Chapter II

REVIEW OF LITERATURE

Review of literature is a broad, comprehensive, systematic identification and summary of written materials that contain information on related problem. Review of literature is an integral component of any study or research project. It inspires insight and enhances the depth of knowledge into the problem. The review of literature throws light on the study and the findings related to the study (Basavanthappa, 1998).

Review of literature is important for broadening the understanding and insight necessary for the development of a conceptual framework (Gupta, 1991).

An extensive review of literature was carried out by the researcher on the topic in order to gain deeper insight into the problem and to collect maximum relevant information for building up the study in a scientific manner, so as to achieve the desired results. The reviewed literature has been organized and presented under the following headings:

Section I : Prevalence of anemia
Section II : Risk Factors and Causes of anemia
Section III : Signs and symptoms of anemia
Section IV : Diagnosis of anemia
**Section V**  :  Knowledge on anemia

**Section VI**  :  Effectiveness of STP in prevention of anemia

**Section VII** : Drumstick leaves supplementation

**Section VIII** : Cauliflower leaves supplementation

**Section IX** : Nurses’ role in treatment and prevention of anemia

**Section – I : Prevalence of Anemia**

Marques, et al., (2015) assessed the prevalence of anemia among women attending universities. The risk of developing anemia was almost threefold higher among the students attending the public university (OR 2.71; p = .0248). The results revealed that prevalence of anemia was much higher than in the overall female population (79%). The higher education was not a protective factor for anemia in women when analyzed separately from the total population of women.

Shrinivasa, et al., (2014) estimated the prevalence of anemia among tribal women of 15-45 years of age of Wayanad District of Kerala. Anemia was diagnosed by estimating the hemoglobin. Prevalence of anemia was found to be 96.5%. Mild anemia (Hemoglobin = 10-11.9 gm %) was found to be 30.5%. About 55.9% had moderate degree anemia (Hb 7-9.9 gm %). Prevalence of severe anemia (<7 gm %) was found to be 10.1%. The study findings concluded that the prevalence of anemia was substantially high among women of reproductive age group of Wayanad.
**Kamath, et al., (2013)** investigated the prevalence of anemia among tribal women, aged 15 to 49 years in Udupitaluk, Udupi district, Karnataka. The study findings revealed that in the sample of tribal women in the age group of 15-49 years, the prevalence of anemia was 55.9%. Among the subjects, 6 (3.5%) were severely anemic, 33 (19.4%) had moderate anemia and 56 (32.9%) were mildly anemic.

**Majid Sadeghiann, et al., (2013)** identified that low socioeconomic status and high parity index were associated with higher prevalence of anemia.

**Sinha (2013)** carried a hospital based study to determine the prevalence of anemia in difference groups among women of reproductive age population. Out of 3,859 subjects, 2,597(67.3%) women amongst reproductive age group were diagnosed as anemic. The highest prevalence of anemia (13.7%) was found at the age group of 25-29 years and the second highest prevalence of anemia 13.1% was at the age of above >40 years of the study population.

**Kalpana (2012)** estimated the prevalence of iron deficiency anemia among adolescent school girls in the age group of 13-17 years in Chennai. A cross-sectional survey was executed among 400 female school students in the age group of 13-17 years in Chennai. Socio-demographic details and anthropometric measurements were obtained. The results revealed that the prevalence of anemia was
found to be 78.75% among school students in the age group of 13-17 years in Chennai.

**Mishra (2012)** reported that 96.8% of the subjects were anemic and majority of anemic women were in the category of mild to moderate anemia. **Manmeet and Kamaljit (2009)** also conducted a similar kind of study in an urban area of Chandigarh and as per their result, the overall prevalence of anemia among reproductive age women was 73.3%. Another study carried out in Karnataka (**NFHS 3-2005-06**) also showed that prevalence of anemia among rural reproductive age women was about 52.7%.

**Premalatha (2012)** stressed the need to investigate the factors associated with the prevalence of anemia. During adolescence anemia is more prevalent in both sexes due to growth spurt especially in girls where they are exposed to the risk of onset of menarche. Prevalence of anemia is very high in vulnerable groups even in higher socioeconomic status. Prevention of anemia is effective when the strategy is focused right from adolescence for their future reproductive life and this will contribute to achieve Millennium Development Goals (MDG).

**Panigrahi and Sahoo (2011)** correlated Nutritional anemia with epidemiological indices among women of reproductive age in an urban slum of Bhubaneswar, Orissa. The prevalence of anemia was found to be 60.8%, of which 39.6, 20.0 and 1.2% women had mild, moderate and severe anemia, respectively. Statistical analyses have shown that epidemiological factors like age, education of
respondents, socioeconomic status, history of excessive menstrual bleeding and inadequate intake of green leafy vegetables and pulses were found to be significantly associated with anemia.

**Ansari and Nagina (2010)** examined the frequency and nutritional risk factors of iron deficiency anemia among 200 women of reproductive age of 15-45 years in Karachi, Pakistan. The study findings indicated that 44.5% of them were found to be anemic. Community based program to monitor the severely anemic cases will help to overcome iron deficiency anemia.

**Karkada (2010)** reported that anemia is a silent emergency among the women of reproductive age group (15-45). As per, prevalence of anemia among the reproductive age group was very high (72.6%) in India. The overall prevalence of anemia in India increased from 74.2% (1998-99) to 79.2% (2005-06). Nagaland had the lowest prevalence (44.3%), then Goa (49.3%) & Mizoram (51.7%). Bihar had the highest prevalence (87.6%) followed closely by Rajasthan (85.1%), and Karnataka (82.7%). As per statistical rate in 2006, the incidence rate of anemia among women aged 15-49 years in India was 55.3% and in Karnataka 51.5%.

**Pala and Dundar (2008)** addressed the prevalence of anemia and risk factors in women of reproductive age group in Public Health Training and Research Area, Bursa, Turkey. The prevalence of anemia was 32.8 per cent (hemoglobin level < 12 g/dl). Usage of
more than 2 sanitary pads in a day was found to be risk factors for anemia.

**Shobha Rao, et al., (2010)** examined the prevalence of anemia. A field tested structured questionnaire was administrated to obtain personal information, obstetric history, and dietary recall. The study findings revealed that 77% of the women were anemic out of which 28% of them had iron deficiency anemia.

**Varun Arora, et al., (2010)** examined the patterns of social inequalities in prevalence of anemia among women of reproductive age in India. The study was conducted using national representative data from National Family Health Surveys of India (1998/1999 and 2005/2006). A total of 1,64,760 married women aged 15–49 years from 25 Indian states were included in the study. Over the 7-year period, anemia prevalence increased significantly from 51.3% to 56.1% among Indian women. This corresponded to a 1.11-fold increase in anemia prevalence.

**Haidar and Pobocik (2009)** conducted a community based cross sectional study on iron deficiency anemia among women of reproductive age in Ethiopia. About 970 representative samples were selected systematically from the age group of 15 to 49 years. Hemoglobin was measured from capillary blood and for serum ferritin; venous blood from antecubital veins. The result showed that overall prevalence rate of iron deficiency anemia was 48.0%.
Prevalence of anemia, iron deficiency, and iron deficiency anemia was highest among 31-49 years old.

**Kalaivani (2009)** found that the prevalence of anemia in India is highest in the world. Prevalence of anemia is higher among women and preschool children. Even among higher income educated segments of population, about 50% of adolescent girls and women are anemic.

**Mei Ciu Chang, et al., (2009)** highlighted the prevalence of anemia in healthy adolescent girls and a reproductive-age group of adult women residing in an urban area. A total of 441 individuals comprising healthy, non-pregnant, non-lactating, reproductive-age women (aged 13 to 50 years) participated in the study. Prevalence of anemia amongst adults (41.7%) was higher than adolescents (28.3%). Nutrient intake of anemic adolescents was lower than non-anemic adolescents. The results highlighted on the prevalence of anemia among the adolescent girls and reproductive-age group of women, which may be helpful in combating this common disorder in the urban population.

**Negi, et al., (2009)** conducted a study to assess the prevalence of anemia among the women of reproductive age group (15-45) in Dehradun district. Two villages from each of the ten subcentres were selected for the study. From every village 10 women of reproductive age were randomly covered from different households. The results showed that the prevalence of anemia was
found to be 65.5% and 66.0% among the subjects respectively. Age and occupation of the women did not significantly affect the prevalence of anemia. An inverse relation emerged between the prevalence of anemia and literacy status.

**Sanjeev (2008)** estimated the prevalence of anemia among adolescent females and studied the socio-demographic factors associated with anemia. A total of 296 adolescent females (10-19 years old) were included in this study. The prevalence of anemia was found to be 35.1%. A high prevalence of anemia among adolescent females was found, which was higher in the lower socio-economic strata and among those whose parents were less educated. It was seen that anemia affects the overall nutritional status of adolescent females.

**Tupe, et al., (2008)** explored the influence of dietary factors of iron bioavailability and socio-demographic conditions prevalence of anemia among married women. The study included 173 married women (15-39 years old) from urban slums near Pune city. Diet was assessed by two random 24-hour recalls. The age, weight, height, education, family size, income, physical work, and number of days of menstrual loss were recorded. Fasting blood was analyzed for hemoglobin and serum ferritin. The prevalence of iron deficiency was 25.1%, and anemia was seen in 46.4% among married women.

**Melaku, et al., (2005)** estimated the magnitude of iron deficiency anemia among reproductive age group women.
A total of 22,861 women of reproductive age group (15-49 years) were examined clinically. The majority of anemia in women was in the category of mild (19.3%), moderate (10.3%) and severe (0.9%). Most affected respondents were in the age of 36-49 years.

**Malhotra, et al., (2004)** reported that the prevalence of anemia was higher among females than males. Especially the females those who were below 30 years had higher prevalence than the males who were more than 45 years.

**Jolly Rajaratnam, et al., (2000)** did a survey on the prevalence of anemia among adolescent girls was conducted by the Christian Medical College and Hospital. The respondents include 155 women of reproductive age group from the K.V. Kuppam block and 161 from the Gudiyatham block. Results indicated that prevalence of anemia among girls was 44%. Of these, 2.1% was severe, 6.3% moderate, and 36.5% mild anemia. Prevalence of anemia exists in 40.7% of pre- and 45.2% in post-menarchial girls.

**Section – II : Risk Factors and Causes of Anemia**

**Nguyen, et al., (2015)** developed the complex etiology of anemia to direct appropriate prevention strategies. Number of children and socio-economic status were directly associated with Hb concentration. Similarly, RBP was directly (0.27 per mg/dl) associated with Hb and also indirectly (0.09?mg/dl) with ferritin. Hookworm infection was indirectly associated with Hb through RBP and ferritin.
Charles and Dewey (2015) highlighted the multi-faceted etiology of anemia in Cambodia and emphasized the need for comprehensive nutrition survey in order to obtain better information and facilitate policy development.

Reed Mangels (2014) reviewed that iron from plant sources is less easily absorbed than the heme-bound iron of animal sources. Vegetarians and vegans should have a somewhat higher total daily iron intake than those who eat meat, fish or poultry. Legumes and dark-green leafy vegetables are especially good sources of iron for vegetarians and vegans.

Caryn (2013) stated that chronic blood loss occurring within the body from a bleeding peptic ulcer, hiatal hernia, a colon polyp or colorectal cancer causes iron deficiency anemia. Gastrointestinal bleeding can result from regular use of some over-the-counter pain relievers, especially aspirin.

Bhanushali, et al., (2010) stated that the main reason of Iron deficiency anemia is excessive loss of iron or demand of iron associated with menstruation and child birth. Due to poverty, inadequate diet, pregnancy, lactation, poor educational level and poor access to health services women become an easy prey for anemia.

A Systematic Analysis for the Global Burden of Disease Study (2010) listed the factors of iron deficiency anemia, inadequate intake of iron through diets, parasitic infections,
gastrointestinal diseases, growth spurt, menstrual blood loss, pregnancy and lactation are the common causes leading to IDA. Hence, women need to take adequate dietary iron in day to day diet.

Karkada (2010) analyzed the factors influencing anemia among anemic adolescent girls. The result specifies the factors responsible for anemia among anemic adolescent girls were decreased calorie intake, protein intake and iron intake. The study concluded that the knowledge of causes of anemia among adolescent girls about food containing iron was less.

Leenstra, et al., (2004) evaluated the severity and risk factors of anemia in adolescent schoolgirls in an area with intense malaria transmission in western Kenya. Malaria and schistosomiasis were the main risk factors for anemia in younger girls (12-13 years), while menstruation was the principal risk factor in older girls (14-18 years). Iron deficiency and anemia in school-attending girls in western Kenya were more prevalent than in developed countries. It deserves further study to determine if adolescent girls not attending school are at higher risk of anemia (high ESR) was most common among anemic elderly individuals.

Stephen (2009) showed higher prevalence of iron deficiency associated with increased family income. The findings with respect to prevalence of iron deficiency and family income are contradictory to the belief that poverty is a contributing factor to iron-deficiency anemia because families living at or below the poverty level may not
be getting enough iron-rich foods. Again, one should mention that family behavior and social habits regarding eating and food types might contribute to these differences.

**Bharati, et al., (2008)** reported that the different categories of age have impact on anemia. The study found that the women of reproductive age who had children aged less than 5 years had significantly lower Hb than women who had children aged more than 10 years. In particular, the average of Hb was lowest in women who had children less than 2 years old, and then followed by between 2 and 4 years old.

**Hodges, et al., (2007)** concluded that globally the most important cause of anemia is believed to be iron deficiency due to inadequate dietary intake, physiologic demands of pregnancy, rapid growth and iron losses due to parasitic infection. Other prevalent causes of anemia include malaria, chronic infection and nutritional deficiencies of vitamin A, folate and Vitamin B12. Vitamin C is a well known enhancer of iron bioavailability. Several researchers have reported relationship between Iron and vitamin A.

**Brady (2007)** stated that an intestinal disorder, such as celiac disease, which affects the intestine’s ability to absorb nutrients from digested food, can lead to iron deficiency anemia. If part of small intestine has been bypassed or removed surgically may affect your ability to absorb iron and other nutrients.
Mennen, et al., (2007) reported that there is no relation between black, green or herbal tea and iron depletion in a general apparently healthy adult population. The women (15-49 years) often consumed tea, but did not have effect on iron status. It is recommended that the women should not drink tea during mealtime (one or two hours later), as the tea would inhibit iron absorption.

Gandhi, et al., (2005) established an association between iron metabolism and hypovitaminosis A. Anemia provoked by vitamin A deficiency resembles Hypochromic anemia. Vitamin A binds with iron during digestive process and forms a complex that acts as a chelating agent, thus blocking the effect of hydroxyl radicals present in phytates and polyphenols in flour and tea / coffee respectively. After supplementation with Vitamin A, hematologic evidence and measures of iron status have improved Vitamin A can play a role in improving utilization of available iron.

Powers (2005) pointed out that the inhibition of absorption of non-haem iron is caused by phytates, which are found especially in cereal products. A study reported that wheat is a highly consumed cereal crop, on a worldwide scale; it contributes approximately 30% of the total cereal production, making it a major source of minerals for many people (McKevith, 2004). Another study in rural Malawi reported that a community-based method to remove dietary phytates has been used, which resulted in an improved iron status
Cereals and grains containing phytates could hinder the absorption of iron, the cereals and food made from grain were consumed by the absolute majority of women of reproductive age. Results suggested the reduction of the consumption of foods with phytates and the increasement of iron fortification on the major staple foods such as wheat flour or corn flour.

Iron is needed to produce hemoglobin in red blood cells, and iron deficiency is most common during periods of life when iron requirements are high due to rapid growth, menstruation and reproduction, such as infancy, early childhood, adolescence and pregnancy. Healthy normal weight newborns usually have adequate iron stores at birth to last them until about six months of life, provided they are exclusively breastfed. However, 36% of infants in Bangladesh are born with low birth weight (UNICEF, 2005).

National Institute of Nutrition (2002) reported that adolescents often have chaotic eating patterns that do not conform to dietary recommendations. Many adolescent girls try to control their weight and inadvertently limit iron intake. Estimates suggest that about 25-50 per cent girls become anemic by the time they reach menarche. Other factors such as gender discrimination in intra-household food allocation and early marriage leading to early pregnancy also aggravate anemia. A survey conducted by National Nutrition Monitoring Bureau indicates that the daily intake of most
foods in Indian households, except for cereals and millets, is much below the recommended dietary allowances (RDA).

The bioavailability of haem iron, present in animal products, is high with absorption rates of 20-30%, whereas the bioavailability of nonhaem iron is determined by the presence of enhancing or inhibiting factors (Hurrell, 1997). The main enhancers of nonhaem iron absorption are meat (haem iron) and vitamin C (Cook and Reddy, 2001). Inhibitors include phytate (nuts, bran and oat products, whole-wheat and brown flour), polyphenols (tea, coffee, cocoa, some spices and vegetables), calcium (milk products) and Phosphorous (Reddy, et al., 2000).

In developing countries, low standards of living, low socio-economic conditions, restricted access to food and lack of knowledge for good dietary practices and personal hygiene contribute even more to a high occurrence of iron deficiency and hence anemia (Hall et al., 2001; Islam et al., 2001; Soekarjo et al., 2001).

Intestinal parasitic infection, due to poor hygienic conditions also interferes with iron absorption, thus expanding the prevalence of iron deficiency anemia in the developing world (Olivares et al., 1999; Musaiger, 2002).

Many studies reported that tea inhibits non-haem iron absorption to a considerable extent (Disler et al., 1975; Hurrell et al., 1999).
The above review on the causes of anemia confirmed that hook worm infestation, chronic blood loss, menstruation, frequent child birth, reduced intake of iron rich food contribute to the causes of anemia and it has within the overall context of global health, which will play on essential role in guiding the researcher and to develop prevention strategies.

Section – III: Signs and Symptoms of Anemia

People with an iron deficiency may experience the symptoms of a hunger for strange substances such as raw rice, ash (a condition called pica), upward curvature of the nails, referred to as koilonychias and Soreness of the mouth with cracks at the corners.

The symptoms of iron deficiency anemia can be very mild at first. According to the American Society of Hematology (2015), most women don’t realize they have mild anemia until they have a routine blood test.

The symptoms of moderate to severe iron deficiency anemia include general fatigue, weakness, pale skin, shortness of breath, dizziness, strange cravings to eat items that aren’t food, such as dirt, ice, or clay, a tingling or crawling feeling in the legs, tongue swelling or soreness, cold hands and feet fast or irregular heartbeat and brittle nails.

Signs and symptoms of anemia can often be subtle and vague. The review of literature regarding the signs and symptoms of
anemia has given an appreciation for better understanding in diagnosing anemia among reproductive age group women along with lab investigation.

**Section – IV : Diagnosis of Anemia**

Nicolas Galan (2015) suggested that Complete Blood Count test measures the amount of all components in the blood, including, Red Blood Cells (RBCs), White Blood Cells (WBCs), haemoglobin, hematocrit and platelets. The CBC test provides information about your blood that is helpful in diagnosing iron deficiency anemia. In iron deficiency anemia, the hematocrit and hemoglobin levels are low. Also, RBCs are usually smaller in size than normal.

World Health Organization (2011) recommended that the cyanmethemoglobin method for determining hemoglobin concentration is the best laboratory method for the quantitative determination of hemoglobin. It serves as a reference for comparison and standardization of other methods (94). A fixed quantity of blood is diluted with a reagent (Drabkins solution) and hemoglobin concentration is determined after a fixed time interval in an accurate, well-calibrated photometer. Sinha, et al. (2013) reported that the Cyanmethaemoglobin method was used to determine the hemoglobin level.

Karaoglu, et al., (2010) reported that anemia prevalence was 27.1% (Hb< 11.0 gr/dl). Having four or more living children being at
the third trimester and having a low family income were determined as the independent predictors of anemia in pregnancy. Anemia was also associated with soil eating (PICA) in the anemic women, 50.0% had a transferrin saturation less than 10% indicating iron deficiency, 34.5% were deficient in B12 vitamin and 71.7% were deficient in folate. Most of the anemias were normocytic-normochromic (56.5%) indicating mixed anemia.

Gibson (2005) accomplished that serum and erythrocyte ferritin concentrations reflect the level of storage iron. Serum measurements are simpler and are the more common of the two tests. Having been found to be directly proportional to the abundance of storage iron in normal subjects, serum ferritin concentration is used as a sensitive and specific index for ID. When used in combination with the measurement of Hb, serum ferritin distinguishes between the anemia of chronic disease and ID.

Brady (2002) reported that anemia is typically diagnosed on a complete blood count. Apart from the number of red blood cells and the hemoglobin level, the automatic counters also measure the size of the red blood cells by flow cytometry, which is an important tool in distinguishing between the causes of anemia. Examination of a stained blood smear using a microscope can also be helpful, and it is sometimes a necessity in regions of the world where automated analysis is less accessible.
Breymann (2002) indicated that in modern counters, four parameters (RBC count, hemoglobin concentration, MCV and RDW) are measured, allowing others (hematocrit, MCH and MCHC) to be calculated, and compared to values adjusted for age and sex. Some counters estimate hematocrit from direct measurements.

Kotech, et al., (2002) conducted a study on sample of 804 girls for serum ferritin and found a proportion of girls had serum ferritin levels less than 12 g/ml, indicative of poor iron storage.

Many authors had used cynmathemoglobin method for determining hemoglobin concentration to diagnose anemia. Also it was found to be better when compared to other methods for collecting for blood samples from the subjects.

Section – V : Knowledge on Anemia

Imunticha (2015) correlated the relationship between knowledge and practice on prevention of Iron deficiency anemia among the women of reproductive age. Knowledge analysis revealed that 55.8% had inadequate knowledge with regard to iron deficiency anemia and its prevention.

Mamtal and Tamphasana (2014) evaluated the knowledge of anemia among women of reproductive age group (15-49 years) residing in rural Punjab. The result illustrated that 52.5% were having average knowledge regarding anemia (causes, sign & symptoms & treatment). The overall mean score was 6.92. Age, education and working status of the females were found to have
statistically significant association with the knowledge score related to anemia.

**Maj and Laxmipriya (2013)** correlated the knowledge and practice level with selected variables such as age, educational qualification, occupation, and obstetrical score. The result revealed that 69% had good knowledge about prevention of anemia. 59.5% women were following good practices to prevent anemia. There is a significant positive correlation between knowledge and practice.

**Ghimire (2013)** associated the knowledge and practice of women of reproductive age group (15-45yrs) regarding the prevention of anemia. The result showed that there was significant association in level of knowledge to the educational status regarding prevention of anemia. Furthermore, there was significant association between the level of knowledge and the practice of women of reproductive age group on prevention of anemia.

**Ruhi (2013)** depicted that 31.7% of the women of reproductive age group obtained information and knowledge from mass media, 21.7% from books, 18.3% of respondents from Peer Group and 28.3% of them from Health Workers.

**Ahmad (2013)** stated that adolescents are especially vulnerable to anemia because of their rapid growth. Proper nutrition, including adequate iron intake, plays an important part of growth and development. Adolescence should acquire the knowledge and skills because iron deficiency and iron deficiency
anemia can affect their learning, growth and development. Therefore adequate information can help the teenagers to stay healthy and prevent iron deficiency.

Fredanna, et al., (2012) evaluated the knowledge, attitudes and behaviors of anemia among women. The participants responded to questions related to causes, prevention, treatment and complications stemming from anemia. Participants scored less than 50% on a ten-item scale assessing their anemia. A ceiling effect was observed for three items that were answered correctly by a high proportion of participants: does malaria cause anemia (n=149, 87%), does poor diet cause anemia (n=150, 88%), and blood loss due to menstruation cause anemia (n=152, 89%). Conversely, the following items had the lowest number of correct responses: does receiving a blood transfusion cause anemia (n=91, 53%), does HIV/AIDS cause anemia (n=85, 50%), does the common cold cause anemia (n=75, 44%), and does coughing cause anemia (n=55, 32%).

Mishra, et al., (2012) reported that educational qualification is a key determinant which affects the knowledge of women regarding nutrition and anemia. Working women has an opportunity to explore their knowledge outside home. It will give them an opportunity to interact with others, to increase their knowledge regarding anemia.

Wan Daud (2011) indicated that 87.9% agreed with the statement “IDA is preventable through intakes of iron-rich
Yet, quite a few of them failed to identify local foods, which are rich in iron and vitamin C. As regards the role of iron inhibitor and enhancer, 77.5% of them agreed that tea and coffee are not good for iron absorption.

**Shweta and Rita (2011)** studied the knowledge of women residing in hilly area of Uttarakhand regarding anemia. The study was confined to the women of age group of 18-45 years. A total of 223 women were selected randomly. From the outcome of the study, it was observed that mean percent knowledge score of subjects was 23.28. Knowledge scores were found to be increasing with decreasing age and they were significantly associated with educational status.

**Singh (2011)** described that as per the relationship of knowledge score anemia with selected socio-demographic variables is concerned some of the variables were found to have significant relation with knowledge regarding anemia. The most striking factor, which came out to affect the knowledge of subjects on anemia, was age, educational qualification and working status. All the categories of age were found to have statistically significant relationship with knowledge. The subjects falling under the age group as 15-25 years have more access to books and educational materials related to anemia which increase their knowledge.

**Mello, et al., (2010)** stated that there are a wide variety of local, seasonal and regional foods. The foods are rich sources of
both heme and non-heme iron. As iron deficiency anemia is a diet-related micronutrient deficiency, identifying and subsequently improving the knowledge of women about the breadth of their use and how to prepare them promotes self efficacy. Interventions that are based on a variety of locally available foods make it cost-effective. Health educators should work closely with the agricultural sector, urban gardens and local communities to provide a multipronged approach to ensuring availability and usability of locally grown foods.

Mirzoyan (2010) stated that most of the women residing in rural area of reproductive age had poor knowledge regarding anemia which may prevent them from seeking early treatment and adopting preventive measures.

Pandey (2010) scrutinized the knowledge on causes, sources, prevention of anemia, among the mothers of reproductive age group. It was observed that 98% stated inadequate iron containing diet as the cause of anemia. Regarding the knowledge on sources of iron rich foods, 47.5% stated green leafy vegetables, meat, fish, egg as important source of iron. About the preventive measures, 76.7% answered that iron containing foods should be taken, 72.1% stated the use of iron drug, 21.8% stated increase in birth interval, 10.2% stated treatment of worm infestation and 9.0% stated regular visit to physician as the preventive measures of anemia.
Rita (2010) revealed that educational qualification was significantly related to knowledge score. Women who never attended the school and women who studied up to secondary level had inadequate knowledge. This may be because of greater exposure to the information of the subjects with higher educational qualification.

Stang and Bayerl (2010) identified that adolescent girls were more aware than boys regarding anemia and its prevention. Screening and school health programs were needed to improve the knowledge on nutritional health and awareness about anemia.

Tabish and Li Yu (2010) appraised the level of awareness about causes, prevention and treatment of iron deficiency anemia among women of reproductive age in Hubei province, a southeastern province of China. Women aged 18-45 years without any previous history of medical or gynecological problems were recruited. A total 385 women were surveyed for Iron Deficiency Anemia (IDA). Among them 77.9% women (n=300) were aware of the term IDA, with the highest proportion of 88.1% falling in the age group 25-35 years. Most of the women were aware of the fact that their diet contains iron and its importance in health. Women who have children and belong to working class have greater knowledge about iron deficiency anemia.
Kalimbira, Mtimuni and Chilima (2009) revealed that 56.6% of the women were aware of anemia, with at least two thirds knowing its causes, ways of prevention, and treatment.

Chatterjee (2008) reported that normally women are not aware of their tendency of being anemic. They don’t have any complaints otherwise. It is only when they come for blood test for some disease.

Lower maternal education will lead to higher rates of anemia in the mother in rural areas. Though there are various programs started by the government of India, the prevalence of anemia remains higher especially among the rural population. The ignorance of rural women about anemia and lack of knowledge on preventive practices may still contribute to poor health conditions.

Anemia remains as a very common health problem among the women of reproductive age group which leads to high mortality and morbidity among the females. Most of the women have poor knowledge regarding anemia, its causes, prevention and management. The current review attempted to estimate the knowledge regarding anemia among women of reproductive age.

Section-VI: Effectiveness of Structured Teaching Programme in Prevention of Anemia

Kala and Christopher (2014) implemented the structured teaching program on knowledge and attitude of post-adolescent girls in prevention of iron and folic acid deficiency anemia at a
selected corporation school, Coimbatore. Major findings of the study revealed that during pretest 90% of them were had inadequate knowledge and 65% of them had unfavorable attitude towards iron and folic acid deficiency anemia. After the structured teaching program, the knowledge and attitude was improved (73% had adequate knowledge and 79% of them had most favorable attitude).

Greiner (2009) measured how communication proceeded among health workers and women in Southern India. Participants included 5 nurses, 10 health aides, and 10 (traditional birth attendants) TBAs working with maternal health care and education, as well as 32 women seeking reproductive health care. Those women who received health education where they lived, from health workers they knew, and together with participants familiar to them learned more about anemia prevention than others.

Manmeet and Kamaljit (2009) assessed the effect of health education on the KAP of women for prevention of anemia in a village of Chandigarh. Interpersonal and group communication approaches were used to communicate messages on anemia. The results revealed that 93.3% and 96.6% could specify at least one correct cause of anemia and identified a sign or symptom of anemia. The knowledge about methods of anemia prevention was significantly higher; 93% women were in favor of including green leafy vegetables in their diet. Hence, from the study it was concluded that nutrition
education is one of the appropriate, effective and sustainable approaches to combat iron deficiency anemia.

**Yusoff (2009)** compared the effectiveness between multimedia nutrition education intervention and non-nutrition education intervention in improving awareness level regarding iron deficiency among anemic adolescents. The awareness components assessed include the causes, symptoms and preventive measures of iron deficiency. Both interventions were implemented for 3 months. The changes in awareness among respondents of both groups were evaluated using multi-choices questionnaire. Multimedia nutrition education program conducted at school setting was in fact practical and effective in improving awareness on iron deficiency among anaemic adolescents.

**Sajjan (2008)** concentrated on the impact of nutrition education on hemoglobin status of rural adolescent girls in Dharwad. A total of 300 women of reproductive age group were selected. Specific information on the consumption pattern of green leafy vegetables indicated that the adequacy of green leafy vegetable was less than ten percent. Nutrition education intervention resulted in significant increase in the mean knowledge scores. The mean pretest knowledge score was 13.70 and was increased to 24.43 after intervention. The study concluded that nutrition education is one of the appropriate, effective and sustainable approaches to combat iron deficiency anemia.
Kakunte (2008) demonstrated the knowledge and nutrition education as a long term approach to combat iron deficiency anemia. A folder was developed consisting of brief information regarding iron, anemia, sources, enhancers, inhibitors, consequences of anemia and fortification. The knowledge assessment tool was tested thrice during the study period initially before the education, soon after the nutrition education and one month later and the subjects were classified on the scores obtained. Assessment of the knowledge immediately after the education programme revealed that 97.44 per cent of subjects scored high (>23) whereas 2.56 per cent scored medium (17-23) and one month later, the knowledge level revealed that 95.51 per cent scored high (>23) and 4.49 per cent scored medium (17-23), reflecting that the retention of knowledge is quite satisfactory during follow up assessment. The response improved after education intervention that could help to combat micronutrient malnutrition.

Minakshi (2008) addressed the effectiveness of structured teaching program on knowledge regarding iron deficiency anemia and its prevention among early adolescent girls in selected schools of Bhavnagar District. The overall pre -test mean knowledge score of adolescent girls was 13.81±3.67 and posttest mean knowledge score of was 22.71±2.35. The posttest mean knowledge score is significantly greater than the pretest mean knowledge score. It infers that structure teaching programme was effective.
**Werner and Bower (2004)** measured the impact of teaching programme on their level of knowledge of pre-university students. There was a significant improvement in the level of knowledge at the end of the programme, with the greatest improvement in those who attended most sessions. The low scores recorded for questionnaire administered before the teaching programme suggest that there is a critical need for improved in education.

**Iron Deficiency Anemia: Assessment, Prevention, and Control (2001)** a guide for programme managers. World Health Organization, stated that innovative measures must be developed to improve nutritional knowledge and awareness among mothers and health workers. Finally, nutrition education and intervention programs should address anemia with a focus on both the dietary quantity. All of these interventions must be monitored for effectiveness. It suggested the health authority to incorporate nutrition education intervention along with the supplementation program since both play an important role, particularly in correcting iron status and preventing reoccurrence of iron deficiency among adolescents.

The above literature has enabled the researcher to understand that structured teaching programme improve the understanding of people and meets specific learning needs of women of reproductive age group.
**Section – VII : Drumstick Leaves Supplementation**

Vanisha (2015) supplemented the Drumstick Leaves (DL) with its high beta carotene content (19690 mcg/100g) along with vitamin C from lemon juice for the mobilization of stored iron and to increase hemoglobin levels of anemic subjects. Based on pallor, 100/700 girls studying in the first and second year of the Faculty of Family and Community Sciences were selected and assessed for hematological Indices (Hb, Hct, PCV, MCV, MCHC) and red cell morphology and were divided into Group A (329 RE of Beta carotene from DL rich recipes (boiled mung/desi chana/kabuli chana) and 5.85 mg Vitamin C as lemon juice, n=21), Group B (329 RE from the above DL recipes, n=20) and Group C (recipes without DL leaves, n=21) for 45 days respectively. Post supplementation data revealed 28.6% reduction of anemia in Group A, by followed by 5% in group B and 4.7% in group C. There was a positive change observed for RBC, MCV and MCHC. Group B which received drumstick leaves showed small positive change in MCH.

Nadimin, et al., (2015) aimed to determine the effect of Moringa leaf extract for anemia prevention in women of reproductive age group. Hemoglobin (Hb) level was measured by cyanmenthemoglobin method using a hemocue. Hb levels of women of reproductive age group in a group of moringa leaf extract before intervention (11 283 ± 0777 g/dL) increased to 11 754 ± 1089 g/dL after intervention (p <0.040). Hb levels of women of reproductive age group in folic iron group also increased between before and after
intervention (p <0.002). The amount of increase in hemoglobin concentration of women of reproductive age group in folic iron group of 0.9886 ± 1.7638 g/dL was higher than moringa leaf extract group (0.4771 ± 1.3051 g/dL), but a large increase in hemoglobin levels between the two groups was not significant (p <0168).

**Mangala Subramanian (2013)** intended to introduce an efficient substitute in the form of non-haem iron of vegetable origin for iron deficiency anemia (IDA) among Indian women in reproductive age. Women belonging to lower socio-economic strata in suburban/rural Bangalore aged 15-45 were the target group. Sixty women suffering from IDA was taken where 30 women were assigned to the intervention group and 30 to the control group. The intervention group was then given a therapy which consisted of 100gm of *Moringa oleifera* and jaggery (dry weight) in a ratio of 80:20 for thirty days. The inhibitors of iron absorption (milk, phytates, and tannins) were not taken along with the supplements. After thirty days the haemoglobin levels were analysed again and recorded. At the end of the supplementation period (30 days), the women in intervention group showed an increase in hemoglobin level. By the Student’s t test, the post intervention data is highly significant (‘t’ value 4.109).

**Vanisha. Nambiar and Parul (2013)** demonstrated the antioxidant potential in green leafy vegetables which are rich sources of β-carotene, iron and other micronutrients. The efficiency
of beta carotene from shade dehydrated drumstick leaf (DDL) powder on the hematological indices of young women had a positive shift of anemic girls to the non-anemic category, a mild increase in Hemoglobin, a favorable change in the hematological indices and an increase in the normocytic normochromic cells.

Idohou-Dossou, et al., (2011) conducted a randomized study to test the efficacy of Moringa powder on iron status and weight gain in women. In an open-labelled randomized trial, 82 moderately anaemic, lactating women, aged 26.7± 6.5 years, received a weekly dose of either 100g of Moringa powder (Moringa group) or 120 mg iron sulphate with 0.5 mg folic acid (Control group). Data from 64 women (33 from Moringa group and 31 from Control group) were analyzed. Low plasma ferritin (<12 µg/l) indicating iron deficiency was found in 13 and 14 women from the Moringa and Control groups, respectively. After 3 months of treatment, mean haemoglobin concentrations significantly increased in both groups (p < 0.001), but iron stores were unchanged in the Moringa group while they significantly increased in the Control group-Indicating that consumption of Moringa leaves failed to restore iron stores in anaemic subjects. A slight improvement was observed in the prevalence of anemia in both groups, but anemia still persisted due to other reasons than iron deficiency anemia.

Shilpa Parnami (2008) advocated a diet including easily accessible and inexpensive green leafy vegetables to alleviate micronutrient deficiencies. However, some of the most nutritious
green leafy vegetables are underutilized—probably because of their taste. The aim of the present study was to standardize and organoleptically evaluate freshly blanched leaves of the drumstick tree (*Moringa oleifera* ) incorporated into three recipes commonly consumed in India. One serving of each of these recipes (30 g raw weight of pulses) could incorporate a maximum of 20 g of fresh drumstick. The drumstick leaf recipes were micronutrient rich, and each serving could provide 3955 µg β-carotene (665 retinol equivalents or RE), 46 mg ascorbic acid and 1.6 mg iron. Meal planners typically use a benchmark of the RDA, and these recipes could achieve the level for adult women in energy, vitamin C, iron and β-carotene respectively.

*Nambaiar and Seshadri (2007)* examined drumstick leaves and found moisture 79.2%, total iron 0.26±0.005mg, calcium 431.6±51.73 mg, phosphorous 133.57±6.51 mg, ascorbic acid 139±8.37 mg, oxalic acid 218±11.3mg, calcium: phosphorous (Ca:P) ratio 3.2:1 and calcium : oxalic acid ratio 1.9:1. Drumstick ranked second and fourth in ranking of highest content of ascorbic acid and Ca: oxalic acid respectively in comparison with colocasia, chana, radish, fenugreek.

*Muringa* has a potential benefit in improving the hemoglobin after administering three month of muringa leaf is a rich source of vitamin A, vitamin C, iron and calcium.
Section – VIII : Cauliflower Leaves Supplementation

Buvaneswari, and Ramya (2014) incorporated the dried form of the Cauliflower (Brassica oleracea) leaves powder in the common recipes to increase the nutrients and to treat anemia among the women of reproductive age group. Nutrient analysis proved Brassica oleracea leaves were found to have high Vitamin C – 54.27 mg/100gm, Beta Carotene – 42.58 mg/100gm, Iron – 60.78 mg/100gm. Three recipes were prepared with and without incorporation of the developed Brassica oleracea leaves powder. The powder was incorporated in 5%, 10%, 15% level in chocolate, cookies and green gram ball. Only 5% Brassica oleracea leaves powder incorporate recipes were highly acceptable; the recipes that had highest overall acceptability were selected for supplementation. After the supplementation period of 60 days their final hemoglobin and iron binding were analyzed. Hb levels of the selected samples were in the range of 7.4 to 10.3. Iron binding capacity levels of the selected samples were in the range of 228 mg/dl to 380 mg/dl. There is a significant difference between initial and final levels on supplementation with 5% Brassica oleracea leaves incorporated Cookies and Chocolate.

Preethi Rathi (2012) developed the process of drying of cauliflower leaves in mechanical dryer after taking trials for different temperature and time period. On the basis of organoleptic characteristics of powder, the leaves dried at 40°C temperature for 22 hrs were finalized. CLP was then analyzed for their nutritional
and anti-nutritional composition. On dry weight basis CLP contained 12.55 g moisture, 17.67 g protein, 1.76 g fat, 8.20 g fiber, 15.32 g ash per 100 g. Energy was found to be 256 Kcal. Calcium, phosphorus, iron was 3600 mg, 368 mg and 36 mg, respectively. Regarding anti nutrients it had tannins 40 µg, oxalates 0.201 g and phytates 11.3 g. The results revealed that CLP developed from cauliflower leaves serve as a source of micronutrients. Thus, CLP need to be popularized which will be helpful in overcoming micronutrient deficiency diseases. In addition, optimum utilization of these uncommon leaves will help in widening food basket.

Raj Kumari Kaul (2011) added cauliflower leaf powder into roasted wheat flour containing wide range of nutrients in enrichment of noodles. The results of the study indicated that samples of cauliflower leaf powder added noodles, for all addition levels, contained more protein, fiber and ash as compared to control sample. Thus, cauliflower leaf powder could be successfully used to enrich noodles, giving alternative utilization opportunity to producers and healthy choice option to the consumers.

From the above literature it is evident cauliflower leaves supplementation is an efficient means of improving the hematological variables as it is rich in iron and vitamin C. Enriching the common recipes with a cauliflower leaves was found to have increased the hemoglobin level of women
Section – IX: Nurses’ Role in Treatment and Prevention of Anemia

Iron deficiency anemia has some ill effects on mother and child as well. Maternal effects include reduced physical capacity and work performance, impaired immune response predisposing for infections, decrease in peripartum reserve, risk of cardiac failure and increased need for blood transfusions leading to negative reproductive consequences.

Nurses play a vital role in prophylaxis of iron deficiency anemia. She increases the awareness of women by teaching them to avoid frequent childbirths. Supplementary iron therapy should be encouraged when woman becomes free of nausea of pregnancy. Daily administration of 200mg of ferrous sulphate along with 1mg of folic acid is a quite effective prophylactic procedure. Proper nutritional education should be given to encourage increased intake of iron rich diet. Adequate treatment of disease like hookworm infestation, dysentery, bleeding piles, malaria and urinary tract infection should be done to prevent iron deficiency anemia. Early detection of Hb should be estimated at 1st antenatal visit, at 28th and finally at 36th week (Joyce, 2009).

When anemia exists after acute blood loss, dietary sources of iron will probably not be adequate to maintain iron pools. For every 2ml of blood lost, 1 mg of iron is also lost. Oral or parental iron preparations can be administered. Nursing intervention includes treating shock in acute blood loss and locating the cause and take
measures everyday in both acute and chronic blood loss (Basvanthappa, 2009).

Nurses should give nutritional education to increase the awareness of people especially mothers, pregnant and lactating women on the importance of consuming iron rich nutritious diet that can satisfy their specific requirement. They must consume adequate quantities of cereals, pulses, green leafy vegetables and also citrus fruits to increase the intake of iron and facilitate its absorption in presence of vitamin C. They must avoid drinking of tea or coffee and chewing of betel shortly after meals, to avoid interference in the absorption of iron. Non-vegetarian should increase their intake of meat, poultry, fish and eggs because these contain haem iron of high bio-availability that can promote the absorption of non-haem iron present in vegetarian foods (Dhaar, 2008).

Iron deficiency Anemia is commonly treated with iron supplements. Nurses must educate women about the intake of iron supplements and their side effects to maximize absorption. Supplements should be taken on an empty stomach with a food or beverage containing vitamin C, but not with calcium-containing foods or antacids as calcium hinders iron absorption. Common side effects of iron supplement treatment include constipation, nausea, and dark stools. Some women are able to reduce these symptoms by using a time-release supplement or by taking supplements in smaller doses throughout the day. For women who remain anemic
despite supplements, intra-muscular iron injections may be given (Marcia Stanhope, 2004).

A study was conducted on high prevalence of anemia among women in Mumbai. Iron-deficiency anemia is highly prevalent among women of reproductive age in South-East Asia. The study concluded that nutritional interventions reducing fertility, and iron supplementation during pregnancy were beneficial, but many women remain iron deficient (Loretta, et al., 2000).

Based on the literature review for this investigation, it is found that women are more prone to get anemic. So, the researcher selected the reproductive age group of women.