

**FEASIBILITY AND ACCEPTABILITY OF NUTRITION EDUCATION
TOOLS TO PREVENT ANEMIA AMONG COLLEGE GOING GIRLS**



DISSERTATION

Submitted in the Partial Fulfilment of the Requirement for

The Award of the Degree of

MASTER'S PROGRAMME IN

CLINICAL NUTRITION AND DIETETICS

BY

MUHSINA Y

(Register No: SM23MCN008)

DEPARTMENT OF CLINICAL NUTRITION AND DIETETICS

ST. TERESA'S COLLEGE (AUTONOMOUS)

ERNAKULAM

APRIL 2025

CERTIFIED AS BONAFIDE RESEARCH WORK

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Signature of HOD

Signature of Guide

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Signature of Internal

DECLARATION

I hereby declare that the thesis entitled **“FEASIBILITY AND ACCEPTABILITY OF NUTRITION EDUCATION TOOLS TO PREVENT ANEMIA AMONG COLLEGE GOING GIRLS”** submitted in partial fulfilment of the requirement for the award of the Degree of **Master’s Programme in Clinical Nutrition and Dietetics** is a record of original research work done by me under the supervision and guidance of **Ms. Dr Abhina B**, Assistant Professor Department of Clinical Nutrition and Dietetics, Women’s Study Centre, St. Teresa’s College (Autonomous), Ernakulam and that the thesis has not previously formed on the basis for the award of any degree work has not been submitted in part or full or any other degree/diploma/fellowship or the similar titles to any candidate of any other University.

Place:

MUHSINAY

Date:

CERTIFICATE

I hereby certify that the dissertation entitled “**Feasibility and acceptability of nutrition education tools to prevent anemia among college going girls**” submitted in partial fulfilment of the requirement for the award of the Degree of Master’s Programme in Clinical Nutrition and Dietetics is a record of original research work done by **Ms. Muhsina Y** during the period of her study under my guidance and supervision.

Signature of HOD



Signature of Guide

Dr. Abhina B

Assistant Professor

Department of Clinical Nutrition and Dietetics

Women’s Study Centre

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ABSTRACT

Anemia is a major health problem worldwide. Preschool children, pregnant women, and adolescents are mostly affected. Anemia is the reduction in hemoglobin count, or it can be described as the reduction in the proportion of red blood cells. It commonly affects more than one-third of the global population. If anemia is left undiagnosed or untreated for an extended period, it can lead to organ failure and death. The cardiovascular system is commonly affected in chronic anemia. Iron deficiency anemia commonly affects most of the population. Worldwide, approximately 40% of children, 35% of all women, 51% of pregnant women, and 18% of men are anemic.

College-going girls are affected mainly by anemia due to nutrient deficiency and lifestyle factors. This study evaluates the Feasibility and acceptability of nutrition education tools to prevent anemia among college-going girls. A self-structured questionnaire was developed to assess the knowledge attitude and practices on anemia among 109 students. And the study revealed that only 53.2% have knowledge on anemia and have moderate attitude and mild practises. Data was collected and tabulated using MS Excel and analysed using IBM SPSS version 20.00, and are interpreted.

Results indicates that the participants respond positively towards the nutrition education programme.

INTRODUCTION

INTRODUCTION

Anemia is a significant global public health concern, particularly among young adults, with the WHO Globally, it is estimated that 40% of all children aged 6–59 months, 37% of pregnant women and 30% of women 15–49 years of age are affected by anaemia (WHO, 2024). College students, especially females, are highly susceptible to anemia due to inadequate dietary intake, poor nutritional knowledge, menstrual blood loss, and lifestyle factors such as irregular meal patterns and high consumption of processed foods (Kaur, 2020). Anemia not only impairs physical health but also adversely affects cognitive performance, academic achievements, and overall quality of life in this demographic (McLean et al., 2020).

In India, anemia is particularly prevalent, with studies indicating that nearly 50% of college-aged women are anemic (NFHS-5, 2021). Despite several national programs targeting anemia, such as the Anemia Mukh Bharat initiative, the awareness and implementation of preventive measures among college students remain limited (MoHFW, 2021). Addressing this issue necessitates innovative and accessible approaches that prioritize nutrition education tailored to the specific needs of young adults.

Anemia, particularly iron deficiency anemia (IDA), continues to be a pervasive health issue among college students, especially in developing countries like India. Despite being preventable, anemia remains a significant concern due to its adverse effects on academic performance, physical health, and cognitive development (WHO, 2021). College students, characterized by irregular eating habits, inadequate dietary diversity, and insufficient intake of iron-rich foods, are particularly vulnerable to anemia (Kaur, 2020).

Several public health initiatives, including India's Anemia Mukht Bharat program, have aimed to combat anemia through supplementation and dietary diversification. However, these interventions often fall short in addressing the specific lifestyle and dietary challenges faced by college students, highlighting the need for tailored strategies (MoHFW, 2021). One critical gap is the lack of effective nutrition education tools that are feasible, culturally appropriate, and acceptable to this demographic (Lemacks et al., 2019). Moreover, existing tools often fail to engage students effectively or address the socio-economic and cultural barriers influencing their dietary choices (Edelstein and Sharlin, 2020). This problem is particularly concerning in Kerala, where the prevalence of anemia among young adults is notable despite the state's relatively high literacy and health indices (NFHS-5, 2021). College students in Kerala face unique challenges, including high academic stress, reliance on cafeteria or hostel food, and limited awareness about anemia prevention.

Nutrition education has emerged as a pivotal strategy to combat anemia by improving dietary habits, raising awareness about nutrient-rich foods, and reducing knowledge gaps regarding the role of iron and enhancers of iron absorption (De-Regil et al., 2017). However, the effectiveness of nutrition education depends on its feasibility, cultural relevance, and acceptability among the target population (Lemacks et al., 2019). For college students, interactive and innovative tools such as mobile apps, gamified learning, and community-based interventions have shown promise in promoting dietary behaviour change (Edelstein & Sharlin, 2020).

Nutrition education tools have emerged as a promising strategy to combat anemia by empowering individuals with knowledge about balanced diets, iron-rich foods, and enhancers of iron absorption such as vitamin C (De-Regil et al., 2017). Tools like interactive workshops, mobile applications, gamification, and culturally adapted educational materials have demonstrated success in enhancing nutritional

knowledge and fostering behaviour change among young adults (Edelstein and Sharlin, 2020). However, the feasibility and acceptability of such tools among college students require careful evaluation to ensure their effectiveness and sustainability in real-world settings (Lemacks et al., 2019).

This study aims to assess the feasibility and acceptability of nutrition education tools designed to prevent anemia among college students in India. By focusing on a population at a critical stage of life, the research seeks to bridge gaps in awareness and encourage long-term dietary improvements. Insights from this study can guide the development of scalable interventions to reduce anemia prevalence and improve the health outcomes of college students.

The significance of this study lies in its focus on evaluating and implementing nutrition education tools tailored to the needs of college students. By assessing the feasibility and acceptability of these tools, the research aims to identify practical solutions to improve nutritional knowledge and practices. This is critical for preventing anemia and addressing its long-term impacts on health and productivity.

OBJECTIVES OF THE STUDY

- 1.To assess the knowledge, attitude and practice of college-going girls in anemia.
- 2.To develop nutrition education tools about anemia.
- 3.To assess the feasibility and acceptability of the developed tools.
- 4.To assess the impact of developed nutrition education tools.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

The purpose of this review of literature is to gain greater understanding about anemia. The following are the literatures reviewed for the work titled “Feasibility and acceptability of nutrition education tools to prevent anemia among college going girls”.

The review of literature is grouped under five sub headings.

2.1. Anemia

2.1.1. Anemia in different age groups

2.1.2. Anemia in college going girls

2.2. Nutrition education

2.2.1. Feasibility and acceptability study on nutrition education tools.

2.1 ANAEMIA

According to Vieth and Lane 2017 anemia is a condition marked by a lower count of red blood cells, also known as erythrocytes, in the blood. It can also be described as having lower haemoglobin levels or RBC mass compared to healthy individuals of the same age. In laboratory tests, the normal value is a statistical term that indicates the range in which 95% of the population's values are found. The World Health Organization defines anemia as having a haemoglobin level below 13 g/dL for adult men and below 12 g/dL for non-pregnant adult women.

The World Health Assembly selected six global nutrition targets (GNTs) in 2012 to serve as important indicators of maternal and child health. These targets focus on low birth weight, exclusive breastfeeding, child growth issues (such as wasting, stunting, and overweight), and anemia in women of reproductive age. However, a thorough report assessing progress from 2012 to 2021 has been

lacking. Our goal was to analyse the levels, trends, and the actual versus expected progress in prevalence and related burdens from 2012 to 2021, along with prevalence forecasts up to 2050, across 204 countries and territories (Arndt et al., 2024)

A study by Yadav et al., 2024 highlights that anemia is a major public health issue worldwide, impacting 1.62 billion people. According to the Global Burden of Disease 2017, approximately 45% of the population in India suffers from anemia. Iron deficiency is a leading cause of this condition, with 50% of anemia cases potentially improved through iron supplementation. However, in preschool children, iron deficiency accounts for only about 25% of all anemia cases. The Comprehensive National Nutrition Survey (CNNS) conducted in 2018 is the largest nutrition assessment in India for individuals aged 0 to 19 years, providing valuable data on both micronutrient and macronutrient status. The CNNS offers insights into micronutrient deficiencies and the various factors linked to anemia.

Anemia can happen because of a lack of nutrients like iron, folate, or vitamin B12. Additionally, about one-third of anemia cases are caused by chronic diseases (Domenica Cappellini & Motta, 2015).

Chaparro and Suchdev, (2019) defined anemia as having fewer red blood cells (RBCs) than normal or having insufficient RBCs to meet the body's oxygen needs. It is usually diagnosed through low haemoglobin (Hb) levels or low haematocrit, but can also be assessed by RBC count, mean corpuscular volume, reticulocyte count, blood film analysis, or Hb electrophoresis. Measuring Hb concentration is the most common method for diagnosing anemia in both population studies and clinical settings. The key role of Hb in oxygen transport leads to common anemia symptoms like fatigue, shortness of breath, rapid heart rate, and palpitations.

According to Camaschella et al., 2015 iron deficiency anemia is a prevalent health issue encountered in daily medical practice. This condition impacts over 2 billion individuals globally and is recognized as the leading cause of anemia. This conclusion is supported by an analysis of numerous reports on disease burden from 187 countries between 1990 and 2010. In developing nations, iron deficiency and iron-deficiency anemia often stem from inadequate dietary intake, blood loss due to intestinal worm infections, or a combination of both (Camaschella et al., 2015).

Natekar et al., 2022, shows that anemia significantly impacts health, particularly in rural areas of developing countries. The main cause of iron deficiency anemia in these regions is a lack of dietary iron. Conditions like gastroenteritis or malabsorption can further hinder iron absorption. Prolonged blood loss from the genitourinary, reproductive, or gastrointestinal systems is the most common cause. Menstruating women and pregnant mothers have a high iron demand. Postpartum iron deficiency anemia affects both mothers and infants during pregnancy and early life. In many tropical areas, malaria contributes to anemia by disrupting iron metabolism, leading to the loss of erythrocyte iron through urine. (Natekar et al., 2022)

According to Sarna et al., 2020, Iron deficiency anemia is the most prevalent type of anemia in young children, while other types of anemia are more common in children aged 5 to 9 and adolescents. Anemia caused by a lack of folate or vitamin B12 makes up over one-third of all anemia cases. To prevent anemia, it is important to enhance current iron and folate supplementation programs and to address the prevention of folate or vitamin B12 deficiency anemia.

2.1.1. ANEMIA IN DIFFERENT AGE GROUPS

According to Stauder et al., 2018, Anemia is common in older adults, affecting about 17% of people over 65. Many studies link anemia to important health issues. Low haemoglobin (Hb) levels can increase the risk of heart disease, cognitive decline, sleep problems, mood issues, and limitations in daily activities. Additionally, anemia can lead to poorer executive function and physical ability. Low Hb levels also raise the chances of falls and fractures. Furthermore, having anemia is connected to more hospital visits and longer stays in the hospital (Stauder et al., 2018).

A study conducted by Gupta revealed that iron deficiency (ID) is the most prevalent nutritional deficiency globally, particularly affecting infants and young children who are most at risk. Iron deficiency greatly heightens the chances of developmental delays and behavioural issues in young children. Additionally, it can lead to iron deficiency anemia (IDA) (Gupta et al., 2016).

According to Salive et al., 1992, older adults have different blood values compared to younger people. These studies often found that older individuals are more likely to have anemia. Some research indicated that average haemoglobin (Hgb) levels decrease with age in older adults, while other studies did not find this trend. Hemoglobin levels were linked to various factors, including race, body mass index, and issues with serum creatinine and albumin. This study, which included 3,946 people aged 71 and older from three communities, offers valuable insights into how anemia relates to hemoglobin levels, age, and health in older adults, highlighting that anemia tends to increase with age.

Nah et al., 2020, found that normal hemoglobin (Hb) levels can vary due to factors such as age, gender, lifestyle, ethnicity, and socioeconomic status. A study was done to look at hemoglobin levels and anemia rates based on sex, age, and region in 13 cities in Korea. It involved data from 1,159,298 people who had

health checkups at 16 health-promotion centres in 2018. In males, Hb levels steadily decreased with age. For females, levels dropped from ages 15-29 to 40-49, then rose for those aged 50-59, and fell again for those 70 and older. The highest anemia rates were found in people aged 80 and above, with males showing a higher rate (20.14%) compared to females (18.02%). The study revealed that Hb levels and anemia rates varied by sex, age group, and region across Korea. Overall, 6.0% of people had anemia (2.98% in males and 8.56% in females), with severe anemia affecting 0.92% (0.23% in males and 1.51% in females) (Nah et al., 2020).

According to Halawi et al., 2017, found that anemia is more prevalent among older adults, primarily because they tend to face various health problems as they age, often dealing with multiple conditions. Over 80% of anemias are normocytic, and most cases are mild. In the elderly, anemia is frequent and linked to a decrease in ability to function and higher rates of illness and death.

Mawani and Aziz Ali, 2016 highlights that iron deficiency anemia is a significant public health issue for women of reproductive age in developing countries. Various factors, including age, number of children, socioeconomic status, and diet, influence the iron levels in these women. Anemia can result in several negative consequences, but timely and cost-effective interventions can help prevent them (Mawani & Aziz Ali, 2016)

2.1.2. ANEMIA IN COLLEGE GOING GIRLS

Jamali et al., 2016, found that anaemia is the most significant public health issue affecting school-age children. World Health Organization estimates two billion people suffer from anemia in the world. Besides pregnant women, children (both preschool and school-age) are the most affected group by ID because of their quick growth and general cognitive development. Anaemia has a wide range of

adverse results involving poor cognitive performance, poor development of infants, preschool, and school-aged children, impairment of physical capacity, work performance of adolescents and adults, reduction in immune competence, and increased morbidity from infections in all age groups.

Rahman et al., 2024, conducted a cross-sectional study that took place in two secondary schools in Chandpur, Bangladesh, from January to April 2022. He randomly selected 422 adolescent girls and conducted interviews using a semi-structured questionnaire after obtaining ethical approval and written consent. Additionally, he performed physical examinations and anthropometric measurements, followed by blood tests to check for anemia. Blood haemoglobin levels were assessed using a spectrophotometric method, with quality control maintained through validated results and control samples. The overall anemia prevalence was found to be 37.7%. Anemia among adolescent girls in rural Bangladesh remains high, often linked to undernutrition. Factors such as having working mothers, using slab latrines, and irregular lunch consumption were associated with anemia in this group. Therefore, it is recommended that policymakers implement school-based nutritional education and lunch programs that include iron supplementation, as well as enhance sanitary facilities. (Rahman et al., 2024).

According to Garg et., al 2025, a cross-sectional observational study conducted in both government and private schools in Agra in 2023. It focused on teenage girls from 6th to 12th grades. A pre-tested semi-structured questionnaire was used to gather data on dietary habits, deworming practices, and sociodemographic information. Anthropometric measurements and general health examinations were also conducted. The study aimed to determine the prevalence of anemia among school-going adolescent girls in urban Uttar Pradesh. The findings revealed a very high anemia prevalence of 95.02%, with severe anemia affecting 8.42% of the participants. Implementing school-based interventions is crucial to

address the high rates of anemia in both urban and rural areas. There is an urgent need for programs that provide iron and folic acid supplements, deworming initiatives, and similar health camps for adolescents. A targeted set of policies and interventions could significantly lower the rates of anemia among adolescent girls (Garg et al., 2025)

To assess the anemia in adolescent girls (Manisha Nitin Gore et al., 2024) conducted a research study having a group of 400 girls was chosen from 22 villages by Symbiosis International University. Standard methods were used to measure height, weight, and BMI-for-age. The socioeconomic status was assessed using the Kuppuswamy scale. The results showed an overall anemia rate of 42.75%, which included severe cases (2.5%), moderate cases (21%), and mild cases (20.25%). Furthermore, a significant number of girls (74.6%) were found to be underweight. The socioeconomic analysis indicated that 64.25% of the families were in the lower middle class, while 27% were in the upper lower class. Anemia was more common among young adolescent girls aged 10-14 and in families with low income, illiteracy, unemployment, and those classified as lower-middle class or upper-lower class in terms of socioeconomic status (SES). (Manisha Nitin Gore et al., 2024)

Pareek, 2015 conducted a random selection of one hundred college girls from a junior college in Hyderabad to assess their nutritional status and understanding of anemia. A structured questionnaire was created to gather information on their demographics and eating habits, using a Food Frequency Questionnaire (FFQ) for food intake data. Knowledge about anemia was measured with a pretested questionnaire. The height and weight of the participants were recorded using standard methods, and the data was analysed with appropriate statistical techniques. More than half of the participants were aged 14-16 years, 87% lived in nuclear families, most were non-vegetarian, and they belonged to the middle-income group. In terms of anemia knowledge, only 25% had good knowledge,

36% had fair knowledge, while the rest had poor knowledge. Many girls were not fully aware of their increased nutritional needs for growth, leading to issues like being underweight and shorter than average. Educating girls in schools and colleges about the importance of healthy meals and good health could help reduce anemia rates in less developed areas.

A research study was carried out by Kumar et al., 2018, highlights that anemia is more prevalent in developing nations due to issues such as poverty, inadequate nutrition, specific health conditions, pregnancy, and restricted healthcare access. The study targeted adolescent girls between the ages of 12 and 18 from schools in Jorhat, with permission from their parents. Researchers used a prepared form to gather information on demographics, medical history, and dietary habits. They recorded height, weight, and hemoglobin levels. The data was analysed to determine the prevalence and severity of anemia and iron deficiency among these girls. For those with hemoglobin levels below 12g/dl, a peripheral blood smear (PBS) test was done. Serum Iron and Total Iron Binding Capacity (TIBC) tests were conducted for those showing signs of iron deficiency anemia. Research indicated that improving female education and literacy can enhance nutrition and encourage women to seek regular healthcare. Various strategies exist for dietary changes, focusing on increasing iron intake or absorption, such as including haem iron and vitamin C-rich fruits in the diet, or reducing substances that inhibit absorption like phytates and tannins to enhance iron bioavailability (Kumar et al., 2018).

Jamali et al., 2016 conducted a study in District Shaheed Benazirabad. The district was divided into four areas: Sakrand, Nawabshah, Kazi Ahmed, and Daur, to gather data. The aim was to assess the rate of anemia among school and college-aged children in relation to their socio-economic status, age, education, and diet. Students aged 11 to 18 years were chosen from various government high schools and colleges. A questionnaire was created to collect information on

education, social class, age, gender, and eating habits. A total of 1,686 students participated, with 946 males (56.1%) and 740 females (40.3%). The questionnaire included clinical observations to check for anemia in the district. Blood samples were also taken for further testing after clinical evaluations. The study found that anemia affected 43.1% of the students, with a higher prevalence (27.8%) in rural areas. Female students had a higher prevalence of anemia at 30.4%, while male students had 12.7%. Most anemic students (30.2%) came from lower-income families (Jamali et al., 2016).

Kaur, 2021, focused on the nutritional status of 105 college girls aged 18-24 in Haryana. Data was collected through direct interviews using a pretested questionnaire that covered general, specific, and dietary information. The girls were assessed for hemoglobin levels and measured for height, weight, and BMI. The findings indicated that poor eating habits were the primary cause of malnutrition among these college girls, posing a significant health issue. Since this age is crucial for growth and development, it is important to provide nutrition education on balanced diets, food groups, meal patterns, and meal spacing. They should also be informed about iron-rich foods like green leafy vegetables, meat, and jaggery, as well as factors that affect iron absorption. Encouraging the use of iron utensils and promoting regular health checkups, particularly blood tests, in colleges can lead to better health outcomes (Kaur, 2021).

2.2. NUTRITION EDUCATION

Nutrition education helps lower the rates of specific diseases, such as anemia, in various countries across Europe, North America, Asia, and Australia. Thus, it is essential to provide nutritional advice and establish nutrition education programs. Given the significant influence of schools in shaping knowledge, introducing a

nutrition education program in schools is recommended as an effective way to enhance nutritional awareness (Khani Jeihooni et al., 2021).

According to Jalambo, understanding nutrition is crucial for people to develop a healthy, disease-free lifestyle. After an intervention, undergraduate students showed better practices regarding healthy eating. Enhancing the nutrition attitudes, knowledge, and habits of adolescents and young adults is vital for fostering a more food-aware society and promoting healthier individuals. Additionally, a study in Malaysia highlighted the need for thorough and ongoing nutritional education to equip schoolchildren with the knowledge and skills necessary for adopting healthy eating behaviours (Jalambo et al., 2017).

Kamalaja et al., 2018, highlighted that health and nutrition education serves as a means to encourage positive behaviour changes aimed at enhancing people's nutritional well-being. This approach is cost-effective and highly effective, with available health services addressing many prevalent diseases in developing nations. By offering individuals the necessary information and motivation, health and nutrition education empowers them to make informed choices for better health.

Abu-Baker et al., 2021 found that school nutrition education effectively enhances adolescents' knowledge, attitudes, and practices to prevent anemia. Additionally, this type of education is sustainable as it fosters better nutritional health (Abu-Baker et al., 2021).

Sunuwar et al., 2019, in his study evaluated the impacts of nutritional knowledge, hemoglobin levels, and dietary habits of anemic pregnant women. Pregnant women were enrolled and divided into two groups: one group (n = 58) received nutrition education and a diet plan, while the other group (n = 57) received only general education. The nutrition education was provided individually at enrolment, with follow-ups conducted through phone calls every two weeks and

during antenatal care visits every four weeks. Initial data were gathered using a semi-structured questionnaire, and haemoglobin levels were measured. Data collection occurred after 10 weeks of the nutrition education program. An independent sample t-test was used to analyse the differences between the two groups. After the program, the intervention group showed a significant increase in haemoglobin levels compared to the control group. The provision of nutrition education and an iron-rich diet was strongly linked to better haemoglobin levels, improved dietary intake, and enhanced knowledge about anemia and iron-rich foods (Sunwar et al., 2019)

Febrianti et al., 2023, research study aimed to find out how effective nutrition education is in improving knowledge about anemia and hemoglobin levels in girls aged 12 to 19. The PAKEM program, which stands for Active, Creative, Effective, and Fun Learning, positively influenced the knowledge of adolescents about anemia. This method of nutrition education helped girls understand more about anemia and the use of iron tablets. However, it did not lead to changes in hemoglobin levels.

Abu-Baker et al., 2021, quasi-experimental design was used in four government schools in Irbid, northern Jordan, under the Ministry of Education. This study looked at how common iron deficiency anemia (IDA) is among female adolescents. The schools are large, with space for 700 to 900 students. The study focused on female students in grades 8 to 10 in northern Jordan. Researchers created a structured questionnaire with two parts. The first part gathered demographic and menstrual information, including age, parents' education, family income, and menstruation status. The second part was the Knowledge, Attitude, and Practice (KAP) questionnaire from the Food and Agriculture Organization of the United Nations. The intervention was designed for the study and included four sessions with lectures, videos, and brochures, each lasting about 45 minutes. The lectures were based on WHO guidelines titled “Nutrition

anemia: Tools for effective prevention and control.” More efforts are needed to raise awareness among adolescents to improve their health now and in the future. Health care professionals should be informed about this issue in this age group and supported to assess, intervene, and regularly monitor the problem, especially in schools.

Rokade et al., 2024 conducted a study to explore knowledge about anaemia and evaluate the dietary habits regarding iron-rich food consumption among adolescents aged 14 to 17 years in public schools of Mulshi Taluka, Pune District. Data were gathered from public schools using a structured questionnaire that had been pretested, with information collected through individual interviews. A total of 285 responses were received. The findings indicated that over half of the adolescents (59.6%) were aware of anaemia, but only a smaller portion (45.6%) viewed it as a health issue. A mere 13% of the adolescents reported taking Iron-folic Acid (IFA) tablets in the past year, while a larger group (70.2%) had taken deworming tablets in the last six months. Daily consumption of roti or rice was reported by 90.2% of the participants, with 54.7% consuming pulses and 73.7% eating Dark Green Leafy Vegetables (DGLV) weekly. Fruits were mainly eaten weekly (46%) or occasionally (39.6%), while fried foods and soft drinks were consumed regularly. The study underscored a lack of knowledge about anaemia and highlighted poor dietary practices among adolescents. Therefore, there is a need for comprehensive initiatives to address these knowledge gaps, enhance dietary habits, and improve program implementation to promote the overall health and well-being of adolescents.

2.2.1. FEASIBILITY AND ACCEPTABILITY STUDY ON NUTRITION EDUCATION TOOLS

Zuair, 2025A conducted a study to examine how common iron deficiency anemia (IDA) is, to see how a simple educational program affects students' knowledge, attitudes, and practices (KAP) regarding IDA, and to create a logic model for

future school health initiatives. Researchers used a pre-post design to assess a two-session educational program (45 minutes each) led by community health nurses at a public secondary school. The program aimed to enhance understanding of IDA, encourage healthy eating habits, and correct misunderstandings found in a needs assessment. Among the 153 participants, 29.4% (45 out of 153) reported having IDA. The program significantly boosted knowledge and practices among students with IDA, but there were no notable changes in attitudes. Additionally, the study created a logic model to support future school-based health programs for IDA. Overall, the educational intervention effectively improved knowledge and practices related to IDA, but attitudes did not change

To evaluate Kale & Gawade, 2024, effectiveness of dietary counselling on the improvement of haemoglobin (HB) levels among adolescent girls. To assess the HB level among adolescent girls at selected schools of Loni, to evaluate the effectiveness of dietary counselling on HB improvement and to determine the association between the post-test HB with their selected demographic variables. A quasi experimental pre- and post-test study was conducted on 200 adolescent girls aged 10–14 years from the selected school of Loni village. HB levels were assessed pre- and post-counselling using Sahil's method. Participants received 3 months of dietary counselling. Statistical analysis involved descriptive and inferential methods. The study finding shows that dietary counselling was effective in improving the HB level. Nutrition education programs led to notable enhancements in the nutritional well-being and HB levels among adolescents (Kale & Gawade, 2024).

According to Afreen et., al 2023, school-based pre-post quasi-experimental study was carried out to conduct a nutrition education intervention and assess its efficacy among adolescent females aged 10 to 19. The study area, Lucknow, a northern Indian state of Uttar Pradesh, A Knowledge Assessment Questionnaire

consisting of 21 multiple-choice questions was administered to 472 respondents before and after exposure to the educational documentary among experimental group EG. The number of respondents having "inadequate" knowledge decreased from 130 to 79 in EG, while the number of respondents having "adequate" knowledge increased from 34 to 86 post-intervention with a self-designed documentary, respondents showed improved scores. Malnutrition and low nutrition literacy prevail in India. Nutritional literacy needs to be improved, and nutrition education interventions are an effective method. More efforts should be made to make nutritional information available to adolescents, particularly at the school level, to improve their eating habits and health status. These findings have vital messages for the education system and curriculum designers to have more consideration for food and nutrition-related knowledge and skills in schools. It also emphasizes implementing customized and targeted nutrition education programs for adolescent girls (Afreen et al., 2023)

Salam et al., 2023 carried out a study in three government schools in the Karnataka, India. The aim was to investigate how school nutrition messages can influence adolescents' awareness of anaemia and its prevention. Teachers and nutrition experts worked together to create an educational program using local materials, which included lectures, role plays, and hands-on demonstrations. Over seven weeks, school teachers conducted seven half-hour sessions for 455 students. Tests before and after the program assessed changes in the students' knowledge about anaemia. The results showed that educational programs led by teachers in schools effectively enhance adolescents' awareness and attitudes towards anaemia and its prevention.

Kamalaja et al., 2018 conducted a study aimed to find a community-based nutrition education program to enhance the iron levels in adolescent girls. A total of 300 girls aged 13-17 years, with hemoglobin levels below 12 mg/100 ml and who regularly attended school, were selected from four villages in Moinabad

mandal, Rajendranagar district, Telangana, India. The participants were divided into two groups: a control group of 150 and an experimental group of 150. The girls were assessed for clinical signs of nutrient deficiencies, including those related to protein, iron, calcium, vitamin C, B vitamins, energy, and vitamin A. Their height and weight were measured to evaluate their nutritional status using Body Mass Index (BMI). After the nutrition education intervention, the number of subjects with severe and moderate hemoglobin levels decreased. Additionally, all participants in the experimental group improved their understanding of anemia and its prevention.

Rakesh et al., 2019 done a research study to estimate the prevalence of anemia among school-going children in Ernakulam district and to determine a few factors like age, gender, type of school and food habits associated with anemia. Children studying in schools from VIth to IXth standard in Ernakulam district. 880 children participated in the study. Among them 0.8% had severe anemia, 3.5% had moderate anemia and 39.7% had mild anemia. the prevalence of anemia among school-going children in Ernakulam district was found to be 44%. Anemia was more common among females and in the age group of 12–15 years.

Varghese et al., 2022 conducted a study in various states of India among college students and published between the years January 2000 to December 2021 were included. Analysis of reported studies shows a high prevalence of anemia among college students and more among female students. The subjects of most of the conducted studies were medical students. It is essential to conduct studies among college students to give them not only awareness but also warn them about health hazards and consequences affecting their day-to-day lives (Varghese et al., 2022).

A qualitative phenomenological study was conducted to investigate how acceptable and feasible video-based health education is for pregnant and breastfeeding women, as well as to identify the barriers and facilitators involved. The study focused on a video health education program designed to enhance

community care for pregnant women, mothers, and infants in the Dira she District of Ethiopia. The videos covered nine key themes related to health, nutrition, and hygiene for mothers and infants. Overall, the video-based health education was found to be both acceptable and feasible. The messages were clear, easy to understand, culturally appropriate, and relevant to the mothers' needs. However, feasibility was impacted by the nature of the work, insufficient support, and the overlapping responsibilities of health extension workers (HEWs). To enhance the intervention, it was recommended to establish a common location for video screenings, involve husbands, and engage HEWs more actively (Godana Boynito et al., 2023).

This study was done by Wiafe et., al 2023, to evaluate how nutrition education affects young adolescents' understanding of iron and their consumption of iron-rich foods in rural Ghana. Researchers used a 24-hour dietary recall questionnaire to gather information on food intake. A total of 137 adolescents took part, with a higher percentage of males (62.3%) in the intervention group and more females (60.3%) in the control group. Most participants (70.1%) had completed primary school, and a significant number of guardians (77.9%) also had formal education. A nutrition education program was created for both participants and their guardians in the intervention group. This program, led by dieticians and nutritionists, lasted six months and included group discussions, leaflets, charts, and posters. Data collection after the intervention occurred six months later. The results indicated that nutrition education significantly enhanced the participants' knowledge about anemia, its causes, consequences, iron-rich foods, and factors that enhance or inhibit iron absorption, compared to the control group, except regarding anemia prevention. After the intervention, most participants in the intervention group showed better food intake status than those in the control group. This study supports previous findings that nutrition education can improve adolescents' nutritional knowledge. It is recommended that nutritionists and

dieticians be involved in conducting nutrition and dietetic research interventions (Wiafe et al., 2023).

This study reveals about how much feasible the nutritional education intervention tool is. Sasmita et., al 2022, research is an interventional study conducted with school children selected intentionally from Kendriye Vidyalaya, No. 2 in Belgaum district, India. The study took place from March 2013 to February 2014, involving 57 students from grade V and 58 students from grade VI, totalling 115 participants who completed both pre-tests and post-tests. To evaluate their socio-demographic information and their knowledge, attitudes, and practices regarding anemia, pre-tested, structured, and self-administered questionnaires were utilized. The questionnaire contained 40 questions: 22 focused on knowledge, nine on attitudes, and nine on practices. A pilot study was conducted with 10% of the total sample size, leading to necessary adjustments. The findings indicate that the nutritional education intervention significantly enhanced knowledge, fostered a positive attitude, and encouraged healthy practices related to anemia after the intervention. Initially, knowledge about anemia was low, despite it being a common issue among adolescents. However, post-intervention, there was a notable increase in knowledge by 50% and in attitude by 20%. Thus, the study concludes that nutritional education interventions are a cost-effective and sustainable approach that can be integrated into school curricula to broaden the program's impact. This proven nutritional education intervention during the formative years of school children not only improves their knowledge and fosters a positive attitude but also supports the maintenance of healthy practices (Sasmita et al., 2022).

To show the relevance of acceptability and the feasibility of nutrition education tools Bhandari & Banjara, 2015 conducted a similar study that reveals the relevance of nutrition education tool. This study reveals that various forms of Micronutrient Deficiencies (MNDs) are more common in Nepal. The primary

factors contributing to MNDs include inadequate nutrition, illnesses and infestations, as well as insufficient healthcare practices. The consequences of MNDs include increased child and maternal mortality, diminished quality of life, and a decline in productivity and cognitive abilities. Schools serve as the initial environment for learning about the benefits of proper nutrition. The key benefit of school-based nutrition education is its ability to promote lasting behaviour change. When the intended audience is engaged and the educational program is effectively planned and executed, the likelihood of success increases significantly (Bhandari & Banjara, 2015)

These studies show that offering nutritional education about anemia has greatly benefited college girls and children. By using the right iron supplements, maintaining a balanced diet, eating healthy foods, and ensuring they receive all necessary nutrients, individuals can successfully combat anemia. This education gives them the knowledge to make better dietary decisions that enhance their overall health and well-being.

METHODOLOGY

METHODOLOGY

3.1 LOCALITY OF STUDY

3.2 SAMPLE

3.3 ASSESSMENT TOOL

3.4 PILOT STUDY

3.5 DATA COLLECTION

3.6 DEVELOPMENT OF NUTRITION EDUCATION TOOL

3.7 FEASIBILITY AND ACCEPTABILITY OF NUTRITION EDUCATION TOOL

3.8 IMPACT OF TOOLS

3.9 STATISTICAL ANALYSIS

3.1 LOCALITY OF STUDY

The area selected for the study was kollam.

3.2 SAMPLE

The samples were collected from college-going girls aged between 18 and 25. 109 students were selected for the study.

3.3 ASSESSMENT TOOL

A standardized questionnaire was created to evaluate the subject's understanding of iron deficiency anemia. A survey was carried out to collect the essential data for the study, featuring both multiple-choice and open-ended questions. The multiple-choice questions were structured to provide quantifiable data, allowing for easy analysis of the respondent's knowledge levels. In contrast, the open-ended questions were designed to encourage participants to express their thoughts and insights in their own words. This format allowed for a deeper exploration of individual perspectives and experiences related to iron deficiency anemia. By analysing the responses, the study sought to identify gaps in knowledge, common

misconceptions, and areas where further education might be beneficial. Ultimately, the findings from this survey could inform future educational initiatives aimed at improving awareness and understanding of iron deficiency anemia among the target population.

The scoring was done to assess the knowledge, aptitude, and practice. A standard approach is to use 2 for "yes" and 1 for "no." A hierarchical coding system is usually applied for questions with multiple choices, assigning values in decreasing order. High score for must positively answer.

3.4 PILOT STUDY

A pilot study was conducted to evaluate the significance and relevance of the research in question. The pilot study aimed to establish a standardized version of the questionnaire. This initial phase involved a small group of 15 participants whose primary role was assessing the effectiveness and appropriateness of the research methods.

3.5 DATA COLLECTION

Informed consent was collected from the subjects. The questionnaire was structured to facilitate ease of understanding and completion, incorporating a range of question types, including multiple-choice and close-ended questions. In addition to the primary questions within the questionnaire, supplementary demographic information was also acquired from participants. This included essential details such as their name, age, and educational background. Collecting this demographic data was crucial for contextualizing the responses and analysing potential correlations between participant characteristics and their knowledge, attitudes, and practices. The questionnaire itself encompassed a variety of inquiries related explicitly to the participant's knowledge, attitudes, and practices concerning the subject matter of the study. Questions were designed to assess the

level of understanding participants had about the topic, their beliefs and feelings towards it, and the behaviours they exhibited about it.

3.5.1 DEMOGRAPHIC INFORMATION

Data regarding gender, age, and educational qualifications were obtained through the standardized questionnaire designed to gather comprehensive demographic information from participants. The questionnaire included specific sections to provide details about their gender identity, age range, and the highest level of education they have completed. This demographic information is crucial for understanding the context of the study and for analysing how these factors may influence the outcomes being investigated.

3.5.2 NUTRIENT SUPPLEMENTS

A Nutritional supplement is taken for many specific purposes: to ensure micronutrient adequacy, to compensate for some increase in need or defective handling of a nutrient or metabolite, to prevent or treat illness, either to alleviate or reverse existing conditions or to reduce the long-term risk of developing a chronic disease (Webb, 2007). These supplements enhance overall nutritional intake and support health and well-being. The primary dietary cause of anemia is iron deficiency; however, folate, vitamin B12, and vitamin A deficiencies contribute significantly to this condition. Anaemia represents a critical public health concern globally, particularly affecting vulnerable populations such as young children, menstruating adolescent girls, women, and individuals who are pregnant or have recently given birth. The questionnaire encompasses inquiries about the consumption of any supplements, including iron and folic acid (IFA) tablets, vitamin C, and vitamin B12, as well as dietary sources such as leafy greens, fiber-rich foods, and sprouted grains.

The Knowledge, Attitudes, and Practices (KAP) surrounding anemia is essential for creating effective prevention and management plans. It allows us to pinpoint

areas where knowledge is lacking, correct misunderstandings, and encourage beneficial behaviours for preventing and treating anemia.

3.6 DEVELOPMENT OF NUTRITION EDUCATION TOOL

A comprehensive nutrition education resource was created, consisting of two key components: a video presentation and a flip book. The video presentation serves as an interactive visual medium designed to captivate the audience's attention while delivering essential nutritional information in an accessible and engaging format. By utilizing dynamic visuals, animations, and clear narration, the video not only conveys important concepts but also encourages viewer participation, making the learning process more enjoyable and memorable. In addition to the video, the flip book provides a tangible resource that is useful in the future. This physical format allows individuals to engage with the material at their own pace, facilitating a deeper understanding of the topics covered.

3.7 FEASIBILITY AND ACCEPTABILITY OF NUTRITION EDUCATION TOOL

The feasibility of the tools was thoroughly examined to assess their effectiveness and practicality in engaging the target audience. This evaluation process was comprehensive and multifaceted, involving a detailed analysis of various factors that contribute to audience engagement. A diverse group of participants was selected to ensure a representative sample of whole to target the audience. These participants were then exposed to both video presentations and flipbooks, two distinct formats designed to convey information in engaging ways. The evaluation included not only qualitative feedback but also quantitative measures. Surveys were conducted to capture their experiences, focusing on aspects such as clarity of information, ease of use, visual appeal, and overall enjoyment. By thoroughly assessing the effectiveness of video presentations versus flip books,

the evaluation sought to identify the most impactful method for engaging the intended audience and achieving the desired educational outcomes.

Research indicates that providing nutritional education regarding anemia has significantly aided college-aged females and children. Nutrition education has been shown to improve nutrition knowledge, attitudes, and practices of adolescents' healthy eating in different countries. Implementing nutrition education alone improved the weight of pregnant women and reduced low birth weight. However, researchers further commented that nutrition education might not immediately improve the nutritional status and hemoglobin (HB) levels of adolescents (Wiafe et al., 2023). This educational initiative equips them with the knowledge to make informed dietary choices that improve their health and well-being.

3.8 IMPACT OF TOOLS

The questionnaire to assess the effectiveness and functionality of the tools in question. This comprehensive survey was designed to gather detailed user feedback regarding their experiences, satisfaction levels, and any challenges they encountered while utilizing the tools.

3.9 STATISTICAL ANALYSIS

Statistical analysis is a systematic approach to collecting, organizing, and interpreting data to uncover meaningful patterns and trends that can inform decision-making and enhance understanding of various phenomena. This process involves a series of steps, including data collection, data cleaning, exploratory data analysis, and the application of statistical models to conclude. In the context of coding for statistical analysis, specific numerical representations are often used to facilitate data interpretation

The age and demographic information were converted into percentage values, while scores reflecting nutritional knowledge were assigned. To analyse the

differences in nutritional knowledge among college girls, a paired t-test was conducted to compare their scores before and after the intervention.

Statistical analysis was done using IBM SPSS 20. (SPSS Inc, Chicago, USA). Internal consistency was examined, the homogeneity of the question items in each domain was evaluated using Cronbach's α coefficient. A coefficient of 0.7 or higher is preferred for a questionnaire to be internally consistent. For all the continuous variables, the results are given in Mean $\pm$ SD, and for categorical variables as number and percentage. To compare the Pre and post KAP total scores, paired t test was applied. A p-value ≤ 0.05 was considered as statistically significant.

RESULT AND DISCUSSION

RESULT AND DISCUSSION

4.1. PRELIMINARY ASSESSMENT

4.2. PILOT STUDY

4.3. FEASIBILITY AND ACCEPTABILITY OF NUTRITION EDUCATION TOOLS

4.4. IMPACT OF NUTRITION EDUCATION TOOLS

4.1. Preliminary assessment

In order to study the impact of nutrition education tools developed knowledge, attitude and practice of college girls on anemia was assessed using a pre tested questionnaire. And the results are furnished below.

4.1.1. Demographic Profile

Demographic characteristics of 109 college going girls with reference to age group and education qualification were assessed.

4.1.1.1. Age of respondents

Table 1 reveals that, the sample's respondents are 18 to 25 years old. With age 22 being the most prevalent and accounting for 29.35% of the total, the majority of responders are concentrated in their early twenties. Age 23 comes in second, making up 23.85%. With 12.8% of the respondents, the age 21 and 24 are equally represented. Age 19 accounts for 7.3% of the total and age 25 for 6.4%. At 3.6% of the sample, 18 and 20 are the least represented ages.

4.1.1.2. Education status of respondents

Table 2 reveals that; the distribution of respondents by educational level specifically, whether they are pursuing undergraduate (UG) or postgraduate (PG) studies is displayed in the table. 65 people (59.6%) of the total respondents, are enrolled in postgraduate programs. 44 respondents (40.4%) are in undergraduate programs. A larger percentage of the sample is made up of postgraduate students.

The mean $\pm$ SD of 109 female study samples was 22.13 $\pm$ 1.689 and the median (Q1, Q3) was 22.00 (21,23). The age varies from 18 to 25.

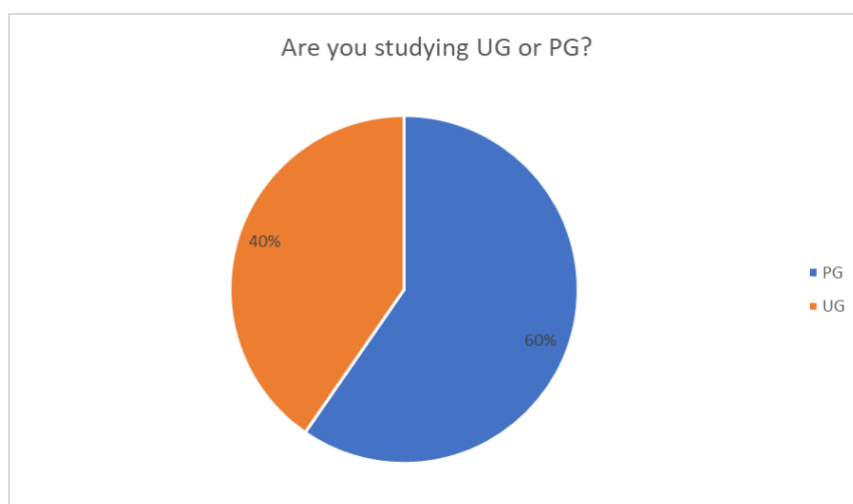
Table 1: Age of respondents

Variable	Category	Total (%)
Age group	18	3.6
	19	7.3
	20	3.6
	21	12.8
	22	29.35
	23	23.85
	24	12.8
	25	6.4

Table 2: Education status of respondents

Variable	Category	Total (%)
Education	UG	44 (40.4)
	PG	65 (59.6)

Figure 1: Education status of respondents



4.1.2. Knowledge, Attitude and Practice of respondents towards Anemia

A structured questionnaire was developed and was pre tested to measure the knowledge, attitude and practices of college going girls towards anemia. Ten statements to assess knowledge about anemia, 10 statements to assess attitude towards anemia and 8 statements to assess the practice of anemia were given to the college going girls.

4.1.2.1. Knowledge Toward Anemia Among College Going Girls

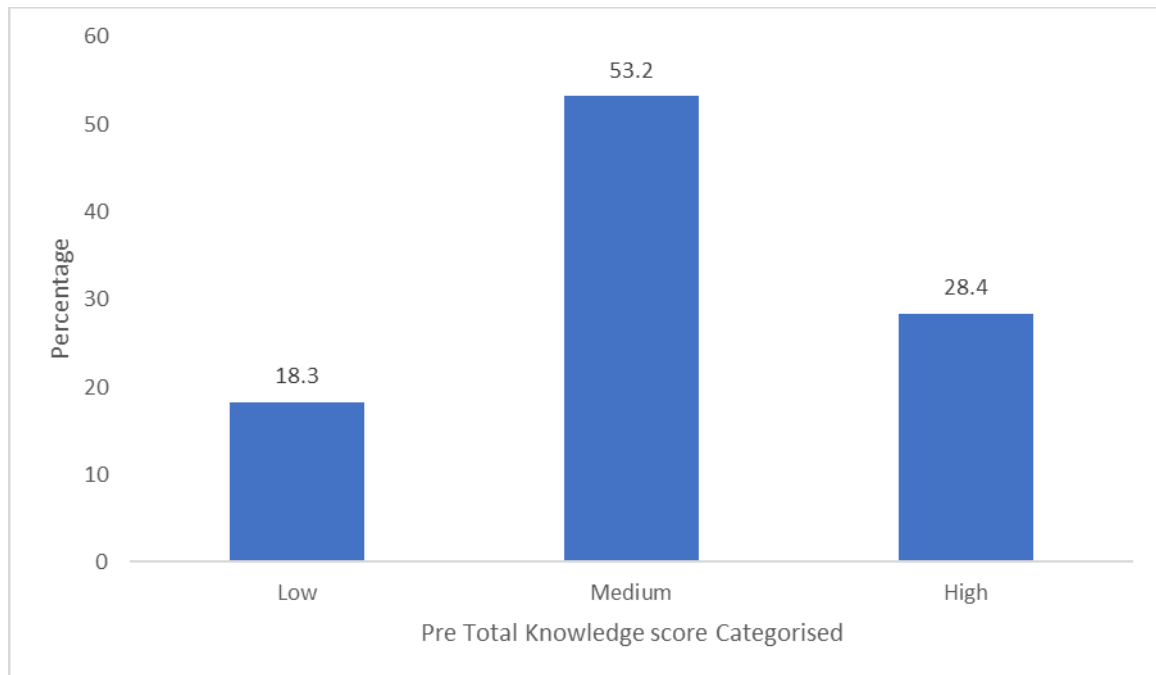
Table 3 illustrates the distribution of college going girls according to the knowledge toward anemia.

Table 3. Distribution of college going girls with respect to knowledge toward anemia.

Pre Total Knowledge score Categorised	Frequency	Percentage
Low (26 and below)	20	18.3
Medium (27-32)	58	53.2
High (33 and above)	31	28.4
Total	109	100.0

The distribution of college bound females according to their degree of anemia knowledge is displayed in Table 3. 20 (18.3%) out of 109 participants were found to know very little about anemia. 58 girls (53.2%) made up the majority of participants with a medium level of knowledge. In contrast, 31 girls (28.4%) showed a high degree of anemia knowledge.

Figure 2: Pre Total Knowledge Score Categorised



4.1.2.2 Attitudes Toward Anemia Among College Going Girls

Table 4 demonstrates the distribution of college going girls according to their attitude towards anemia.

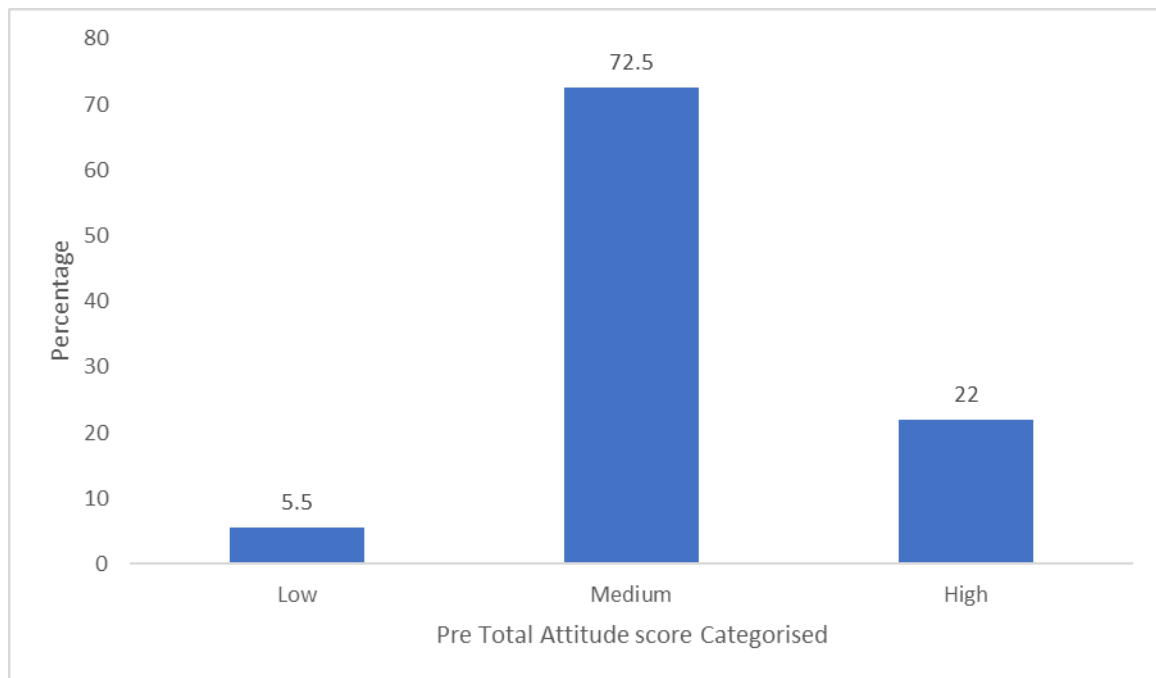
Table 4. Distribution of college going girls according to their attitudes towards anemia.

Pre Total Attitude Score Categorised	Frequency	Percentage
Low (26 and below)	6	5.5
Medium (27-32)	79	72.5
High (33 and above)	24	22.0
Total	109	100.0

Only 5.5% of the girls showed a low attitude toward anemia, indicating little knowledge or concern. The majority of the girls (72.5%) were classified as medium, meaning they had a moderate attitude toward anemia. One fifth of the

participants (22%) showed a high level of attitude toward anemia, indicating a strong awareness of the condition and a likely proactive approach to managing and preventing it.

Figure 3: Pre Total Attitude Score Categorized



4.1.2.3. Practice Toward Anemia Among College Going Girls

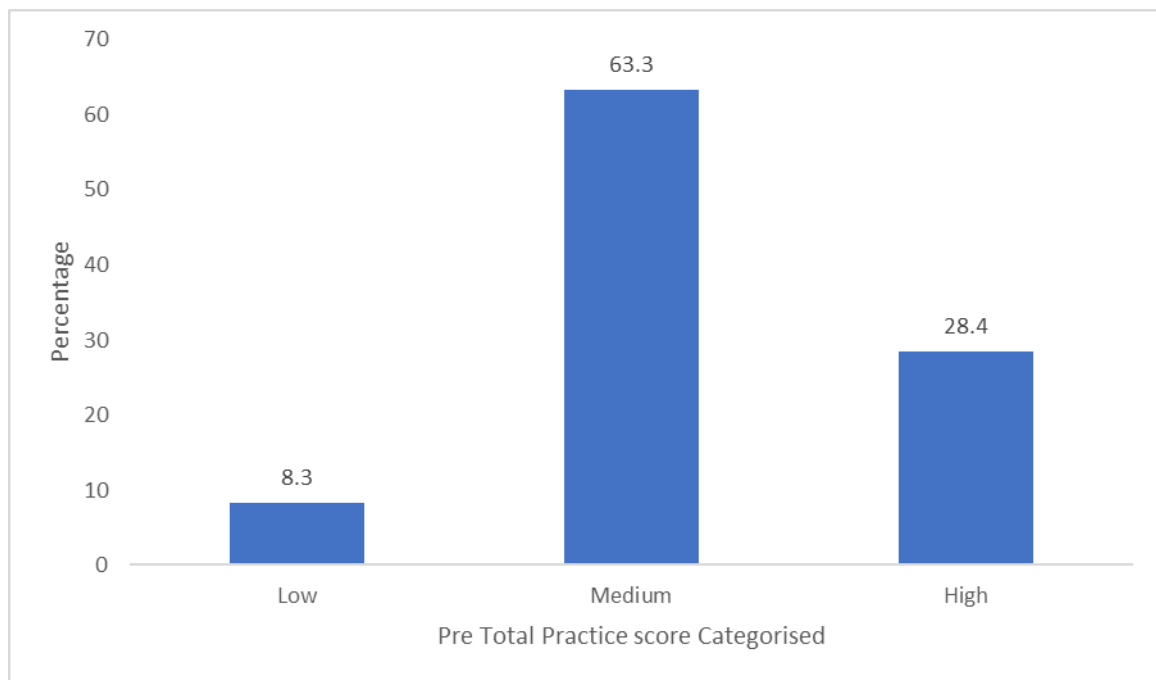
Table 5 shows the distribution of college going girls according to their practice towards anemia.

Table 5. Distribution of college going girls according to their practice towards anemia.

Pre Total Practice Score Categorised	Frequency	Percentage
Low (26 and below)	9	8.3
Medium (27-32)	69	63.3
High (33 and above)	31	28.4
Total	109	100.0

Regarding anemia, the majority of college bound girls (63.3%) had a modest degree of practice. Even though a sizable percentage (28.4%) exhibit high level practice, a tiny percentage (8.3%) have low awareness or practice, which may call for focused health education or treatments.

Figure 4: Pre Total Practice Score Categorized



4.2 Pilot Study

Questionnaire Validity

Table 6: Reliability Statistics of Questionnaire

Questionnaire	Reliability Statistics	
	Cronbach's Alpha (α)	N of Items
Knowledge	0.698	10
Attitude	0.821	10
Practice	0.778	10
Overall	0.766	30

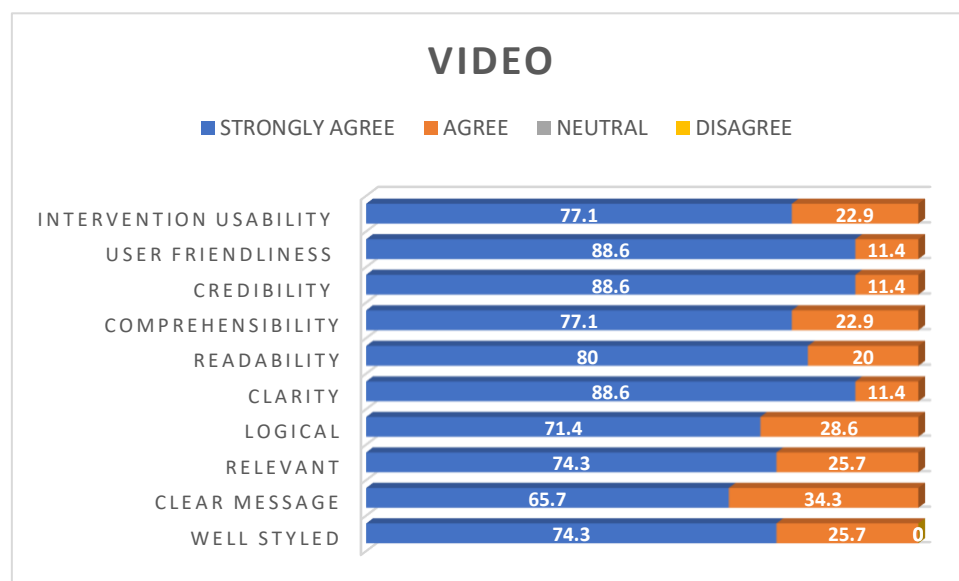
For determining the internal consistency of the questionnaire, the overall reliability was reflected by the Cronbach's alpha (α) of 0.766, which is deemed acceptable given that our questionnaire assesses distinct dimensions uncorrelated with each other. Independent Cronbach's alpha (α) for KAP domains were 0.698, 0.821, and 0.778, respectively. These values indicate good internal consistency.

4.3 Feasibility and Acceptability study of Nutrition Education Tools

Developed tools were subjected to the college going girls. A structured questionnaire was developed to assess the feasibility and acceptability of the developed nutrition education tools toward anemia.

The figures illustrate the respondents' responses to the questionnaire assessing the feasibility and acceptability of nutrition education tools.

Figure 5: Feasibility and acceptability of the video



The graph displays the developed video's rating according to a number of criteria determined by participant answers. Four categories—Strongly Agree, Agree, Neutral, and Disagree—are used to evaluate each quality.

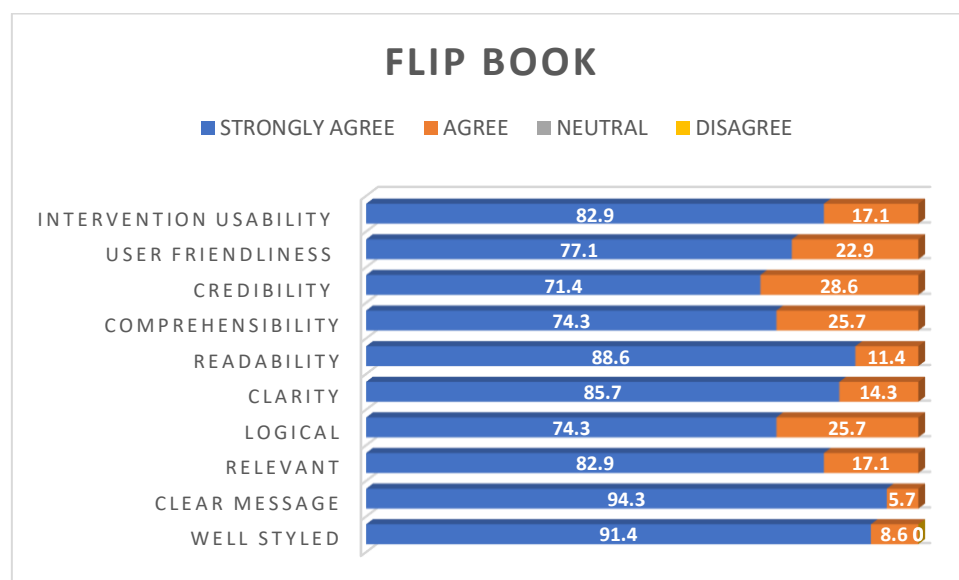
With 88.6% of respondents falling into the Strongly Agree group, most participants strongly agreed that the video was clear, credible, and easy to use. In a similar vein, readability and clarity received high ratings of 80% and 88.6%, respectively, suggesting significant agreement.

22.9% of respondents disagreed with both comprehensibility and intervention usefulness, whereas 77.1% strongly agreed with both. The video's logical flow was a little more ambiguous, with 28.6% disagreeing and 71.4% strongly agreeing.

With 74.3% of participants strongly agreeing on both points, relevance and style were well accepted. There is potential for improvement, though, as about 25% of individuals differed on these points.

The message's clarity was the feature that got the fewest compliments. While a sizable 34.3% disagreed, just 65.7% strongly agreed that the message was clear.

Figure 6: Feasibility and acceptability of the flipbook



The above bar graph displays the feasibility and acceptability of flip book participant feedback based on a number of evaluation criteria. "Strongly Agree" (blue), "Agree" (dark orange), "Neutral" (Gray), and "Disagree" (light orange) are the response types that are used to segment each bar. Most participants gave

the flip book a positive rating, with "Clear Message" (94.3%) and "Well Styled" (91.4%) receiving the highest "Strongly Agree" ratings. High ratings were also given to "Readability" (88.6%) and "Clarity" (85.7%). "Credibility" received the lowest "Strongly Agree" grade (71.4%) and the highest "Disagree" proportion (28.6%). Additionally, "Comprehensibility" and "User Friendliness" revealed some participant hesitancy. Although there may be room for development in terms of user connection and credibility, overall feedback shows good approval, particularly for presentation factors.

Table 7 displays the mean score of the developed nutrition education tools toward anemia given by college going girls.

Table 7. Mean score of the nutrition education tools toward anemia by college going girls.

Characteristics	Video (Mean score; max:5)	Flip Book (Mean score; max:5)
Intervention usability	4.83	4.83
User friendliness	4.93	4.76
Credible	4.93	4.76
Comprehensible	4.83	4.80
Readable	4.83	4.90
Clear	4.86	4.86
Logical	4.70	4.73
Total acceptability score	4.84	4.80
Readable	4.83	4.90
Comprehensible	4.83	4.80

Interesting	4.90	4.96
Relevant	4.76	4.80
Attractive	4.79	4.92
Give clear message	4.70	4.93
Well styled	4.76	4.93
Total feasibility score	4.79	4.89

According to the mean value, the video has a higher acceptability score of 4.84 overall, while the flipbook has a lower score of 4.80. In contrast, the flipbook has a 4.89 overall feasibility score, while the video has a 4.79, indicating that the flipbook is more possible than the video.

4.4. Impact of Nutrition Education Tools

After three months of nutrition education, the college going girls were asked to fill the questionnaire to assess the nutrition education knowledge-attitude-practice, to assess the impact of the use of nutrition education tools toward anemia. For the impact assessment, tools used in preliminary data collection were used again.

4.4.1. Post Knowledge Toward Anemia Among College Going Girls

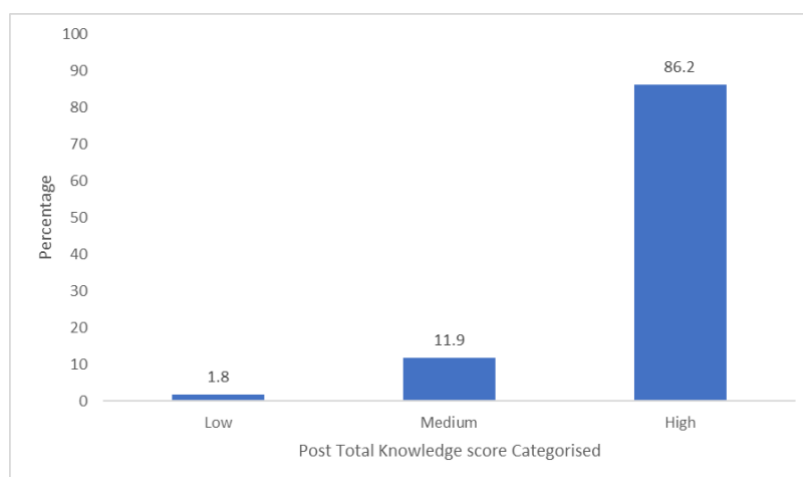
Table 8 shows that the distribution of college going girls according to the post knowledge toward anemia.

Table 8. Distribution of college going girls according to their post knowledge towards anemia.

Post Total Knowledge score Categorised	Frequency	Percentage
Low (33 and below)	2	1.8
Medium (33.5)	13	11.9
High (34 and above)	94	86.2
Total	109	100.0

The post intervention knowledge levels of college bound girls about anemia are shown in the table. The bulk of the participants, 94 females (86.2%) of the 109 total, showed a high degree of anemia knowledge. Just 2 girls (1.8%) remained in the poor knowledge category, while 13 girls (11.9%) demonstrated a medium level of understanding.

Figure 7: Post Knowledge Score Categorized



4.4.2. Post Attitude Toward Anemia Among College Going Girls

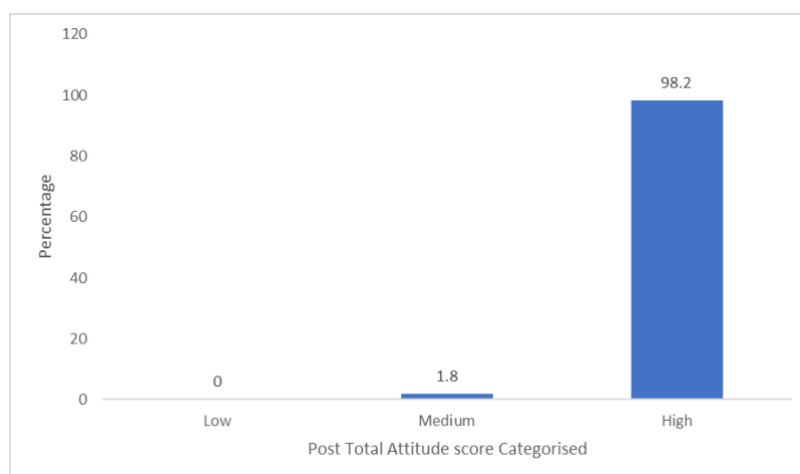
Table 9 demonstrates the distribution of college going girls according to the attitudes toward anemia.

Table 9. Distribution of college going girls according to their post attitude towards anemia.

Post Total Attitude Score Categorised	Frequency	Percentage
Low (33 and below)	2	1.8
Medium (33.5)	107	98.2
High (34 and above)	0	0
Total	109	100.0

The majority of the 109 participants fell into the medium attitude category based on their post intervention total attitude ratings. In particular, 107 participants (98.2%) were classified as medium, suggesting that attitudes were largely positive after the session. On the other hand, just 2 individuals (1.8%) were categorized as having a low attitude score. None of the individuals fell within the high attitude score category.

Figure 8: Post Total Attitude Score Categorized



4.4.3. Post Practice Toward Anemia Among College Going Girls

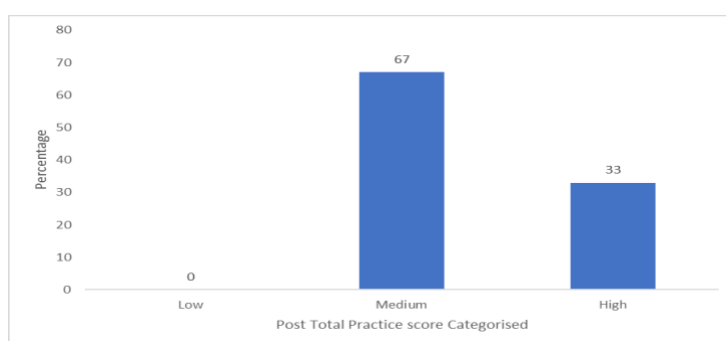
Table 10 illustrates the distribution of college going girls according to the practice toward anemia.

Table 10. Distribution of college going girls according to their post practice towards anemia.

Post Total Practice Score Categorised	Frequency	Percentage
Low (33 and below)	0	0
Medium (33.5)	73	67.0
High (34 and above)	36	33.0
Total	109	100.0

The distribution of college bound college going girls based on their post practice anemia level is displayed in table 10. The absence of poor post practice conduct was shown by the fact that no respondents (0%) were included under the low post practice category. 36 respondents (33.0%) were classified as having a high post practice level, but the majority 73 respondents (67.0%) were classified as having a medium level. With no representation in the low category, this distribution shows that the majority of individuals had moderate to good post practice behaviours related to anemia.

Figure 9: Post Total Practice Score Categorized



4.4.4. Impact of Nutrition Education Tools on Knowledge, Attitude, Practice (KAP) Regarding Anemia: A Pre-Post Evaluation.

To find out if there was an improvement in the nutrition knowledge, attitude, and practice of college-bound females, it would be ideal to evaluate improvements in their knowledge, attitude, and practice related anemia. Table 11 shows a

substantial increase in knowledge about anemia (29.55 to 33.83), table 12 shows an attitude (8.45 to 8.98), and table 13 shows a practice (4.16 to 4.92) between the pre- and post-intervention mean values.

Table 11. Distributes the impact of nutrition education tools on knowledge, regarding anemia: A Pre-Post Evaluation.

Total Knowledge score	N	Mean	SD	P value
Pre test	109	29.550	3.826	<0.001
Post Test	109	33.835	0.462	

Before and after the intervention, the mean knowledge score was 29.550; it rose to 33.835. The standard deviation dropped from 3.826 to 0.462, suggesting that participants' knowledge scores were less variable following the intervention. The observed rise in knowledge scores is statistically significant, according to the p-value, which is less than 0.001.

Figure 10: The impact of nutrition education tools on knowledge, regarding anemia: A Pre-Post Evaluation.

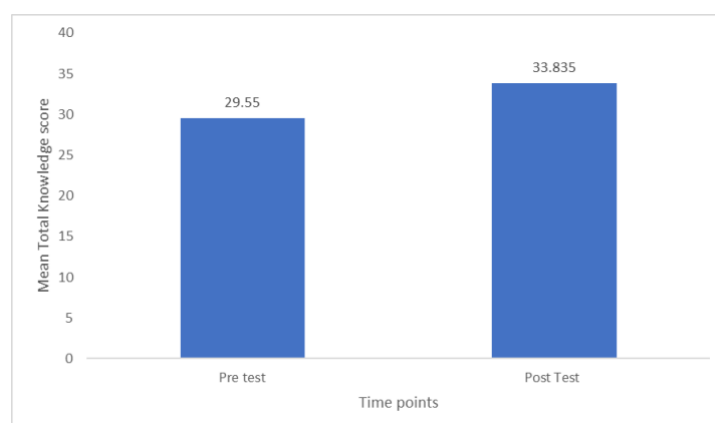


Table 12. Distributes the impact of nutrition education tools on attitude, regarding anemia: A Pre-Post Evaluation.

Total Attitude score	n	Mean	SD	P value
Pre test	109	8.450	1.430	<0.001
Post Test	109	8.982	0.135	

The average attitude score increased from 8.450 prior to the intervention to 8.982 following it. The standard deviation dropped from 1.430 to 0.135, suggesting that participants' attitude scores were less variable following the intervention and attitude scores is statistically significant, according to the p-value, which is less than 0.001.

Figure 12: The impact of nutrition education tools on attitude, regarding anemia: A Pre-Post Evaluation.

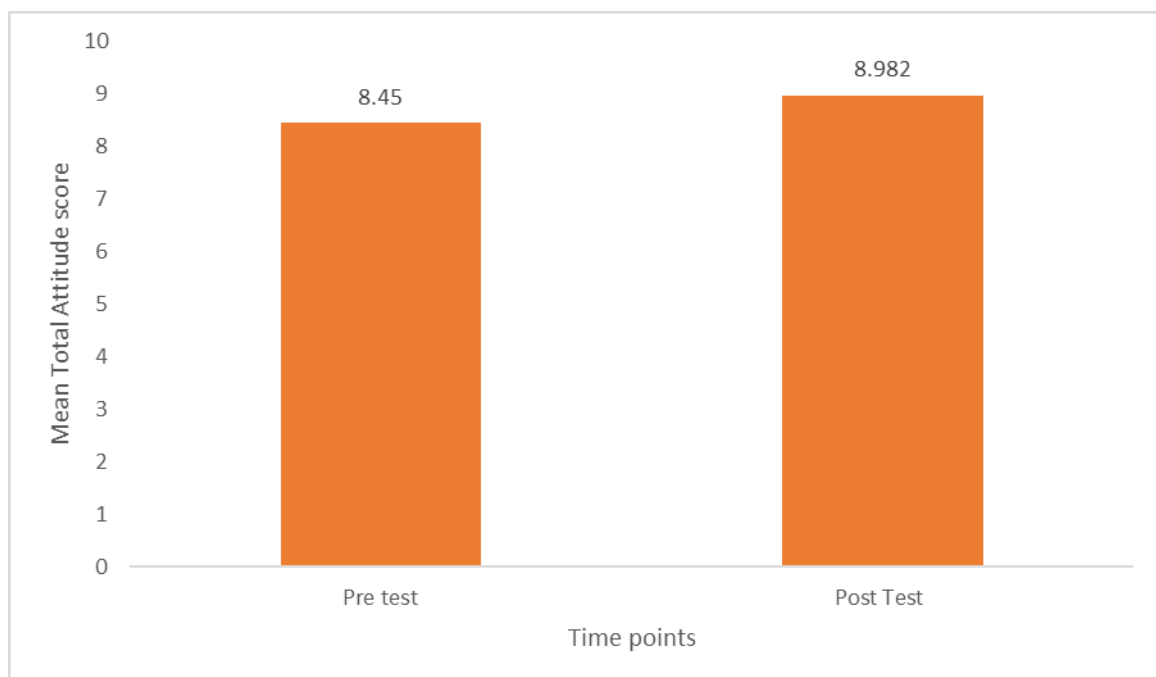
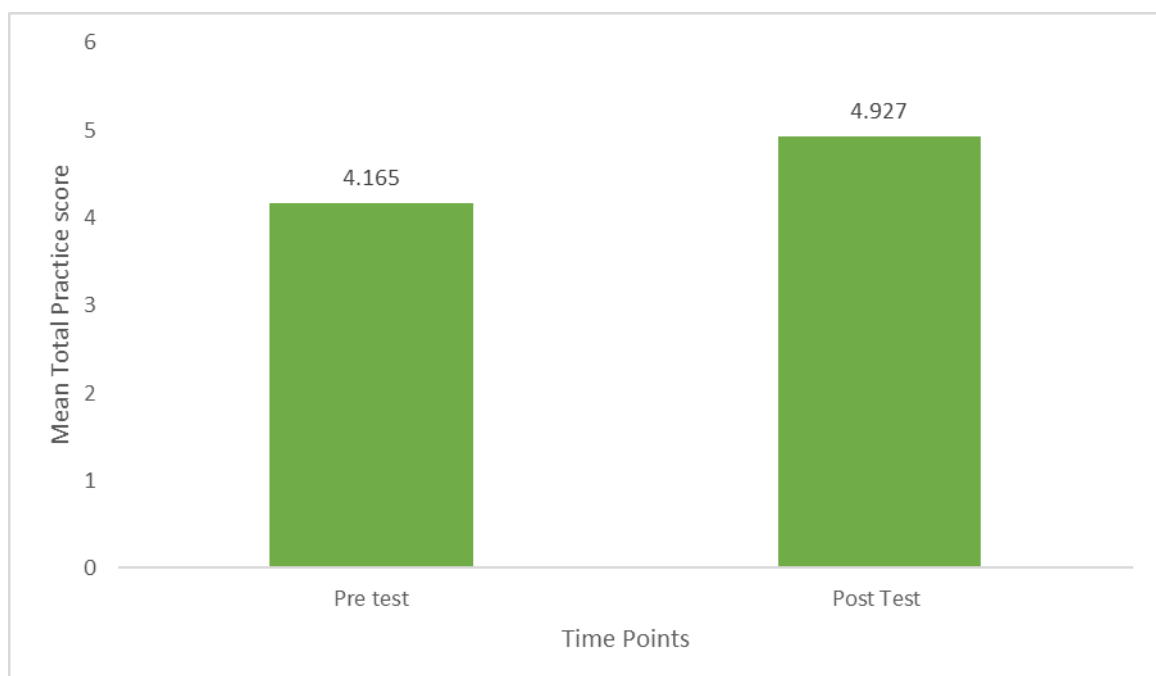


Table 13. Distributes the impact of nutrition education tools on practice, regarding anemia: A Pre-Post Evaluation.

Total Practice score	n	Mean	SD	P value
Pre test	109	4.165	2.080	<0.001
Post Test	109	4.927	1.445	

Prior to and during the intervention, the mean practice score was 4.165; it rose to 4.927. The standard deviation dropped from 2.080 to 1.445, suggesting that following the intervention, there was less variation in the practice scores of the participants and practice scores is statistically significant, according to the p-value, which is less than 0.001.

Figure 13: The impact of nutrition education tools on practice, regarding anemia: A Pre-Post Evaluation.



DISCUSSION

The present study was conducted to test the feasibility and acceptability of the nutrition education tool to prevent anemia among college going girls in Kerala. Indian adolescent girls and women have highest rates of anemia globally according to national family health survey. Food insecurity, poverty, and lack of nutrition education contribute to iron deficiency in this population. The study reported a significant improvement in nutritional knowledge and awareness after the implementation of intervention. Result indicated that among the 109 participants aged between 27 to 32 had a medium level knowledge on anemia ;53.2% and 72.5% had a moderate attitude towards anemia and 63.3% showed modest degree of practice.

A pilot study was conducted to determine the feasibility of the questionnaire, and it indicated a good internal consistency. As part of intervention tool, a video was developed, which included the cause and the symptoms of the anemia, how it can be diagnosed, prevented and also the measures for the treatment and management of anemia. The video was very user friendly and had positive feedback on reliability. The video was interpretable, clear and the contents were easily readable and logical. A comparison was done between the video and flip book for their acceptability and feasibility. The video was more acceptable than the flip book while flip book scored higher for its feasibility.

A similar study was conducted by salam in 2023 to analyse the impact of school based nutritional education on iron deficiency anemia in Karnataka. An intervention was developed by nutritional experts and school teachers like role play, lectures and the sessions were delivered by the teachers and this tool was very effective for improving awareness and attitude towards anemia (Salam et al., 2023).

Another study was conducted by Rahman in 2024 that concluded the differences in findings may arise from varying research methods, KAP questionnaires, and study group characteristics. Some KAP elements, like recall questionnaires, may have affected results. Our study indicated low knowledge and practice levels among participants, with many unaware of anemia and its risk factors. Implementing school-based nutrition education could improve understanding of anaemia's causes and prevention. Programs should include culturally relevant materials, interactive learning, and community involvement to enhance KAP levels, ultimately leading to better health outcomes for adolescent girls (Rahman et al., 2024).

Another similar study was conducted by Pareek in 2015 on 100 college girls from a junior college in Hyderabad to assess their nutrition and understanding of anemia. Data was collected using a structured questionnaire, including a Food Frequency Questionnaire (FFQ) for dietary habits. Knowledge of anemia was evaluated with a pretested questionnaire. Participants' height and weight were measured, and data was analysed statistically. Over half were aged 14-16 years, 87% lived in nuclear families, most were non-vegetarian, and from middle-income backgrounds. Only 25% had good knowledge of anemia, 36% had fair knowledge, and the rest had poor knowledge. Many girls were unaware of their increased nutritional needs for growth, leading to issues like being underweight and shorter than average. Educating girls in schools and colleges about healthy meals could help reduce anemia rates in underdeveloped areas (Pareek et al., 2015).

Another study was conducted by Abu-Baker in 2021 which included iron deficiency anemia (IDA) prevalence among teenage girls in northern Jordan, focusing on grades 8 to 10 in schools with 700 to 900 students. A structured questionnaire was developed, gathering demographic and menstrual data in the first section, and utilizing the KAP questionnaire from the FAO in the second.

The study included four 45-minute intervention sessions with lectures, videos, and brochures based on WHO guidelines on nutrition and anemia prevention. Increased initiatives are needed to raise awareness among adolescents for improved health outcomes. Health care professionals should be trained to assess and address this issue in schools. (Abu-Baker et al., 2021).

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

Anemia occurs when the hemoglobin concentration or the number of red blood cells falls below a critical value. It consequently impairs the capacity of the blood to transport oxygen in the body. Anemia is an indicator of poor nutrition and poor health. About 60-70% of Indian adolescent girls are anemic. Iron deficiency is the most common type of anemia. Anemia is a significant health problem among college-going girls in both urban and rural areas. It is due to menstruation, nutritional deficiencies, dietary changes, and lifestyle factors. Many college-going girls consume food that is lacking in iron, and other factors, including irregular eating, skipping meals, and consumption of processed food, also contribute to poor iron intake. As per the surveys conducted, the following summary is drawn based on the results obtained.

To assess the knowledge, attitude, and practice of college-going girls in anemia, a survey was conducted among 109 college students to assess the knowledge, attitude, and practice towards anemia. UG and PG students were the respondents of the study. 53.2% have a medium knowledge, 72.5% have a moderate attitude, and 63.3% have mild practices as well.

Objective 1: to assess knowledge, attitude, and practice among the college-going girls among the participants, 53.2% have a medium knowledge, 72.5% have a moderate attitude

Objective 2: To develop nutrition education tool about anemia for college going girls, a video was developed showing the causes of anemia its symptoms and how it can be diagnosed and how to prevent it and also measures for treatment and management. 88.6% of respondents strongly agreed with the video.

Objective 3: To assess the feasibility and acceptability of developed tools, a pilot study was conducted, and among the students, this video was very useful,

acceptable, and logical. It makes the participant know more about anemia rather than conventional lectures and also about the prevention of anemia. And flip book was more feasible to the participants as compared to video.

Objective 4: To assess the impact of the developed nutrition education tool. A post-KAP test was conducted among the subjects, and the results showed significant scores in their knowledge, attitude and their practices

CONCLUSION

The present study analysed the feasibility and acceptability of nutrition education tools to prevent anemia among college-going students in Kerala. The study focused on the knowledge, attitudes, and practices regarding anemia. Data revealed that only a few have knowledge of anemia, moderate attitudes, and a low level of practice. They should be made aware of anemia by developing a suitable education intervention programme, and thus nutrition education programmes play a vital role in improving the nutritional status.

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APPENDIX I

**Questionnaire to Assess the Knowledge, Attitude and Practice Level of
Subject regarding Iron Deficiency Anaemia**

1.Sociodemographic Details

Age:

Educational Qualification:

Email:

2. Knowledge Based Questions:

1. Have you ever heard about anaemia?

(a) Yes

(b) No

2. Is anaemia being a fatal condition?

(a) Yes

(b) No

3. What is anaemia?

(a) Increased RBC count/haemoglobin concentration

(b) Increased WBC count

(c) Decreased RBC count/haemoglobin concentration

(d) Decreased WBC count

4. What is Haemoglobin?

(a) Lipid

(b) Carbohydrate

(c) Transport protein

(d) None of these

5. What is the normal range of haemoglobin in female?

(a) 12.0–15.0 g/dl

(b) 15.0–18.5 g/dl

(c) 8.0–11.0 g/dl

(d) 6.0–8.0 g/dl

6. What causes anaemia?

(a) Poor diet

(b) Intestinal worm infestation

(c) Severe blood loss

(d) All the above

7. How to prevent anaemia?

(a) Intake of iron-rich foods

(b) Consumption of caffeine products

(c) Intake of Vitamin C and folic acid-rich foods

(d) Both A and C

8. What are the common symptoms of anaemia?

(a) Pale skin

(b) Tiredness

(c) Poor vision

(d) Both A and B

9. Does heavy menstrual bleeding cause anaemia?

(a) Yes

(b) No

10. What is the treatment for anaemia?

(a) Iron/vitamin supplements

(b) Blood transfusion

(c) Deworming

(d) All the above

3. Attitude Based Questions

1. I believe that anemia significantly affects a person's quality of life.

(a) Yes

(b) No

2. I feel that it is important to get tested for anemia regularly.

(a) Yes

(b) No

3. I think that dietary choices play a major role in preventing anemia.

(a) Yes

(b) No

4. I am confident that I can identify the symptoms of anemia in myself or others.

(a) Yes

(b) No

5. I believe that anemia is a common condition that does not require

much concern.

(a) Yes

(b) No

6. I feel that taking iron supplements is an effective way to manage anemia.

(a) Yes

(b) No

7. I think anemia is a condition that primarily affects women and children.

(a) Yes

(b) No

8. I believe that fatigue caused by anemia is often underestimated by others.

(a) Yes

(b) No

9. I feel motivated to educate others about the risks of anemia.

(a) Yes

(b) No

10. I think it is easy to manage anemia with lifestyle changes.

(a) Yes

(b) No

4.Practice Based Questions:

1. Have you ever checked your haemoglobin level in the past 1 year?

(a) Yes

(b) No

2. Have you taken IFA tablets in the past 1 year?

(a) Yes

(b) No

3. Do you take Vitamin C and Vitamin B12 supplements regularly?

(a) Yes

(b) No

4. Have you ever taken Albendazole in the past 1 year?

(a) Yes

(b) No

5. If your haemoglobin level is below the normal range, are you eligible for blood donation?

(a)Yes

(b) No

6. Did you undergo deworming in last year?

(a) Yes

(b) No

7. Do you include green leafy vegetable in your diet every day?

(a)Yes

(b) No

8. Do you include sprouted grains in your diet every day?

(a) Yes

(b) No

9. Do you include fibre rich food frequently?

(a) Yes

(b) No

10. Did you donate blood in the past?

(a) Yes

(b) No

APPENDIX II

**Questionnaire to assess the feasibility and acceptability of nutrition
education tools to prevent anemia**

1.Intervention Usability

- (a) Strongly Agree
- (b) Agree
- (c) Neutral
- (d) Disagree

2.User friendliness

- (a) Strongly Agree
- (b) Agree
- (c) Neutral
- (d) Disagree

3.Credibility

- (a) Strongly Agree
- (b) Agree
- (c) Neutral
- (d) Disagree

4.Comprehensibility

- (a) Strongly Agree
- (b) Agree
- (c) Neutral
- (d) Disagree

5.Readability

- (a) Strongly Agree
- (b) Agree
- (c) Neutral
- (d) Disagree

6.Clarity

- (a) Strongly Agree
- (b) Agree
- (c) Neutral
- (d) Disagree

7.Logical

- (a) Strongly Agree
- (b) Agree
- (c) Neutral
- (d) Disagree

8.Relevant for college girls

- (a) Strongly Agree
- (b) Agree
- (c) Neutral
- (d) Disagree

9.Gives clear message

- (a) Strongly Agree

(b) Agree

(c) Neutral

(d) Disagree

10. Well styled for college girls

(a) Strongly Agree

(b) Agree

(c) Neutral

(d) Disagree

APPENDIX III

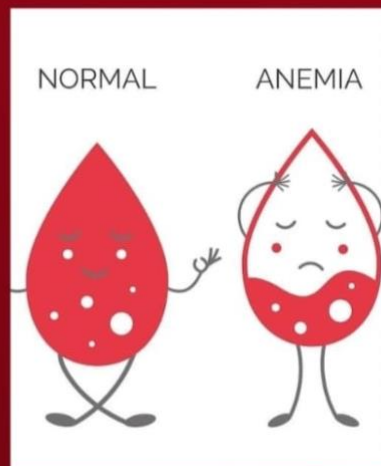
POWERPOINT

ANEMIA

RESEARCH SCHOLAR: MUHSINA Y
RESEARCH GUIDE: DR.ABHINA B

ANEMIA

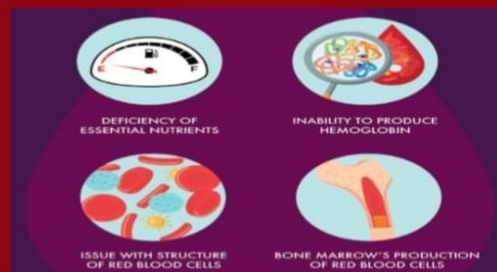
Anemia is a health disorder that occurs when your body doesn't produce enough hemoglobin and fails to carry sufficient oxygen throughout the body. It makes you feel lethargic all the time and make you more prone to other health problems. Iron deficiency is the primary cause of anemia



CAUSES OF ANEMIA

Anemia can be caused by a number of different factors:

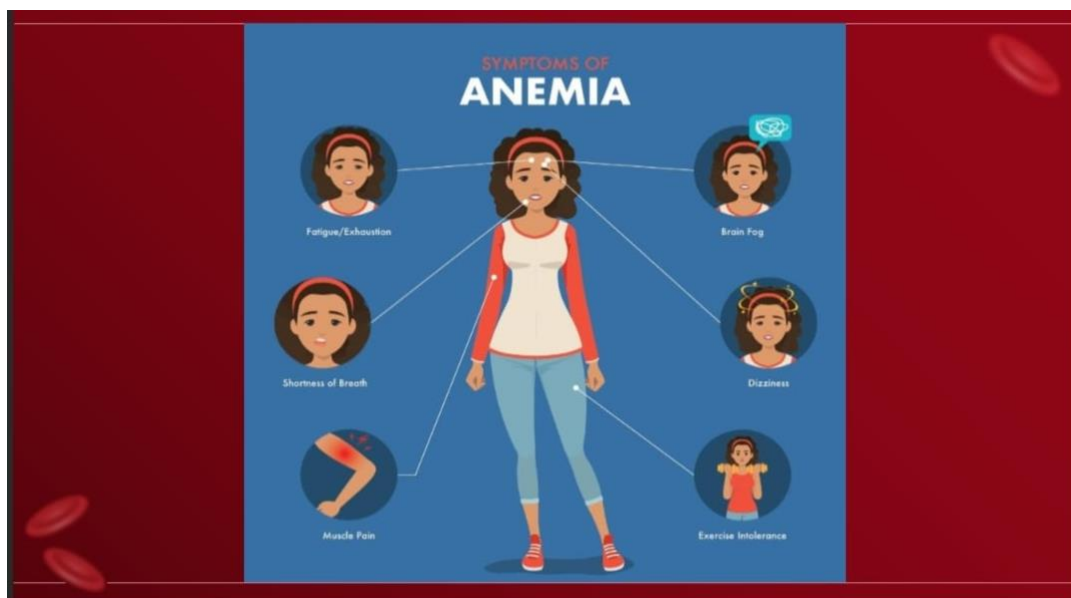
- Deficiency of essential nutrients (iron, B-vitamins, etc.)
- Inability to produce the protein hemoglobin
- An issue with the structure of red blood cells
- An issue with the bone marrow's ability to make red blood cells



SYMPTOMS OF ANEMIA

Anemia can cause a variety of symptoms, all generally related to the fact that not enough oxygen is reaching the tissues in the body.

- Fatigue/exhaustion – feeling tired even after a full night sleep
- Shortness of breath – feeling out of breath even from minor exertion
- Brain fog – feeling unable to focus and a lack of mental clarity
- Muscle pain – feeling discomfort or knots of tightness in your muscles, or experiencing muscle spasms
- Dizziness – feeling faint, woozy, weak, or unsteady
- Exercise intolerance – feeling unable to perform physical exercise that a person of the same age and fitness level normally could. Exercise intolerance may also involve unusually severe post-exercise pain, fatigue, nausea, vomiting, or other negative effects.



DIAGNOSIS OF ANEMIA

1. Clinical evaluation

- **Medical History:** Assess symptoms, dietary habits, and medical conditions.
- **Physical Examination:** Check for pallor, jaundice, and lymphadenopathy.

2. Laboratory tests

- **Complete Blood Count (CBC):** Evaluate haemoglobin (Hb), hematocrit (Hct), and red blood cell indices.
- **Peripheral Smear:** Examine red blood cell morphology.
- **Iron Studies:** Measure serum iron, transferrin saturation, and ferritin levels.
- **Vitamin B12 and Folate Levels:** Assess for deficiency.

Diagnostic criteria

- **Hemoglobin (Hb) Levels:**
- Mild anemia: Hb 10-12 g/dL
- Moderate anemia: Hb 8-10 g/dL
- Severe anemia: Hb < 8 g/dL

Healthy and Low Iron Studies in Adults

Iron, $\mu\text{mol/L}$	Normal	10 to 30
	Iron-deficiency anemia	Less than 10
Ferritin, $\mu\text{g/L}$	Normal	Men 40 to 300 Women 20 to 200
	Iron-deficiency anemia	Less than 10

PREVENTION

Iron-deficiency anemia may be preventable if you are able to treat the causes of blood loss or problems with iron absorption that can lead to the condition.

It is also always a good idea to help the body keep iron levels where they need to be by maintaining a healthy diet that includes good sources of iron and vitamin C.

- **Good sources of iron** include beans, dried fruits, eggs, lean red meat, salmon, iron-fortified breads and cereals, peas, tofu, and dark green leafy vegetables.
- **Vitamin C-rich foods** such as oranges, strawberries, and tomatoes help your body absorb iron.
- **Ensure that toddlers** eat enough solid foods that are rich in iron.

HOW TO PREVENT ANAEMIA

Choose foods rich in iron, folate, vitamin A & B12

FOOD EXAMPLES:



MANAGEMENT

- The recommended daily amounts of iron depend on your age, your sex, and whether you are pregnant or breastfeeding.
- Generally, a diet that includes beans, dried fruits, eggs, lean red meat, salmon, iron-fortified breads and cereals, peas, tofu, and dark green leafy vegetables will provide the iron level that your body needs.

Recommended daily iron intake for children and adults

Recommended Daily Amounts of Iron, in milligrams (mg)				
Age	Male	Female	Pregnancy	Breastfeeding
Birth to 6 months	0.27 mg	0.27 mg		
7 to 12 months	11 mg	11 mg		
1 to 3 years	7 mg	7 mg		
4 to 8 years	10 mg	10 mg		
9 to 13 years	8 mg	8 mg		
14 to 18 years	11 mg	15 mg	27 mg	10 mg
19 to 50 years	8 mg	18 mg	27 mg	9 mg
51 or older	8 mg	8 mg		

BEST FOODS TO PREVENT ANEMIA



PLANT BASED SOURCES OF IRON



TREATMENT

Dietary changes

1. Increase Iron Intake: Consume iron-rich foods, such as:

- Red meat (beef, lamb, pork)
- Poultry (chicken, turkey)
- Fish (tuna, salmon)
- Legumes (lentils, chickpeas, black beans)
- Leafy greens (spinach, kale, collard greens)
- Nuts and seeds (pumpkin seeds, sesame seeds, sunflower seeds)

2. Enhance Iron Absorption: Vitamin C can enhance iron absorption, so consume foods high in vitamin C (citrus fruits, bell peppers, tomatoes) along with iron-rich foods.

3. Increase Folate Intake: Consume folate-rich foods, such as:

- Leafy greens (spinach, kale, collard greens)
- Legumes (lentils, chickpeas, black beans)
- Citrus fruits (oranges, grapefruits, lemons)
- Whole grains (brown rice, quinoa, whole wheat bread)

4. Increase Vitamin B12 Intake: Consume vitamin B12-rich foods, such as:

- Animal products (meat, poultry, fish, eggs, dairy)

Supplements

1. **Iron Supplements:** Ferrous sulfate, ferrous gluconate, or ferrous fumarate can be taken orally.
2. **Folic Acid Supplements:** Folic acid supplements can be taken orally, especially for pregnant women or those with folate deficiency.
3. **Vitamin B12 Supplements:** Vitamin B12 supplements can be taken orally or via injection, especially for those with vitamin B12 deficiency.

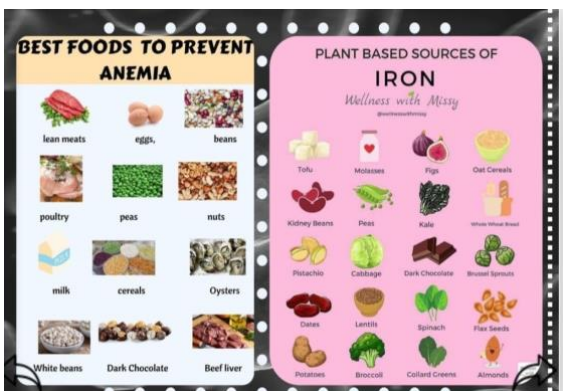
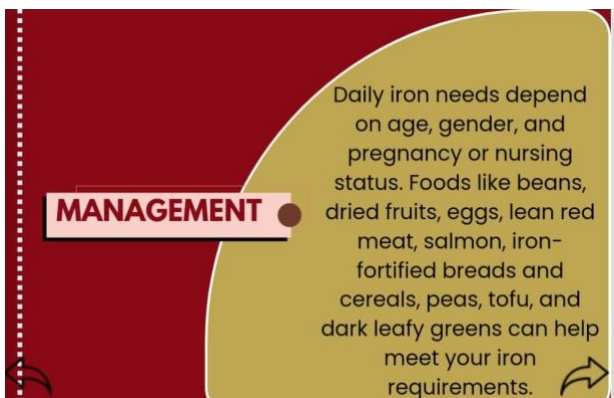
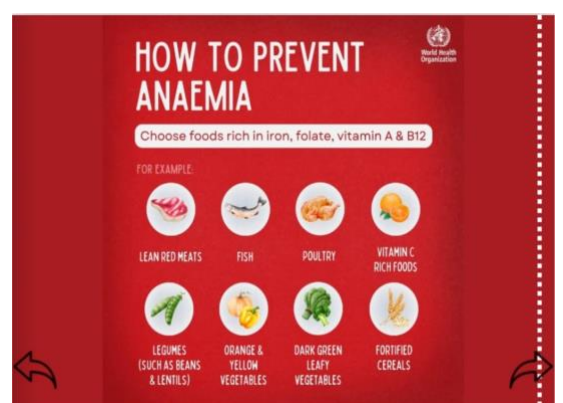
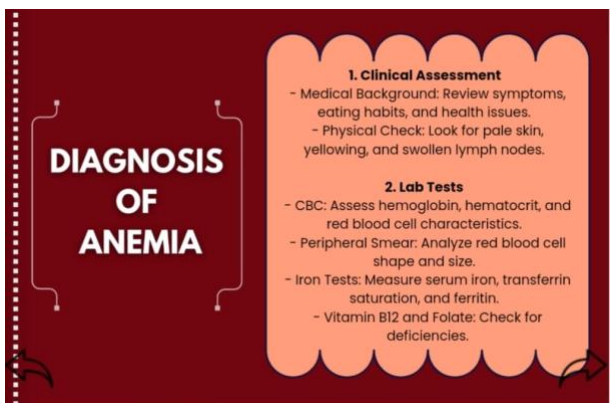
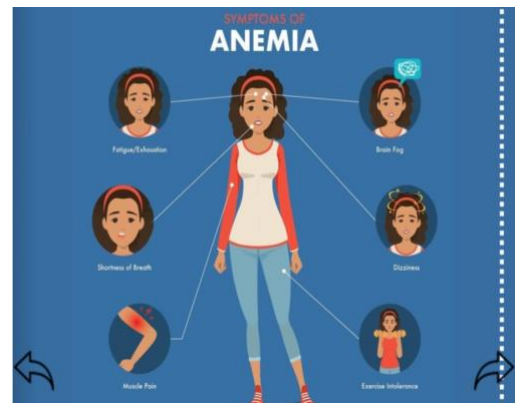
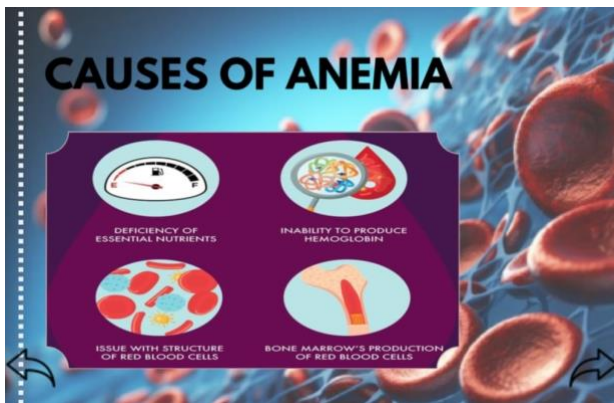
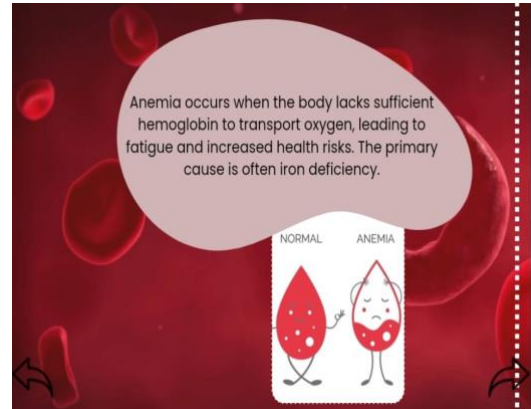
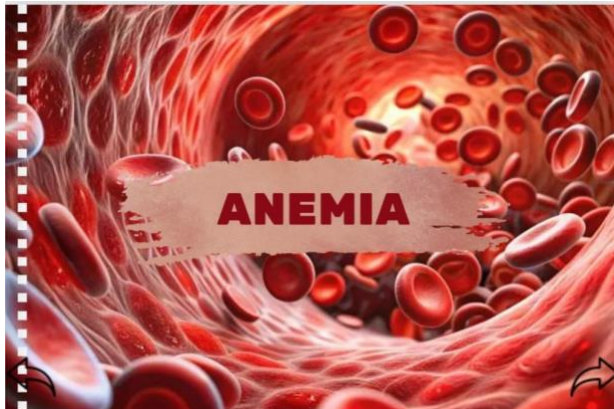
Rest and Relaxation

1. **Get Adequate Sleep:** Aim for 7-8 hours of sleep per night to help your body recover from anemia.
2. **Manage Stress:** Engage in stress-reducing activities, such as meditation, yoga, or deep breathing exercises.
3. **Avoid Overexertion:** Pace yourself and avoid overexerting, as this can worsen anemia symptoms.

THANK YOU

APPENDIX IV

FLIP BOOK



TREATMENTS

DIETARY CHANGES

1. **Boost Iron Intake:** Eat more iron-rich foods like red meat, poultry, fish, legumes, leafy greens, and nuts/seeds.
2. **Enhance Iron Absorption:** Pair iron-rich meals with vitamin C sources (citrus fruits, bell peppers, tomatoes).
3. **Increase Folate:** Include folate-rich foods such as leafy greens, legumes, citrus fruits, and whole grains.
4. **Increase Vitamin B12:** Add more B12-rich foods like meat, poultry, fish, eggs, and dairy.

SUPPLEMENTS

1. **Iron Supplements:** Take ferrous sulfate, gluconate, or fumarate orally.
2. **Folic Acid Supplements:** Folic acid is recommended for pregnant women or those with low folate levels.
3. **Vitamin B12 Supplements:** Obtain vitamin B12 through oral supplements or injections if deficient.

**“Healthy blood, healthy life!
Take small steps today for a
stronger tomorrow.”**

