%
Alternate Day	39	10.68%
Once In a Week	99	27.12%
Fortnightly	54	14.79%
Once In a Month	78	21.37%
Rarely	9	2.47%
Never	3	0.82%
Kurkure/Lays		
Daily	162	44.38%
Alternate Day	48	13.15%
Once In a Week	83	22.74%
Fortnightly	41	11.23%
Once In a Month	22	6.03%
Rarely	4	1.10%
Never	5	1.37%

Biscuits, Breads		
Daily	238	65.21%
Alternate Day	70	19.18%
Once In a Week	38	10.41%
Fortnightly	15	4.11%
Once In a Month	3	0.82%
Rarely	1	0.27%
Sweets		
Daily	139	38.08%
Alternate Day	92	25.21%
Once In a Week	90	24.66%
Fortnightly	38	10.41%
Once In a Month	5	1.37%
Rarely	1	0.27%

In our study, at least once in a week 80% of the participants consume junk foods like fried foods, puffs, cake and lays. Interestingly, 44.38% of the participants are daily consuming Kurkure/LAYS (fried potato chips). 90% of the participants consume biscuits and bread at least once a week and 65.25 consume biscuits and bread daily. In the same manner 27.12%.the participants mentioned that they would consume cool beverages once a week.

Graph 3: Bar diagram showing food habits of study participants (N=365)

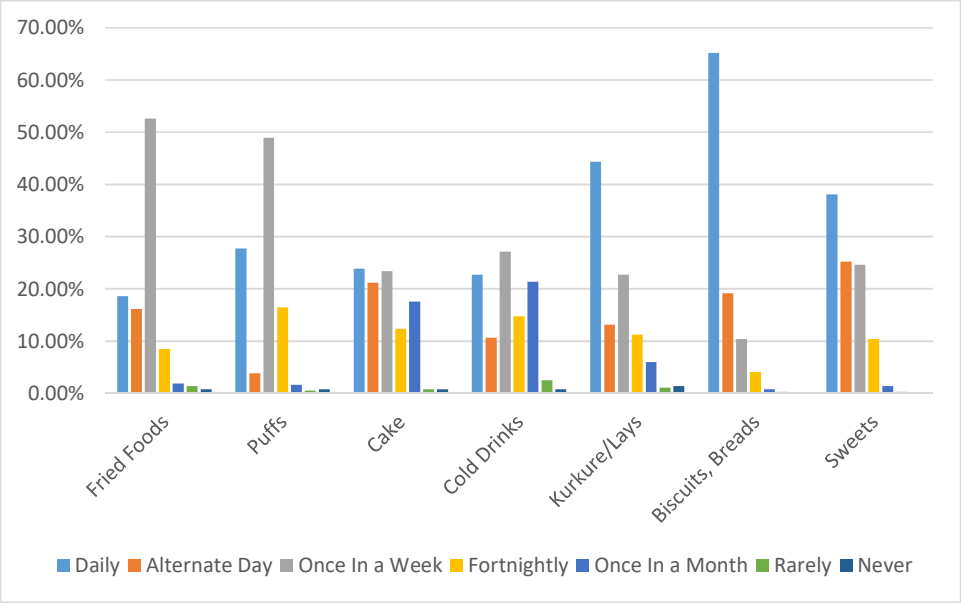


Table 29: Distribution of participants based on food intake (N=365)

Questionnaire for the managers of the family	Frequency	Percentage
Cereals		
Daily	337	92.33%
Alternate Day	25	6.85%
Once In a Week	3	0.82%
Pulses		
Daily	291	79.73%
Alternate Day	60	16.44%
Once In a Week	14	3.84%
GLV S		
Daily	327	89.59%
Alternate Day	32	8.77%
Once In a Week	5	1.37%
Never	1	0.27%
Other Veg		
Daily	285	78.08%
Alternate Day	63	17.26%
Once In a Week	15	4.11%
Fortnightly	1	0.27%
Once In a Month	1	0.27%
Milk		
Daily	98	26.85%
Alternate Day	9	2.47%
Once In a Week	31	8.49%
Fortnightly	18	4.93%
Once In a Month	12	3.29%
Rarely	12	3.29%
Never	185	50.68%
Milk Products		
Daily	21	5.75%
Alternate Day	46	12.60%
Once In a Week	52	14.25%
Fortnightly	51	13.97%
Once In a Month	19	5.21%
Rarely	6	1.64%
Never	170	46.58%
Egg		
Daily	33	9.04%
Alternate Day	114	31.23%
Once In a Week	104	28.49%
Fortnightly	10	2.74%
Once In a Month	35	9.59%
Never	69	18.90%

Meat		
Daily	8	2.19%
Alternate Day	48	13.15%
Once In a Week	99	27.12%
Fortnightly	46	12.60%
Once In a Month	58	15.89%
Rarely	15	4.11%
Never	91	24.93%
Poultry		
Daily	31	8.49%
Alternate Day	63	17.26%
Once In a Week	79	21.64%
Fortnightly	56	15.34%
Once In a Month	30	8.22%
Rarely	27	7.40%
Never	79	21.64%
Fish/ Sea Foods		
Daily	33	9.04%
Alternate Day	79	21.64%
Once In a Week	86	23.56%
Fortnightly	35	9.59%
Once In a Month	23	6.30%
Rarely	18	4.93%
Never	91	24.93%
Fruits		
Daily	56	15.34%
Alternate Day	91	24.93%
Once In a Week	97	26.58%
Fortnightly	61	16.71%
Once In a Month	14	3.84%
Rarely	3	0.82%
Never	43	11.78%
Nuts		
Daily	111	30.41%
Alternate Day	77	21.10%
Once In a Week	46	12.60%
Fortnightly	104	28.49%
Once In a Month	13	3.56%
Never	12	3.29%
Rarely	2	0.55%

Our study depicts the following results:

Most of the participants mentioned consuming grains and green leafy vegetables daily. 79.73% of the participants mention that they consume pulses.

78.08% of the participants mentioned that they consume vegetables daily, 17.26% consume an alternative day, and 4.11% consume once a week.

Surprisingly, 50.68% of the participants mentioned that they never consumed milk or milk products and 3.29% consumed it once a month, and rarely.

31.23% of the participants mentioned they would consume an egg every day and 18.9% of the participants never consumed eggs.

27.12% of the participants said they would consume meat once a week, and 24.90% said they never consumed meat. Very few people are consuming meet daily 2.19%.

Majority of the participants or consuming poultry once a week (21.64%) and 21.64% of the participants never consumed poultry.

23.56% of the participants consume fish or seafood once a week and 24.93% of the participants never consume fish or seafood.

65% mentioned they are consuming fruits at least once a week.

30.41% of the participants mentioned they are daily consuming nuts followed by 21.1% consume alternate days, 28.49% consume fortnightly, 12.6% of them are consuming once a week.

Table 30: Distribution of participants based on using of iodized salt while cooking **(N=365)**

Do you use iodized salt while cooking	Frequency	Percentage
Yes, exclusive	219	60%
Yes, but non-iodized is also used	115	31.51%
No	31	8.49%

59.73% of the participants mentioned that they were using iodized salt in cooking daily, followed by 31.5% who said they uses both iodized salt and un iodized salt and 8.49 mentioned that they are not using iodized salt.

Table 31: Distribution of participants based on hands washing with soap and water after defecation and before cooking (N=365)

	yes	no
Do you and your family members wash hands with soap and water after defecation	361(98.90%)	4(1.1%)
Do you and others in your family wash hands with soap and water before cooking	364(99.73%)	1(0.27%)

In our study the hand washing practices in their houses shows, 98.9% of the participants and their family members wash their hands with soap and water after defecation. Only 1.1% said they don't wash with soap and water. Similarly, 99.73% of the participants and their family members use soap and water for washing their hands before cooking.

Table 32: Distribution of participants based on ability to do normal activities (N=365)

Ability to carry out normal activities (Minutes)	Frequency	Percentage
0-15	17	4.65%
15-30	57	15.62%
30-60	78	21.37%
>60	213	58.36%

Table 32 shows the results; most participants can carry out their normal activities for more than 60 minutes, which is 58.36%. 21.37% of the participants carry out normal activities between 30 to 60 minutes. 4.65% of the participants said they can carry out normal activity for 15 minutes.

Table 33: Distribution of participants based on the academic performance in school (N=365)

Grade of academic performance in school	Frequency	Percentage
Below average	3	0.82%
Average	62	16.99%
Above average	253	69.32%
Excellent	47	12.88%

69.32% of the participants mentioned that they were above average in their academic performance in their school, followed by average, i.e., 16.9%, excellent (12.8%), and 0.82% of them are below average (Table-33).

Table 34: Descriptive analysis of Anthropometric Measures in the study population (N=365)

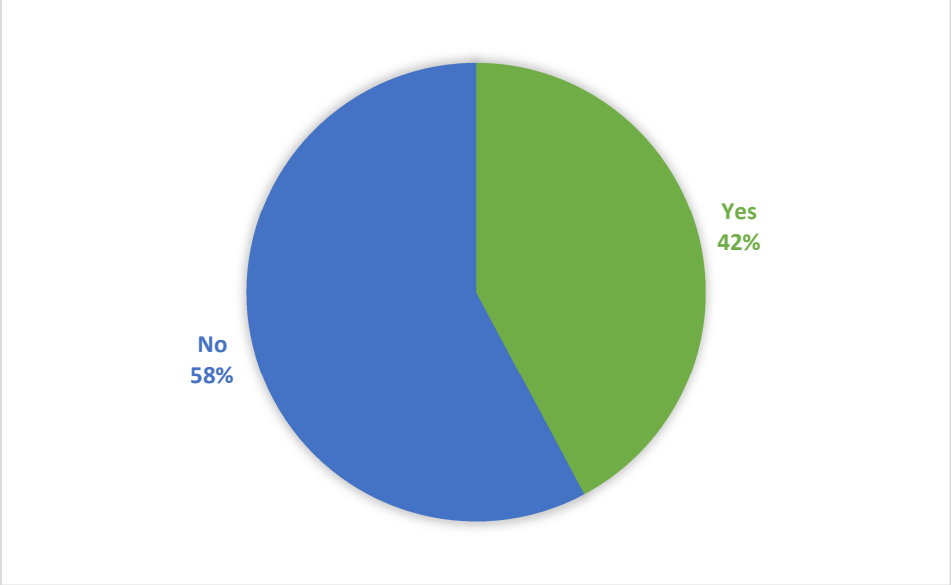
Name	Mean± S.D	Median	Minimum	Maximum	95% CI	
					Lower CI	Upper CI
Height (Cm)	143.87±4.61	143.00	134.00	158.00	143.40	144.35
Weight (Kg)	41.70±6.54	41.00	29.00	67.00	41.03	42.37
BMI(KG/M2)	20.14±2.97	19.90	13.79	32.31	19.83	20.44

The average height of the participants in the current study ranges from 134 cm to 158 cm, with a mean of 143.87±4.61. The average weight in kilograms ranges from 29 to 67 kgs with a mean of 41.70±6.54. The BMI in KG per meter square ranges from 13.79 to 32.31 with a mean of 20.14±2.97. (Table-34).

Table 35: Distribution of participants based on anaemia status (N=365)

Anaemia	Frequency	Percentage
Yes	154	42.19%
No	211	57.81%

Graph 4: Pie Chart of the study population with anaemia (N=365)

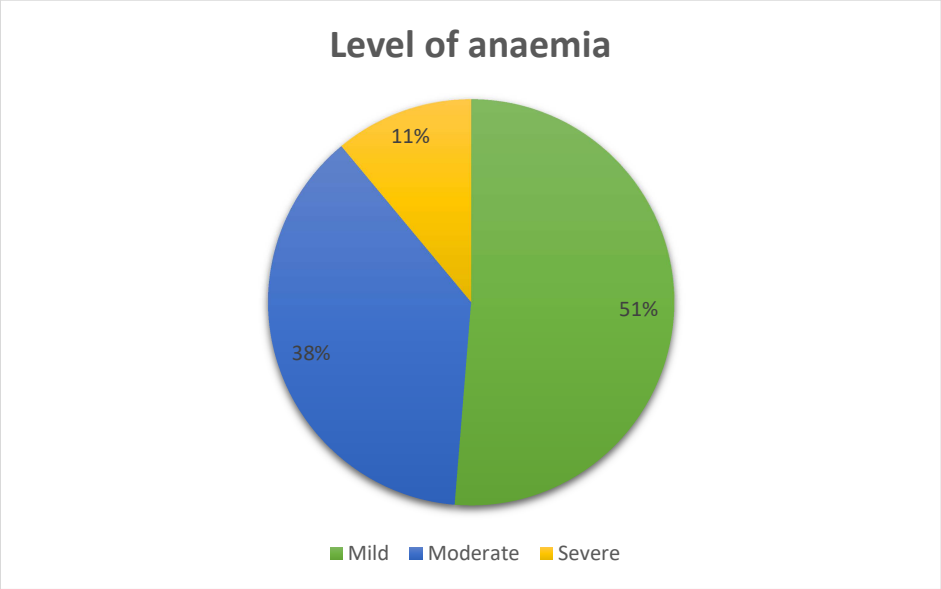


42.19% of the participants have anaemia in the current study, and 57.81% of the participants are not anaemic.

Table 36: Distribution of participants based on level of anaemia (N=154)

Level of anaemia	Frequency	Percentage
Mild	79	51.3%
Moderate	58	37.66%
Severe	17	11.04%
Total	154	100%

Graph 5: Pie chart for Descriptive analysis of Level of anaemia in the study population (N=154)



The majority of the participants in the current study have mild anaemia (51.3%), followed by moderate anaemia (37.66%) and severe anaemia (11.04%) (Table-36).

Table 37: Association of socio-demographic data with level of anaemia (N=365)

Socio-demographic Variables		Presence of anaemia					
		Anaemic		Normal			
		N	%	N	%	Chi-square / Fisher's Exact Test	p-value
Age	16	112	72.70%	150	71.10%	0.773	0.679
	17	32	20.80%	42	19.90%		
	18	10	6.50%	19	9.00%		
	19	0	0.00%	0	0.00%		
Religion	Hindu	137	89.00%	196	92.90%	3.017	0.555
	Muslim	13	8.40%	10	4.70%		
	Christian	0	0.00%	1	0.50%		
	Jain	2	1.30%	2	0.90%		
	Others	2	1.30%	2	0.90%		
Type of family	Nuclear	100	64.90%	136	64.50%	0.197	0.906
	Joint	52	33.80%	71	33.60%		
	Broken	2	1.30%	4	1.90%		
Do you have a BPL card	Yes	143	92.90%	182	86.30%	3.976	0.046*
	No	11	7.10%	29	13.70%		
Socio economic status	Class I	12	7.90%	10	4.70%	3.421	0.49
	Class II	19	12.50%	19	9.00%		
	Class III	32	21.10%	45	21.30%		
	Class IV	49	32.20%	81	38.40%		
	Class V	40	26.30%	56	26.50%		
Education of mother	Illiterate	56	36.60%	68	32.20%	5.402	0.611
	Read and write	17	11.10%	22	10.40%		
	1-4 standard	26	17.00%	41	19.40%		
	5-8 standard	32	20.90%	35	16.60%		
	09-10th standard	18	11.80%	33	15.60%		
	Diploma	2	1.30%	3	1.40%		
	Degree	2	1.30%	8	3.80%		
	PG	0	0.00%	1	0.50%		
Education of father	Illiterate	38	24.70%	54	25.60%	5.519	0.701
	Read and write	19	12.30%	28	13.30%		
	1-4 standard	36	23.40%	48	22.70%		
	5-8 standard	22	14.30%	26	12.30%		
	09-Dec	30	19.50%	34	16.10%		
	Diploma	3	1.90%	7	3.30%		
	Degree	6	3.90%	12	5.70%		
	PG	0	0.00%	2	0.90%		

Occupation of mother	Farmer	75	48.70%	101	47.90%	4.1	0.663
	Self -employed	10	6.50%	16	7.60%		
	Govt employment	16	10.40%	16	7.60%		
	Pvt employee	11	7.10%	12	5.70%		
	Labour	16	10.40%	20	9.50%		
	Homemaker	26	16.90%	43	20.40%		
	Retired/ pensioner	0	0.00%	3	1.40%		
Occupation of father	Farmer	63	40.90%	110	52.10%	11.001	0.088
	Self -employed	32	20.80%	25	11.80%		
	Govt employment	19	12.30%	20	9.50%		
	Pvt employee	16	10.40%	27	12.80%		
	Labour	21	13.60%	22	10.40%		
	Homemaker	3	1.90%	4	1.90%		
	Unemployed	0	0.00%	3	1.40%		
	Retired/ pensioner	0	0.00%	0	0.00%		
Sanitary latrine	Present & in use	138	89.60%	190	90.00%	2.018	0.732
	Present &not in use	4	2.60%	2	0.90%		
	Open defecation	8	5.20%	11	5.20%		
	Shared latrine	2	1.30%	3	1.40%		
	Community latrine	2	1.30%	5	2.40%		
Source of drinking water	Sanitary well	78	50.60%	83	39.30%	8.906	0.179
	Unsanitary well	2	1.30%	9	4.30%		
	Tube well	35	22.70%	62	29.40%		
	Tap water	33	21.40%	45	21.30%		
	Water kiosk	2	1.30%	5	2.40%		
	Packed water	2	1.30%	1	0.50%		
	Other	2	1.30%	6	2.80%		
Values are expressed as frequency and percentages. P-value is by chi-square test, and a p-value of <0.05 is considered statistically significant.							

The association between socio-demographic variables and the presence of anaemia shows that the majority of the variables do not show any association. At the same time, participants with BPL cards are associated with anaemia and shows statistical significance with a chi-square value of 3.97 and a p-value of 0.046. It implies participants who belongs to below poverty line are having higher chance of anaemia

Table 38: Association of menstrual history with level of anaemia (N=364)

Menstrual History		Presence of anaemia					
		Anaemic		Normal			
		N	%	N	%	Chi-square	p-value
Have you attained menarche	Yes	144	93.5%	202	95.7%	0.896	0.344
	No	10	6.5%	9	4.3%		
Average length of flow	2 days	31	21.7%	36	17.8%	0.862	0.652
	3 to 8 days	108	75.5%	161	79.7%		
	More than 8 days	4	2.8%	5	2.6%		
Average Pads used	1 to 5	116	81.0%	167	82.7%	0.689	0.396
	>5	27	19.0%	35	17.3%		

Values are expressed as frequency and percentages. P-value is by chi-square test, and a p-value of <0.05 is considered statistically significant.

Results showed that none of the menstrual factors was associated with the level of anaemia, and there was no statistically significant difference between them.

Table 39: Association of knowledge with level of anaemia (N=364)

Knowledge of anaemia		Presence of anaemia					
		Anaemic		Normal			
		N	%	N	%	Chi-square	p-value
Have you heard about anaemia	No	108	70.1%	125	59.2%	4.572	0.033*
	Yes	46	29.9%	86	40.8%		
Are iron and folic tablets given in school/ Anganwadi centre/ ASHA	Yes	49	31.8%	91	43.1%	10.00	0.007**
	No	44	57.1%	33	42.9%		
	Don't know	62	41.9%	86	58.1%		
Are deworming tablets are given in school/ Anganwadi/ASHA	Yes	47	34.6%	89	65.4%	6.266	0.044*
	No	34	51.5%	32	48.5%		
	Don’t know	74	45.4%	89	54.6%		
Do you consume the iron-folic tablet	Yes	64	39.5%	98	60.5%	1.044	0.307
	No	91	44.8%	112	55.2%		
Do you consume the deworming tablets	Yes	81	40.1%	121	59.9%	1.037	0.309
	No	74	45.4%	89	54.6%		

Values are expressed as frequency and percentages. P-value is by chi-square test, and a p-value of <0.05 is considered statistically significant.

Prevalence of anaemia is more commonly seen in those who have less knowledge about anaemia (chi-square value of 4.5 and a p-value of 0.03 and that is statistically significant).

Prevalence of anaemia is less common in participants who got iron folic acid supplementation from school / Anganwadi/ ASHA compared to those who said they didn’t get or don’t know and are statistically significant with a chi-square value of 4.57 with a p-value of 0.33. Likewise, anaemia is less common in participants who got deworming tablets from school/ Anganwadi/ ASHA and its statistically significant too

Table 40: Association of anthropometric measurement with anaemia (N=365)

Variables	Anaemia level						p-value
	Anaemic			Normal			
	n	Mean	Std Deviation	n	Mean	Std Deviation	
Height in cm	154	144.40	4.60	211	143.49	4.59	0.0643
Weight in kg	154	41.39	7.18	211	41.92	6.04	0.4415
BMI	154	19.84	3.26	211	20.35	2.73	0.1024

There was a difference observed in the BMI of participants with a level of anaemia in our study. The BMI of participants without anaemia (20.35 ± 2.73) is more than BMI of participants with anaemia (19.84 ± 3.26). It is not statistically significant

Graph 6: Association of anthropometric measurement with anaemia (N=365)

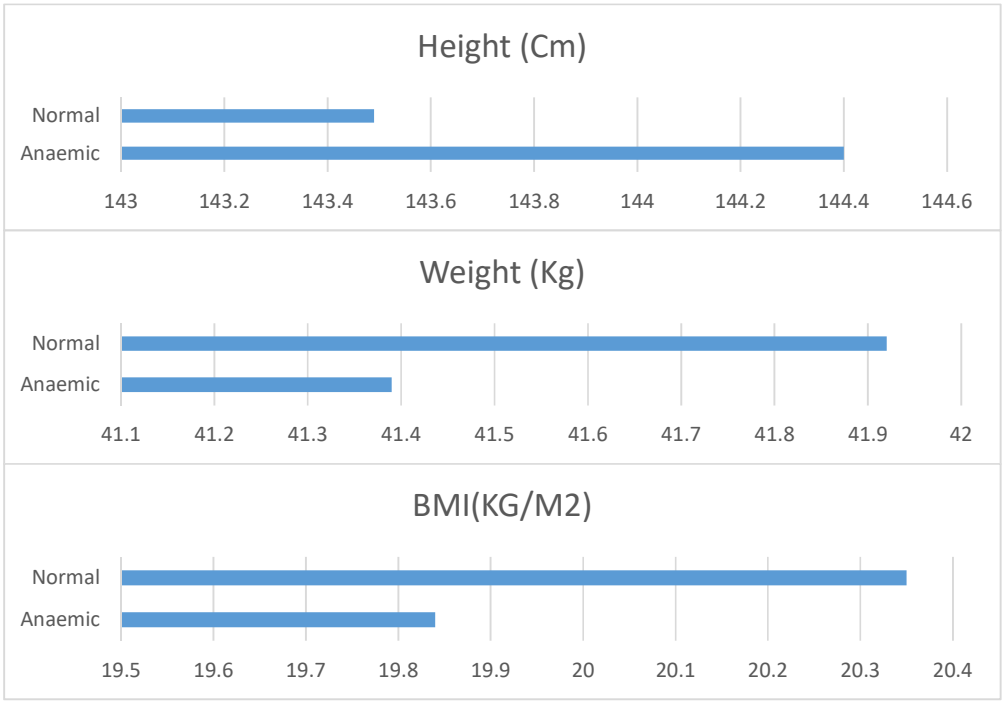


Table 41: Association of anthropometric measurement with level of anaemia (N=365)

Variables	Anaemia level									p-value
	Mild anaemia			Moderate anaemia			Severe anaemia			
	n	Mean	Std Deviation	n	Mean	Std Deviation	n	Mean	Std Deviation	
Height in cm	79	145	5	58	144	4	17	144	4	0.322
Weight in kg	79	43	8	58	39	5	17	42	9	0.02*
BMI	79	20.39	3.62	58	18.9	2.1	17	20.22	4.22	0.009**

While comparing the different levels of anaemia, there was statistically significant difference in the weight and BMI of participants with a level of anaemia. The weight and BMI of participants with moderate and severe anaemia is less than BMI of participants in mild anaemia.

Table 42: Association of diet with level of anaemia (N=365)

Dietary parameters		Presence of anaemia					
		Anaemic		Normal			
		N	%	N	%	Chi-square / Fisher's Exact Test	p-value
Cereals	Daily	143	42.4%	194	57.6%	4.669	0.072
	Alternate day	8	32.0%	17	68%		
	Once a week	3	100%	0	0.0%		
	fortnightly	0	0.0%	0	0.0%		
	Once a month	0	0.0%	0	0.0%		
	Rarely	0	0.0%	0	0.0%		
	Never	0	0.0%	0	0.0%		
Pulses	Daily	119	40.9%	172	59.1%	1.186	0.595
	Alternate day	29	48.3%	31	51.7%		
	Once a week	6	42.9%	8	57.1%		
	fortnightly	0	0.0%	0	0.0%		
	Once a month	0	0.0%	0	0.0%		
	Rarely	0	0.0%	0	0.0%		
	Never	0	0.0%	0	0.0%		
Green leafy Vegetables	Daily	138	42.2%	189	57.8%	1.435	0.879 (MCT)
	Alternate day	13	40.6%	19	59.4%		
	Once a week	3	60%	2	40%		
	fortnightly	0	0.0%	0	0.0%		
	Once a month	0	0.0%	0	0.0%		
	Rarely	0	0.0%	0	0.0%		
	Never	0	0.0%	1	100%		
Other veg	Daily	120	42.1%	165	57.9%	1.539	0.984 (MCT)
	Alternate day	27	42.9%	36	57.1%		
	Once a week	7	46.7%	8	53.3%		
	fortnightly	0	0.0%	1	100%		
	Once a month	0	0.0%	1	100%		
	Rarely	0	0.0%	0	0.0%		
	Never	0	0.0%	0	0.0%		
Milk	Daily	33	33.7%	65	66.3%	5.231	0.519
	Alternate day	4	44.4%	5	55.6%		
	Once a week	14	45.2%	17	54.8%		
	fortnightly	8	44.4%	10	55.6%		
	Once a month	7	58.3%	5	41.7%		
	Rarely	6	50.0%	6	50.0%		

	Never	82	44.3%	103	55.7%		
Milk products	Daily	5	23.8%	16	76.2%	20.385	0.002*
	Alternate day	20	43.5%	26	56.5%		
	Once a week	12	23.1%	40	76.9%		
	fortnightly	17	33.3%	34	66.7%		
	Once a month	8	42.1%	11	57.9%		
	Rarely	4	66.7%	2	33.3%		
	Never	88	51.8%	82	48.2%		
Egg	Daily	18	54.5%	15	45.5%	15.439	0.008*
	Alternate day	36	31.3%	79	68.7%		
	Once a week	42	40.8%	61	59.2%		
	fortnightly	2	20%	8	80%		
	Once a month	19	54.3%	16	45.7%		
	Rarely	0	0.0%	0	0.0%		
	Never	37	53.6%	32	46.4%		
Meat	Daily	7	87.5%	1	12.5%	8.164	0.224
	Alternate day	21	43.8%	27	56.3%		
	Once a week	44	44.4%	55	55.6%		
	fortnightly	19	41.3%	27	58.7%		
	Once a month	21	36.2%	37	63.8%		
	Rarely	5	33.3%	10	66.7%		
	Never	37	40.7%	54	59.3%		
Poultry	Daily	16	51.6%	15	48.4%	19.931	0.003*
	Alternate day	28	44.4%	35	55.6%		
	Once a week	47	59.5%	32	40.5%		
	fortnightly	21	37.5%	35	62.5%		
	Once a month	12	40.0%	18	60.0%		
	Rarely	8	29.6%	19	70.4%		
	Never	22	27.8%	57	72.2%		
Fish or seafood	Daily	14	42.4%	19	57.6%	8.430	0.209
	Alternate day	33	41.8%	46	58.2%		
	Once a week	40	46.5%	46	53.5%		
	fortnightly	11	31.4%	24	68.6%		
	Once a month	7	30.4%	16	69.6%		
	Rarely	4	22.2%	14	77.8%		
	Never	45	49.5%	46	50.5%		
Fruits	Daily	23	41.1%	33	59.9%	8.189	0.213
	Alternate day	36	39.6%	55	60.4%		
	Once a week	47	48.5%	50	51.5%		
	fortnightly	18	29.5%	43	70.5%		

	Once a month	8	57.1%	6	42.9%		
	Rarely	1	33.3%	2	66.7%		
	Never	21	48.8%	22	51.2%		
Nuts	Daily	61	55.0%	50	45.0%	16.534	0.003* (MCT)
	Alternate day	29	37.7%	48	62.3%		
	Once a week	22	47.8%	24	52.2%		
	fortnightly	33	31.7%	71	68.3%		
	Once a month	3	23.1%	10	76.9%		
	Rarely	0	0.0%	2	100%		
	Never	6	50%	6	50%		
Do you use iodized salt while cooking	Yes, exclusive	85	38.9%	133	61.1%	3.784	0.286
	Yes, but non-iodized is also used	56	48.2%	60	51.8%		
	No	13	41.9%	18	58.1%		
Values are expressed as frequency and percentages. P-value is by chi-square test, and a p-value of <0.05 is considered statistically significant.							

In the dietary factors, those who consumption of green leafy vegetables daily has less chance of anaemia but it is not statistically significant on Monte Carlo Simulation test (Fisher's Exact Test value 1.435, p-value 0.879).

Meanwhile milk products consumption is associated with anaemia with Fisher's Exact Test value of 20.385 and p-value of 0.002, which shows statistical significance. Those who take less milk products are more prone to anemic

Similarly, participants consume egg at least once a week (n=42), shows an association with anaemia. Those who take egg at least once in a week have less chance of anaemia.

Participants who consume poultry and nuts frequently shows a positive relationship with anaemia with a p-value of 0.003 and 0.003(MCT) respectively. Frequency of consuming poultry and nuts has no effect in preventing anaemia as anaemia is influenced by multifactorial causes.

DISCUSSION

Adolescence is a phase of rapid growth marked by physical and mental transitions. Nutritional anaemia is one of the most common facets of micronutrient deficiencies in the world and is higher in adolescent females. This study was done among 365 late adolescent girls in the area of Vantamuri, which is the rural field practice area of Department of Community Medicine, J. N. Medical College, KAHER, Belagavi during January 2021 to December 2021.

Socio-demographic characteristics (Tables 1 – 9)

In the present study 71.78% of study population belonged to the age group 16 to 17, remaining 28.2% belonged to the age group 17 to 19. 75.8% of the participants in the current study had completed 9^{th} standard and 21.92% completed 10^{th} standard. Majority of the study subjects (91.23%) were Hindus and 6.3% were Muslims.

90% of the participants comes under below poverty line. Nearly two third of the participants belonged to nuclear family and 33% belonged to joint family. Most participants belong to social economic class four, i.e., 35.81%, followed by social economics class five, i.e., 26.45%, and very few belong to a low social-economic class, i.e., 6.06%. These findings are concordant with other similar studies conducted in Northern India to study anaemia among adolescent girls from *Uttar Pradesh, Nagpur, and Chandigarh*, showing a high prevalence rate among lower socioeconomic groups. [59,60,61]

Among this study, 34% of the mothers were illiterates, 10% know how to read and write and very few have degrees and diplomas. 48% of the mothers work in farm

and 18.9% were home makers. Similarly, 12.8% of the fathers are illiterate and 2.74 were either unemployed or homemakers.

Environmental history (Tables 10-16)

In the present study 91.78% have own houses, among that 29.5% people lived in kuccha houses where as 47.67% lived in pucca houses. 44.1% using sanitary wells, 21.37% using tap water as source of drinking water, only 3% had unsanitary water source. 94% had access to toilet facility and remaining 5.21% practiced open air defecation. Majority of the participants used LPG as cooking fuel and 92% of the participants have a separate kitchen in their house.

Menstrual history (Tables 17-23)

Majority of the participants attained menarche and they had their first period at the age of 14. Nearly 70% of participants had regular periods between 21 to 45 days. Only 15.7% of the participants had a history of passing clots and heavy bleeding during their menstrual cycle.

KAP of participants (Tables 24-31)

Among this study 36.16% of the participants heard about anaemia and 21.1% of them known that anaemia is a health problem. 44.38% of the participants consumed iron and folic acid tablets and 47.95% consumed deworming tablets recently.

Around 34.07% consume tea or coffee within an hour of food consumption. 80% of the participants consume junk foods at least once in a week, in the same way they consume iron rich foods like green leafy vegetables, fruits, legumes etc at least

once in a week. In a study by *Bukelo et al* 25% of the rural adolescents takes fruits and vegetables more than 2 days in a week which was very lower than the findings in our study.[62]

Anthropometric measurements and physical ability (Tables 32-34)

Majority of the participants (58.36%) can carry out their normal activities for more than 60 minutes. The average height of the participants was 143.87 cm and the average weight was 41.70 kgs. The BMI of the participants ranges from 13.79 to 32.31.

Prevalence of anaemia (Table - 35)

The prevalence of anaemia varies around India, which is reflected in various studies such as *Dharmalingam A et al., Anand et al., Rajarathnam et al., and Srivastava et al.*[63,64,65,66]. Our study's findings can be comparable with the study done by *Premalatha et al.* in Chennai [67] with the prevalence of anaemia among adolescent girls at 78.75%. Similarly, in a study done by *Toteja et al.* in around 16 districts of India, the overall prevalence was found to be 90.1%. Our study findings showed a lower prevalence rate when compared with these studies.[68] Different states of rural India reported a prevalence of anaemia from 46% to 98, which is in concordance with our study. Our study results were found to be concordant with *Tamil Nadu*.[69] *Kant et al.* found the prevalence of anaemia in males as 27%, relatively less than our study.[70] The difference in the prevalence rate of anaemia in various studies may be due to different study settings and methods of haemoglobin estimation. The above studies depicted anaemia in India is exceedingly prevalent in many rural areas. It is crucial to improve the condition since physical and intellectual development undertakes and

extends throughout the adolescent period, the nutritional status of the adolescent population to prevent the occurrence of nutritional anaemia.

Severity of anaemia (Table – 36)

The prevalence of anaemia of our study is 42.2%. Most of the participants in our study have mild anaemia (51.3%), followed by moderate anaemia (37.6%) and severe anaemia (11.1%), as per WHO guidelines. A study by *Subramaniam et al.* stated similar results for severe anaemia.[71] Whereas, Siddharam et al. and *Animesh et al.* had different findings where participants had more moderate anaemia.[72] Another study conducted among anaemic adolescent girls in Orissa showed that 45.2% had mild anaemia, and 46.9% and 4.4% had moderate and severe anaemia, respectively.[73] Our study showed a lower prevalence rate of moderate and severe anaemia. Many other studies conducted in India's rural areas revealed prevalence rates ranging from 0.2% to 6% of severe anaemia among adolescent girls.[65,73] This increased prevalence of mild and moderate anaemia demands awareness about health and nutrition among adolescent girls. Insisting on the intake of foods rich in iron and folic acid along with general health education are essential to reduce the prevalence of anaemia among adolescent girls.

Association of socio-demographic characters with anaemia (Table – 37)

Distribution of anaemic girls according to early and late adolescent period. Most participants are in the age group of 16 (71.8%) and least in 18 (7.95%). Increased prevalence of anaemia was noted among girls aged 16 years. Increased prevalence of anaemia was seen during the late adolescent age. A similar study in

Haryana on 110 adolescent girls belonging to low socioeconomic groups observed a similar prevalence among girls over 14 years.

In the present study, age, education, religion and type of family were not significantly related to anaemia. Whereas BPL status shows a significance with anaemia. Similar to our study, *Chaudhary and Dhage et al.*[59] and *Rawat et al.*[60] could not find any association between anaemia and the age of girls identical to our study. *Mehta et al. and Kotecha et al.* [74,75] also reported that age is not a significant correlate of anaemia. The significant relationship between anaemia and socioeconomic status strongly recommends the need for developing and implementing policies which improve and eliminate socioeconomic disparities

Although cast is an independent predictor of anaemia, results from NFHS-3 shows that children in scheduled cast had a higher risk of having anaemia comparing with adolescent age group, in our study also we couldn't find any relationship between religion or cast with anaemia [76]

Association of menarche with anaemia (Table – 38)

In the current study, no statistically significant difference was found between factors and levels of Anaemia like menarche, age when you had a first period, regular periods, or interval between your periods. In contrast, anaemia was high (75.1%) among females who had attained menarche compared to females who had not attained menarche (67.1%). In a *Dutt et al.* study, the prevalence of anaemia was higher in those who had attained menarche when compared to those who had not.[71] Similarly, in a study by *Kaur et al.*, anaemia was higher in those who had attained menarche than in those who had not.[77]

Association of availability Iron folic acid and its consumption with anaemia (Table – 39)

Iron folic acid supplementation are one of the adolescent girls' most important nutritional interventions. Iron-folic acid (IFA) supplementation has been shown its benefits in adolescent growth. Our study has some strong points where it shows a statistical significance with the availability of iron folic acid in schools and the consumption of iron folic acid by the study population. This finding is in line with a study conducted among unmarried adolescent girls in Maharashtra which says there was an increment in hemoglobin level of girls in the group who received IFA supplementation for 3 months.[78]

Knowledge of anaemia among adolescent girls (Table – 39)

When the knowledge of Anaemia was compared with the anaemia level, there was a statistical significance between anaemia levels in our study's category of knowledge. Participants in our study had insufficient knowledge of the cause, symptoms, treatment, and food rich in iron. Similar findings were observed in previous research.[79] A study conducted in urban areas of school-going adolescent girls found better knowledge of anaemia and its related factors.[80] The reason may be that there is low awareness of the national health program and health and hygienic practices in remote areas. Besides this, some studies on community and non-school-going adolescents observed poor knowledge of anaemia and related factors. Implementing a nutrition education program effectively increases female adolescents' anaemia knowledge, attitude, and practice. [81]

Association of anthropometric measurements with anaemia (Table - 40 and 41)

Our study has some strong points as the study population depicts a statistically significant difference in the weight and BMI of participants with a level of Anaemia. In mild Anaemia, the mean weight of the participants ranges from 43±8. In moderate Anaemia, it is 39±5; in severe Anaemia, it is 42±9 with a p-value of 0.01, which is statistically significant. The mean BMI of participants in mild Anaemia is 20.3±3.62. In moderate Anaemia, it is 18.9±2.1; in severe Anaemia, it is 20.22±4.22 with a p-value of 0.009, which is statistically significant. But in a similar study carried out on 340 girls in Jorhat reported that age and BMI was not a significant correlate of anaemia.[82]

Association of dietary habits with anaemia (Table – 42)

In our study, Dietary components do not show any significant association with Anaemia. Although our study indicates dietary habits have no significance on anaemia, excluding milk products and egg. In our study we found poultry products and nuts consumers have low hemoglobin levels, probably we need to look into frequency and quantity of consumption and other causations for anaemia. The prevalence of anaemia in adolescents who takes fewer food varieties was found to be higher in 3780 adolescents in a National Adolescent Nutrition Survey in Nepal.[83] *Verma et al* also reported that related to non-vegetarians (38%), vegetarians (65.9%) were more anaemic.[84] Still, there is a constant need to initiate anaemia prophylaxis measures for adolescent girls in India, including nutrition education in schools.

CONCLUSION

Anaemia is a major public health problem among adolescent girls in rural areas. The prevalence was high among girls above sixteen and those from lower socioeconomic groups. School-based intervention among adolescent girls plays a vital role in preventing and controlling anaemia among this group. There is a need for a regular supply of iron and folic acid tablets and health education among adolescent girls. Special importance should be given for developing corrective measures against nutritional anaemia among adolescent girls by improving the knowledge of consuming foods rich in iron and folic acid. As anaemia is a multifactorial causation, regular check-up of anaemic status, evaluation, treatment and prevention plays a pivotal role in strengthening health in adolescent girls

This study can provide reference point for future research and multicentric research involving a larger sample size can be planned.

RECOMMENDATIONS

Based on the findings of the present study, the following recommendations are suggested.

- Create awareness among school students regarding the knowledge and prevention strategies for anemia. Insisting on the intake of foods rich in iron and folic acid along with general health education should be emphasized in school health curriculum

- Investigations like Serum ferritin, vitamin B12, folic acid levels and electrophoresis should be done to assess the nutritional status of adolescents and also to differentiate between nutritional and non-nutritional causes of anaemia.

- Since ours is a community-based study, future studies of this kind can make use of findings for comparison and observe the changes occurring over a period of time.

LIMITATIONS

The limitations of the study were:

- Anaemia is a multifactorial in causation. Due to economic constraints, we were unable to perform further tests like Serum ferritin, vitamin B12, folic acid levels, serum electrophoresis and stool examinations for occult blood or helminthic infestations; to differentiate between nutritional and non-nutritional anaemia.

- It's a self-administered questionnaire, so the chance of subjective bias can't be ignored.

- As this is a cross sectional study, we couldn't make out the temporal association between food frequency with anaemia

SUMMARY

Our study was conducted among 365 late adolescent girls in the area of Vantamuri, which is the rural field practice area of Department of Community Medicine, J. N. Medical College, KAHER, Belagavi during January 2021 to December 2021 to know the prevalence of nutritional anaemia in late adolescent girls (16 to 19 years).

Grouping of participants was utmost in the age group between 16 to 17 (71.78%). 99% of the participants are currently studying and 21.92% of them have completed high school. Majority of the study implication (91.23%) were Hindus. Nearly two third of the participants belonged to nuclear family. 90% of the participants comes under below poverty line and most of them belonged to socio-economic status Class IV as per modified B.G. Prasad's classification.

Among this study, 34% of the mothers were illiterates and very few have degrees and diplomas. 48% of the mothers work in farms. Similarly, 12.8% of the fathers are illiterate and 2.74 were either unemployed.

Majority of them have their own houses and one third of them lived in kuccha house. 70% are using sanitary wells or tap water as source of drinking water. Only 5 % of the participants practiced open air defecation. Majority of the participants used LPG as cooking fuel and 90% of them have a separate kitchen in their house.

Majority of the participants attained menarche and they had their first period at the age of 14. Nearly 80% of participants had regular periods but 15.7% of the

participants had a history of passing clots and heavy bleeding during their menstrual cycle.

One third of the participants heard about Anaemia and 20% of them known that anaemia is a health problem. 44.38% of the participants consumed iron and folic acid tablets and 47.95% consumed deworming tablets recently. 80% of the participants consume junk foods at least once in a week, in the same way they consume iron rich foods like green leafy vegetables, fruits, legumes etc at least once in a week. The average height of the participants was 143.87 cm. whereas the average weight was 41.70 kgs. The BMI of the participants ranges from 13.79 to 32.31

The prevalence of anaemia of our study was 42.2%. Most of the participants in our study have mild anaemia (51.3%), followed by moderate anaemia (37.6%) and severe anaemia (11.1%), as per WHO guidelines. Age, education, religion and type of family were not significantly related to anaemia. Whereas BPL status shows a significance with anaemia. Our study shows a strong statistical significance with the availability of iron folic acid in schools and the consumption of iron folic acid by the study population. Although our study indicates dietary habits have no significance on anaemia, excluding milk products and egg which shows a beneficial effect.

Likewise, the study population depicts a statistically significant difference in the weight and BMI of participants with a level of anaemia i.e., adolescent girls having low BMI are more anaemic or vice versa.

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ANNEXURE – I

CONSENT FOR PARTICIPANTS

"Prevalence of nutritional anaemia among late adolescent girls in rural area of Belagavi"

Principal Investigator: _____

PG Student, Department of Community Medicine,

J.N. Medical College, KAHER, Belagavi-10.

Guide: _____

Associate Professor, Department of community medicine

J.N. Medical College, KAHER, Belagavi-10.

Purpose of the research:

I **_____,** PG Student, Department of Community Medicine, J N Medical College, KLE Academy of Higher Education and Research, Belagavi is conducting a study called **"Prevalence of nutritional anaemia among late adolescent girls in rural area of Belagavi"** to know the burden of less blood level among late adolescent girls (aged between 16 to 19 years). Most of girls in this age group suffer from low blood levels (anaemia) and has bad effect on health of them. We will also collect half teaspoon (2ml) of blood to know the amount of blood in the body. This study will help us to understand what the factors are influencing this condition and will help in future to make some suggestions to government in preventing low blood level in girls. We believe that you can help us by participating in this study where in you will come to know your blood level (hemoglobin level) and nutritional education for the prevention of anaemia.

Type of Study:

This research will involve your participation only once as the study is to know the burden of low blood level among girls aged between 16 to 19 years in rural areas of Belagavi.

Voluntary Participation:

Your participation in this study is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate all the services you receive at the local health center will continue and nothing will change. You may change your mind later and stop participating even if you have agreed earlier.

Potential Risks or Discomfort:

There are no risks for being in this study. There is a possibility that answering the questions posed to you during the study by the study personnel may make you uncomfortable to respond. You do not have to answer any question, if you feel the question(s) are too personal or if talking about them makes you uncomfortable. While drawing the blood from your arm may cause pain, blood collection at the site of blood drawing, fainting etc. However, we do not wish for this to happen. Photographs may be taken during the study and these will be used for scientific purposes only and will not contain any other personal information.

Benefits:

There may be no direct benefit to you, but your participation is likely to help us find out the burden of low blood levels in the girls aged between 16 to 19 years and factors influencing this condition.

Reimbursements:

You will not receive any monetary reimbursement for participating in the study; your participation will be voluntary.

Confidentiality

Your confidentiality will be respected. No information that discloses your identity will be revealed. All the information taken from you will be kept safely and no person other than authorized local key investigators will be able to trace the information to your name or your address. The de-identified data will be shared with the statistician in JNMC for further analysis and interpretation. However, data will not contain any personal identifiers.

Whom to contact with questions about the study

We have given you information about the study called **"Prevalence of nutritional anaemia among late adolescent girls in rural area of Belagavi"** We have discussed the risks and benefits of the study and you understand that you do not have to agree to be in the study or may decide later not to be part of the study. This will not affect your care in any way.

If you have questions about your rights as a study participant, please contact Dr. Roopa M. Bellad Chairperson, Institutional Ethics Committee for Human Subjects' Research, J.N. Medical College, KAHER, Belagavi – 590010,

I have read this consent form, or it has been read to me in presence of a witness in my vernacular. I was given opportunity to ask questions and they were answered to my satisfaction. By signing this document, I declare that I have consented to participate in this study.

_____

Name & Signature or Thumbprint of Person Providing Consent/assent Date

_____

Name & Signature or Thumbprint of parent (if participant is <18 years) Date

_____

Name & Signature or Thumbprint of Witness Date

_____

Name & Signature of Person Obtaining Consent Date

Person requesting consent, please check applicable boxes:

☐ Consent obtained (for adult respondent)

☐ Assent (for minor respondents)

☐ Consent from authorized person

ANNEXURE – II

QUESTIONNAIRE

TITLE: - "Prevalence of nutritional anaemia among late adolescent girls in rural area of Belagavi"

Note: "The personal data provided by you will be kept confidential. Only aggregated results will be presented/ published".

DATE: __/__/____ Sl. No: _____

Section 1. Sociodemographic details

I. Name:

_____

II. Age: _____ in years.

III. Address and contact number:

_____ Ph: _____

IV. Number of years of completed schooling: _____

V. Presently schooling status

a. Studying (if studying, then skip question 6 and 7)

b. School/college drop out

VI. If dropout, when did you dropout: _____

VII. Reason for dropout: _____

VIII. Religion

a. Hindu

b. Muslim

c. Christian

d. Jain

e. Others (specify_____)

IX. Type of Family

a. Nuclear

b. Joint

c. Broken family

X. Do you have a BPL card?

a. Yes

b. No

XI. Number of family members? _____

XII. Total income of the family? _____

XIII. Per capita income _____/ month

XIV. Socioeconomic status (according to B.G. Prasad classification)

a. Class 1

b. Class 2

c. Class 3

d. Class 4

e. Class 5

XV. Education of mother:

a. Illiterate

b. Read and write

c. 1 – 4 Standard

d. 5 – 8 Standard

e. 9 – 12

f. Diploma

g. Degree

h. PG

XVI. Education of father:

a. Illiterate
b. Read and write
c. 1 – 4 Standard
d. 5 – 8 Standard
e. 9 – 12
f. Diploma
g. Degree
h. PG

XVII. Occupation of mother

a. Farmer
b. Self employed
c. Government employee
d. Private employee
e. Labourer
f. Home maker
g. Retired/Pensioner

XVIII. Occupation of father

a. Farmer
b. Self employed
c. Government employee
d. Private employee
e. Labourer
f. Home maker
g. Unemployed
h. Retired/Pensioner

XIX. 15. Type of house

a. Pucca

b. Semi pucca

c. Kutcha

d. Others (_____)

XX. 16. Ownership of the House

a. Own

b. Rented

c. Others (_____)

XXI. 17. Sanitary latrine

a. Present & in use

b. Present &not in use

c. Open defecation

d. Shared latrine

e. Community latrine

XXII. 18.Source of drinking water

a. Sanitary well

b. Unsanitary well

c. Tube well

d. Tap water

e. Water kiosk

f. packed water

g. Others (_____)

XXIII. 19. Electrification of the house

a. Yes

b. No.

XXIV. 20.Type of cooking fuel mostly used

a. Fire wood

b. Kerosene

c. Biogas

d. LPG

e. Electricity

f. Others (Spfy:_____)

XXV. 21. Separate kitchen

a. Yes

b. No, cooking inside house

c. No, Cooking in open space

Section 2. Menstrual History

I. Have you attained menarche?

a. Yes

b. No (if no, skip to next section)

II. How old were you when you had your first period?

a. Age (years)_____

b. Don't know

III. Do you have regular periods?

a. Yes

b. No, they have never been regular

c. No, they have been irregular for few months

IV. What is the usual interval between your periods (from the first day of one period to the first day of the next)?

a. Less than 21 days

b. 21-45 days

c. More than 45 days

V. Average length of flow?

a. 2 days

b. 3 to 8 days

c. More than 8 days

VI. Any history of passing clots or heavy bleeding during your menstrual cycle?

a. yes

b. no

VII. On an average how many pads do you use in each cycle? _____

Section 3. Knowledge about anaemia:

I. Have you heard about anaemia? (less blood in the body)

a. Yes

b. No

c. Don't know (If answer is II or III, skip to next section)

II. Is anaemia a health problem?

a. Yes

b. No

III. What do you understand by anaemia?

a. Decreased concentration of iron in blood

b. Increased concentration of iron in blood

c. Do not know

IV. Causes of anaemia (check all that apply)

a. Decreased dietary iron intake

b. Worm infestation

c. Increased blood loss during menstrual cycle, bleeding gums, piles

d. Increased demand not fulfilled during adolescence and pregnancy

e. Repeated infections

f. Trauma/Accident

g. Do not know

h. Any other, specify _____

V. Symptoms of anaemia (check all that apply)

a. Decreased appetite

b. Fatigue

c. Irritability

d. Shortness of breath

e. Pale skin color

f. Oedema of the face and legs

g. Any other, specify _____

VI. Effects of anaemia (check all that apply)

a. Decreases growth and development

b. Decreases learning abilities

c. Decreases working capacity

d. Any other, specify _____

e. Do not know

VII. How do you prevent anaemia? (Check all that apply)

a. Increasing dietary iron intake

b. Avoiding post meal tea and coffee

c. Consuming Vitamin C-rich fruits

d. Periodic deworming

e. Always wearing footwear

f. Regular clipping of nails

g. Any other, specify _____

VIII. How anaemia can be treated? (Check all that apply)

a. Dietary modifications

b. Iron and folic acid supplements

c. Iron injection

d. Blood transfusion

Section 4. Practice by adolescents

I. Are Iron folic acid tablets given in school/ Anganwadi/ASHA?

a. Yes, if yes How often? _____times per month

b. No

c. Don't know (If the answer is a or b, skip to question no 4)

II. Do you consume the Iron folic acid tablets given in school/ Anganwadi?

a. Yes, always

b. Yes, sometimes

c. No

III. Where do you consume the tablets?

a. in school/ Anganwadi

b. at home

IV. Are deworming tablets given in your school/ Anganwadi/ASHA?

a. Yes, if yes How often? _____times per year

b. No

c. Don't know (If answer is b or c, skip to next section)

V. Do you consume the deworming tablets?

a. Yes, always

b. Yes, sometimes

c. No

VI. Past 6 months, have you ever diagnosed with anaemia?

a. Yes

b. No

VII. If yes, provide the treatment details:

_____

VIII. Do you commonly (at least once a day) consume tea/coffee within an hour of food consumption (before or after)?

a. Yes

b. No

IX. How often in a week do you eat these foods?

Food items	Daily	Alternate day	Once in a week	Fortnightly	Once in a month	Rarely	Never
fried food							
Puff							
Cake							
cold drinks							
Kurkure, Lays							
Biscuits, Bread							
Sweets							

X. Are you able to carry out normal activities (could include sports in school also)?

a. 0-15 minutes, without any difficulty.

b. 15-30 minutes, without any difficulty.

c. 30-60 minutes, without any difficulty.

d. 60 minutes, without any difficulty.

(Moderate activities - like water aerobics in the pool, biking, brisk walking, ballroom dancing, doubles tennis, gardening Intense/ Heavy exercise - swimming laps, jogging, jumping rope, playing singles tennis, biking faster than 10 miles per hour, heavy gardening, a hilly hike)

XI. How do you grade your academic performance in school/college?

(Applicable to school/college going)

(a)Excellent (b)Above average (c)Average (d)Below average (e)Very poor

Section 5. Anthropometric measurements

Height in cm	cm.
Weight in Kg	Kg.
BMI	cm^2

Section 6. Haemoglobin level

_____mg/dl

Anaemia yes / No

If yes: Mild

Moderate

Severe

Section 7. Questionnaire for the managers of the family

Food items	Daily	Alternate day	Once in a week	Fortnightly	Once in a month	Rarely	Never
CEREALS Wheat Jowar							
PULSES Green gram Red gram Bengal gram Chick pea, pea							
GLVs Spinach Amarnath Fenugreek Spring onion							
OTHER VEG Cabbage Cauliflower Brinjal Ridge gourd							
MILK							
Food items	**Daily**	**Alternate day**	**Once in a week**	**Fortnightly**	**Once in a month**	**Rarely**	**Never**
MILK PRODUCTS (Buttermilk, Paneer, curd)							
EGG*							
MEAT* (Sheep, Goat, pig, etc.)							
POULTRY*							
FISH/SEA FOOD*							
FRUITS							
NUTS (Dry fruit-cashew, almonds, ground nuts)							

I. Which of these is more common in your household about green leafy vegetables?

   a. Wash only before cutting
   b. Cut before washing
   c. Wash before and after cutting
   d. Others, specify_____

II. Do you use iodized salt while cooking?

   a. Yes, exclusively
   b. Yes, but non-iodized is also used
   c. No

III. Do you and your family members (all) wash hands with soap and water after defecation?

   a. Yes
   b. No

IV. Do you and others in your family wash hands with soap and water before cooking?

   a. Yes
   b. No

ANNEXURE III – KEY TO MASTER CHART

Sl. No	ITEMS	KEY CODE
	Sociodemographic details	
1	Name	
2	Age	
	16	1
	17	2
	18	3
	19	4
3	Number of years of schooling	
	9	1
	10	2
	1st PUC	3
	2nd PUC	4
4	Presently schooling status	
	Studying	1
	School/college drop out	2
5	Religion	
	Hindu	1
	Muslim	2
	Christian	3
	Jain	4
	Others	5
6	Type of the family	
	Nuclear	1
	Joint	2
	Broken	3
7	Do you have a BPL card	
	Yes	1
	No	2
8	No of family members	
9	Socio economic status	
	1	1
	2	2
	3	3
	4	4
	5	5
4	Education of mother	
	Illiterate	1
	Read and write	2

	1-4 standard	3
	5-8 standard	4
	9-12	5
	Diploma	6
	Degree	7
	PG	8
5	Education of father	
	Illiterate	1
	Read and write	2
	1-4 standard	3
	5-8 standard	4
	9-12	5
	diploma	6
	Degree	7
	PG	8
6	Occupation of mother	
	Farmer	1
	Self -employed	2
	Govt employment	3
	Pvt employee	4
	labour	5
	Home maker	6
	Retired/ pensioner	7
7	Occupation of father	
	Farmer	1
	Self -employment	2
	Govt employment	3
	Pvt employee	4
	labour	5
	Home maker	6
	Unemployed	7
	Retired/ pensioner	8
8	Type of house	
	Pucca	1
	Semipucca	2
	Kacchar	3
	others	4
9	Ownership of the house	
	Own	1
	Rented	2
	Other	3
10	Sanitary latrine	

	Present & in use	1
	Present &not in use	2
	Open defecation	3
	Shared latrine	4
	Community latrine	5
11	Source of drinking water	
	Sanitary well	1
	Unsanitary well	2
	Tube well	3
	Tap water	4
	Water kiosk	5
	Packed water	6
	Other	7
12	Electrification of the house	
	Yes	1
	No	2
13	Type of cooking fuel mostly used	
	Fire wood	1
	Kerosene	2
	Biogas	3
	LPG	4
	Electricity	5
	Other	6
14	Separate kitchen	
	Présent	1
	Absent	2
	Menstrual Health	
15	Have you attained menarche?	
	Yes	1
	No	2
16	How old were you when you had your first period?	age
17	Do you have regular periods?	
	Yes	1
	No, they have never been regular	2
	No, they have been irregular for few months	3
18	What is the usual interval between your periods (from the first day of one period to the first day of the next) ?	
	Less than 21 days	1

	21-45 days	2
	More than 45 days	3
	Don't know	4
19	Average length of flow?	
	2 days	1
	3 to 8 days	2
	More than 8 days	3
	Don't know	4
20	Any history of passing clots or heavy bleeding during your menstrual cycle?	
	yes	1
	no	2
	Don't know	3
21	On an average how many pads do you use in each cycle?	
	KAP about anaemia	
22	Have you heard about anaemia? (less blood in the body)	
	Yes	1
	No	0
	Don't know (If answer is II or III, skip to next section)	0
23	Is anaemia a health problem?	
	Yes	1
	No	0
24	What do you understand by anaemia?	
	Decreased concentration of iron in blood	1
	Increased concentration of iron in blood	2
	Do not know	0
25	Causes of anaemia (check all that apply)	
	Decreased dietary iron intake	1
	Worm infestation	1
	Increased blood loss during menstrual cycle, bleeding gums, piles	1
	Increased demand not fulfilled during adolescence and pregnancy	1
	Repeated infections	1
	Trauma/Accident	1
	Do not know	0

26	Symptoms of anaemia (check all that apply)	
	Decreased appetite	1
	Fatigue	1
	Irritability	1
	Shortness of breath	1
	Pale skin color	1
	Oedema of the face and legs	1
	Do not know	0
27	Effects of anaemia (check all that apply)	
	Decreases growth and development	1
	Decreases learning abilities	1
	Decreases working capacity	1
	Any other, specify _____	1
	Do not know	0
28	How do you prevent anaemia? (Check all that apply)	
	Increasing dietary iron intake	1
	Avoiding post meal tea and coffee	1
	Consuming Vitamin C-rich fruits	1
	Periodic deworming	1
	Always wearing footwear	1
	Regular clipping of nails	1
	Any other, specify _____	1
	Do not know	0
29	How anaemia can be treated? (Check all that apply)	
	Dietary modifications	1
	Iron and folic acid supplements	1
	Iron injection	1
	Blood transfusion	1
	Do not know	0
	Practice by adolescents	
	Are Iron folic acid tablets given in school/ Anganwadi/ASHA?	
	Yes, if yes How often? _____times per month	1
	No	2
	Don't know (If the answer is b or c, skip to question no 4)	3
	Do you consume the Iron folic acid tablets given in school/ Anganwadi?	
	Yes, always	1
	Yes, sometimes	2
	No	0

	Where do you consume the tablets?	
	in school/ Anganwadi	1
	at home	2
	No	0
	Are deworming tablets given in your school/ Anganwadi/ASHA?	
	Yes, if yes How often? _____times per year	1
	No	2
	Don't know (If answer is b or c, skip to next section)	3
	Do you consume the deworming tablets?	
	Yes, always	1
	Yes, sometimes	2
	No	3
	Past 6 months, have you ever diagnosed with anaemia?	
	Yes	1
	No	2
	If yes, provide the treatment details	Nil, all are no
	Do you commonly (at least once a day) consume tea/coffee within an hour of food consumption (before or after)?	
	Yes	1
	No	2
	How often do you eat these foods	
37	Fried foods	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
38	Puff	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7

39	cake	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
40	Cold drinks	
	daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
41	Kurkure, lays	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
42	Biscuits, bread	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
43	sweets	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
	Are you able to carry out normal activity (could include sports in school also) ?	
	0-15 minutes, without any difficulty.	1

	15-30 minutes, without any difficulty.	2
	30-60 minutes, without any difficulty.	3
	> 60 minutes, without any difficulty.	4
	How do you grade your academic performance in school college	
	Excellent	1
	Above average	2
	Average	3
	Below average	4
	Very poor	5
	Anthropometric measurements	
	Height in cm	
	Weight in Kg	
	BMI	
	Hemoglobin level	
	Questionnaire for the managers of the family	
	CEREALS (Wheat, Rice)	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
	PULSES (Dehusked, Whole)	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
	GLVs (Spinach, Bathua, Fenugreek, Coriander)	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4

	Once in a month	5
	Rarely	6
	Never	7
	OTHER VEG	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
	MILK	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
	MILK PRODUCTS	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
	EGG	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
	MEAT	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7

	Daily	
	Alternate day	1
	Once in a week	2
	fortnightly	3
	Once in a month	4
	Rarely	5
	Never	6
		7
	FISH/SEA FOOD	
	daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
	FRUITS	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
	NUTS	
	Daily	1
	Alternate day	2
	Once in a week	3
	fortnightly	4
	Once in a month	5
	Rarely	6
	Never	7
	Do you use iodized salt while cooking?	
	Yes, exclusive	1
	Yes, but non-iodized is also used	2
	No	3
	Do you and your family members (all) wash hands with soap and water after defecation?	
	Yes	1
	No	2
	Do you and others in your family wash hands with soap and water before cooking?	
	Yes	1
	No	2

ANNEXURE IV – KEY TO MASTER CHART

SL NO	AGE	NUMBER OF YEARS COMPLETED SCHOOLING	PRESENTLY SCHOOLING STATUS	RELIGION	TYPE OF FAMILY	DO YOU HAVE A BPL CARD	NUMBER OF FAMILY MEMBERS	SOCIO ECONOMIC STATUS	EDU OF MOTHER	EDU OF FATHER	OCCU OF MOTHER	OCCU OF FATHER	TYPE OF HOUSE	OWNERSHIP OF HOUSE	SANITARY LATRINE	SOURCE OF DRINKING WATER	ELECTRIFICATION OF THE HOUSE	TYPE OF COOKING FUEL MOSTLY USED	SEPARATE KITCHEN	HAVE YOU ATTAINED MENARCHE	HOW OLD WERE YOU WHEN YOU HAD YOUR FIRST PERIOD	DO YOU HAVE REGULAR PERIOUDS	WHAT IS THE USUAL INTERVAL BETWEEN YOUR PERIOUDS	AVERAGE LENGTH OF FLOW	ANY HISTORY OF PASSING CLOTS OF HEAVY BLEEDING DURING YOUR MENSTURAL CYCLE	CYCLE	HAVE YOU HEARD ABOUT ANEMIA	IS ANEMIA A HEALTH PROBLEM	WHAT DO YOU UNDERSTAND BY ANEMIA	CAUSES OF ANEMIA	SYMPTOMS OF ANEMIA	EFFECTS OF ANEMIA	HOW DO YOU PREVENT ANEMIA	HOW ANEMIA CAN BE TREATED	ARE IRON FOLIC TABLETS GIVEN IN SCHOOL/ ANGANWADI/ASHA	DO YOU CONSUME THE IRON FOLIC TABLET	WHERE DO YOU CONSUME THE TABLET	ARE DEWORMING TABLET GIVEN IN YOUR SCHOOL/ANGANWADI/ASHA	DO YOU CONSUME THE DEWORMING TABLETS	PAST 6 MONTHS HAVE YOU EVER DIAGNOSED WITH ANEMIA	DO YOU COMMOMLY CONSUME TEA/COFFEE WITH AN HOUR OF FOOD CONSUMPTION	FRIED FOODS	PUFFS	CAKE	COLD DRINKS	KURKURE/LAYS	BISCUTS,BREADS	SWEETS	CEREALS	PULSES	GLV S	OTHER VEG	MILK	MILK PRODUCTS	EGG	MEAT	POULTRY	FISH/ SEA FOODS	FRUITS	NUTS	DO YOU USE IODIZED SALT WHILE COOKING	DO YOU AND YOUR FAMILY MEMBERS WASH HANDS WITH SOAP AND WATER AFTER DEEFECATION	DO YOU AND OTHERS IN YOUR FAMILY WASH HANDS WITH SOAP AND WATER BEFORE COOKING	ARE YOU ABLE TO CARRY OUT NORMAL ACTIVITIES	HOW DO YOU GRADE YOUR ACCADEMIC PERFOMANCE IN SCHOOL	HEIGHT (CM)	WEIGHT (KG)	BMI(KG/M2)	Hemoglobin Value	ANEMIA
1	2	2	1	1	1	1	4	5	1	3	1	2	2	1	1	3	1	4	1	1	16	1	2	2	2	2	0	0	0	0	0	0	0	0	1	2	0	1	2	2	2	1	3	5	3	1	1	1	1	1	1	1	7	7	3	7	7	3	1	4	2	1	1	4	1	141	48	24.14	9.1	1
2	2	2	1	1	1	1	6	5	1	2	1	2	2	1	1	3	1	2	1	1	14	1	2	2	2	3	0	0	0	0	0	0	0	0	1	2	0	3	2	2	2	1	3	3	5	3	1	1	1	1	1	1	7	7	1	7	3	7	2	1	1	1	1	4	3	144	48	23.15	11	1
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