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EFFECTIVENESS OF RAGI PORRIDGE IN INCREASING HAEMOGLOBIN LEVEL AMONG ADOLESCENT GIRLS WITH ANEMIA

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CHAPTER I

INTRODUCTION

Anemia as a global public health problem is compelling and harmful as the epidemics of infectious diseases. With a global population of 6,700 million, at least 3,600 million people have iron deficiency and 2000 million out of these suffer from iron deficiency anemia. Children and women in reproductive age group are more vulnerable. WHO estimates that over one third of the world's population suffers from anemia. India continues to be one of the countries with the highest prevalence of anemia (Baniji Mathb, 2014).

Anemia is causing red alert for Indian women and children and we need to address it. In India besides focusing on prevention, we need to talk of curative treatment of rampant anemia to address health, education and economic consequences due to anemia (Vinay Aggarwal, 2017).

The health consequences of anemia in children and adolescents are well documented. In case of children, anemia affects their physical growth and mental development and as children mature, they are subject to other consequences as well, including reduced levels of energy and productivity, and impaired immune systems function. Both boys and girls need iron for their growth during adolescence, with girls having a continuing need to replace iron lost during menstruation (Samlee Plianbangchang, 2017)

Iron deficiency is the most common nutritional disorder in the developing world and the most common cause of nutritional anemia in young children and women of reproductive age. With 40 per cent prevalence of anemia in the world on an average for the general population, the prevalence in the developing countries tends to be three to four times higher than in the developed countries. In studies conducted in developing countries, adolescent anemia was reported as the greatest nutritional problem. In India the reported prevalence was 55 percent for boys and girls (Kotecha ,P.V.,2019).

1.1 Need for the Study: WHO anemia prevalence survey conducted between 1993-2005 shows that 76.1 % of pre-school children, 33.0% of school age children, 69% of pregnant women, 73.5% of non-pregnant women, 40.2% of men and 39.1% of elderly are globally affected with anemia.

In Tamil Nadu, the prevalence of anemia among children 1-5years is 62.7%, among girls 12-14years of age is 53.7%, girls 15-17years 59.4%, among pregnant women 69%, and among lactating women is 67.7% (NNMB, 2003).

In Coimbatore, over all prevalence of anemia among teenage girls was 67.2%, among them 52.72% had mild anemia and 14.9% had moderate anemia (Ajitha Virjileus,2002).

In Arasur , rural part of Coimbatore the prevalence of anemia among teen age girls was 61.4%(Anila P. Joseph,Caroline Susan George et al., 2005).

Adolescents consume highly inadequate diet poor in quality and quantity. While all nutrients are deficient, in particular the intake of calories, iron and vitamin A are highly unsatisfactory in meeting at least 50% of the recommended RDA allowances or less. When compared to other family members, both adolescent boys and girls met relatively less of their nutrient requirement with the adolescent girls showing the greatest deficit in terms of percent RDA met for iron (Prakash V Kotecha,2022).

The adolescent girls tend to skip meals greatly; they develop strong food beliefs and adopt food fads; lower intake of fruits, green leaves and vegetables than the recommended daily allowances of 5 servings per day.

The average daily dietary iron intake of adolescent girls is only among is only 1.15mg/dl, which is lower than the recommended ICMR allowances (Neethu Gupta, Kochar.G.K, 2019).

The best approach to combat mild anemia among population of a developing country would be through initiation of food fortification, creating more awareness about benefits of dietary diversification like use of iron rich diet, use of fresh fruits and green leafy vegetables. Iron and folic acid tablets supplementation is recommended to combat moderate and severe anemia (JilaniTanveer, Mohammad Perwaiz , 2019).

Thus, iron deficiency anemia is more prevalent among adolescent girls, and poor dietary pattern among adolescent attributes to the anemia. There is also complete lack of awareness about the importance of having an optimal hemoglobin level. Rarely the hemoglobin level checked during adolescence. Adolescent anemia is like the tip of ice berg, major part of iron deficiency is hidden as most adolescent with anemia are asymptomatic. This unnoticed state leads to major deleterious health effects. Early detection, nutrition awareness and dietary modification would reduce the severity of anemia .Hence a study on effectiveness of ragi porridge in increasing haemoglobin level among adolescent girls with anemia are selected for further research.

1.2 Statement of the Problem: EFFECTIVENESS OF RAGI PORRIDGE IN INCREASING HAEMOGLOBIN LEVEL AMONG ADOLESCENT GIRLS WITH ANEMIA AT GOVERNMENT GIRLS HIGHER SECONDARY SCHOOL, THONDAMUTHUR

1.3 Objectives:

1.3.1 Identify the prevalence of anemia among adolescent girls.

1.3.2 Assess the effect of ragi porridge on haemoglobin level of adolescent girls with anemia.

1.4 Hypothesis:

There will be significant difference in the pre-assessment and post-assessment haemoglobin level after administration of ragi porridge to adolescent girls with anemia.

1.5 Operational Definition:

1.5.1 **Anemia:** Anemia refers to decrease in heamoglobin level less than 12 gm /dl.

1.6 Conceptual Framework: Effectiveness of Ragi Porridge in Increasing Haemoglobin Level among Adolescent Girls with Anemia: The Conceptual framework adaptaed for this study was Widenbach's helping art theory model. The theory explains nursing as an art based on goal centered care. Central purpose refers to what the nurse wants to accomplish. Nursing practice consists of identifying a need for help, ministering the needed help, and validating that the need for help was met. Identification determines a person's need for help based on the existence of need. Ministration refers to provision of needed help. Validation refers to a collection of evidence that shows the need has been met.

The modified Widenbach’s helping art model explains the central purpose to increase the haemoglobin level by administration of ragi porridge to adolescent girls with anemia. Identification involves assessment of haemoglobin level of adolescent girls with mild anemia. Ministration includes administration of ragi porridge 200ml in the morning and evening. Validation includes reassessment of the haemoglobin level.

1.7 Projected Outcome: Administration of Ragi porridge to adolescent girls with anemia will be effective in increasing heamoglobin level.

CHAPTER II

LITERATURE REVIEW

The present study will reveal the effectiveness of ragi porridge in increasing haemoglobin level among adolescent girls with anemia. An extensive review was made to strengthen the present study in order to lay down foundation. This helps to reveal the prevailing situation of the similar studies in different areas. The related literatures for this study are divided under the different subtitles.

1. Studies related to prevalence and factors associated with anemia.
2. Studies where haemoglobin estimation was done by cyanmethaemoglobin method.
3. Studies where dietary supplements were used to prevent and control anemia.

2.1 Prevalence and Factors Associated with Anemia: A cross-sectional study was conducted in the urban area of Nagpur to study the prevalence of anemia among adolescent females and 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 significant association of anemia was found with socio-economic status and literacy status of parents. Mean height and weight of subjects with anemia was significantly less than subjects without anemia. 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 (Sanjeev Chaudhary, M., 2018).

Assessment of prevalence and associated causes of anemia among school girls of age 11- 14years in Masindi District, Western Uganda was done by a cross –sectional survey and the overall prevalence of anemia was found to be 45.9% among the 109 students. The prevalence was higher in urban schools 61 % than rural schools 30.9%. There was more consumption of plant food of low iron bioavailability than animal food. This resulted in majority of pupils having less than recommend intake of iron 50.5%. Anemia was associated with nutrient content of food, worms, location of school and bleeding (Barugahara,2018)

The anemia status and awareness about anemia among the adolescent girls was analyzed in 16 high schools located in two randomly selected Hatnura and Kondapur mandals of Medak district to find out. Among the 1811 adolescent girls between 10 and 15 years of age, iron deficiency anemia was detected in 85% of adolescent girls. Mild, moderate and severe grades of anemia were 63.25%, 12.5% and 5.3%

respectively. Signs and symptoms of anemia like pale eyes, tongue, nails, fatigue, breathlessness, poor appetite and lack of concentration was 12.5%, 14%, 9.2%, 26.5% and 8.6% girls respectively (Indian Institute of Health and Family Welfare Annual Report,2003).

A study was conducted in rural areas of Meerut district to find out the prevalence of anemia among adolescent girls and to study their socio-demographic characteristics in relation to anemia. Among the 504 adolescent girls included in the study 174(34.5%) girls were anemic. The prevalence of mild, moderate and severe anemia among adolescent girls was 19%, 14.1% and 1.4% respectively. The prevalence of anemia was higher in socio economic class V (50%) and reduced with rise in socio economic status, being minimum 27.3% in class I. Adolescent girls whose fathers were labourers were more anemic (44%) than whose fathers in agriculture (27.1%). Prevalence was higher (42.2%) in adolescent girls having illiterate mother and just literate mothers (51.9%). High level of anemia was observed in adolescent girls belonging to family size > 3(38%) than those from families of size ≤3 (27.2%) (Rawat, C. M. S., 2021).

At slum, areas of Ahmedabad city a study was conducted to high light the problem of anemia in school going pre-adolescents and adolescents girls residing in the slums and to determine the relationship between the prevalence of anemia and various socio–demographic variables. Among 1295 school girls (6-18 years) residing in 15 randomly selected slum areas majority 81.8% of girls were anemic out of which 55.2% were mildly anemic 36% moderately anemic and 0.6% severely anemic. Anemia was found to be higher among girls with the attributes of those with habit of post meal consumption of tea/coffee (94.4%), whose father's were working as semiskilled/skilled workers (77%), those with BMI of 18.5 or lower (82.4%). The prevalence of anemia was lower in girls consuming green leafy vegetables. No relationship of anemia was observed with socio-economic status, parents' education, status of menstruation and daily consumption of lemon/ sour fruits (Verma. A.,2021).

Indian Council of Medical Research had undertaken multicentre study in 18 districts from 13 states of the country to assess the iron deficiency disorders. A community based survey was conducted including rural and urban children (<12 years) adolescent girls (11-18years) and pregnant women. Around 11,260 pregnant women and adolescent girls were covered for anemia screening. The overall prevalence of anemia among 4,332 non-pregnant adolescent girls from 16 districts was 90.1%.The overall prevalence of severe anemia was 7.1%, moderate anemia was 50.9% and mild anemia was 32.1% (Tuteja .G.S., 2016).

While approximately 8% of women are estimated to be iron deficient in the west, 10 - 20 % of younger girls are affected. Although these girls often appear to be in good health, low iron levels profoundly affect many aspects of their day to day lives, including an ability to concentrate, and thus learn, in school (Mike Nelson, 2022).

A cross–sectional study was conducted to find out the epidemiological corelates of nutritional anemia among adolescent girls with anemia at rural Wardha. The prevalence of anemia was 59.8%.The prevalence of severe, moderate, mild anemia was 0.6%, 20.8% and 38.4% respectively.The impotant corelates of anemia was found to be vegetarian diet, excessive menstural bleeding,iron intake and worm infestation (Kaur.S.,2018).

Iron deficiency anemia is a major nutrtional disorder in India and other developing countries.Large population surveys in rural India indicate that the prvalence of anemia according to WHO criteria ranges from 42% to 77% among different age groups. The prevalence of anemia is higher among children than the adults have. The prevalence is higher among girls 68.8% and women 64% than boys 56.8% and men 48%, respectively (Narasinga Rao.B.S.,2017).

A study was conducted to assess the prevalence of anemia among the vulnerable groups in rural areas of Jarkand. Heamoglobin estimation was carried out by cyanamethheamoglobin method on 597 preschool children, 548 pregnant women and 587 lactating mothers. The overall prevalence of anemia was 84 % among preschool children, 91% among pregnant women and 98% among lactating mothers. 5.5% preschool children, 12.7% pregnant women and 8% lactating mothers had severe anemia (Brahmam, 2018).

Nutrition foundation of India carried out a study on prevalence of anemia in seven states in India.The prevalence of anemia was lowest in Kerala and highest in Madhya Pradesh.Women in Kerala had higher literacy, better housing, better access to mass media and health care.In Tamil Nadu 90% were anemic, in Kerala 58% and 68% were anemic in Himachal Pradesh (Nutrition foundation of India,2005).

Even today nearly 1.5 billion people all over the world are affected by iron deficiency anemia. In India alone, depending on age and sex, iron deficiency anemia has been reported to range from 38-72%, majority of them being women and children.The iron deficiency anemia prevalence rate beyond the age of 6 years increases in girls. This could be due to certain factors like menstruation, gender discrimination in intra household food allocation and early marriage leading to early pregnancy. Adolescent girls form 22% of the total population and estimates suggest that about 25-50% girls become anemic by the time they reach menarche (Sharma, 2020).

A study was conducted at nursing school of Vadodara on prevalence of anemia among students and to compare the nutritional status with the prevalence of anemia. The overall prevalence of anemia was 86.8% among 167 students, the prevalence of severe anemia was 1.2%, moderate anemia 43.11% and 42.5% had mild anemia. Anemia was uniformly widespread among all levels of nutritional status of students. The prevalence of anemia remained high and did not differ between all three groups of BMI, that is between those who were normal, under weight and over weight (Karkar.P.D., 2014).

Iron deficiency is the most common cause of anemia in adolescents in the United States, and an adolescent girl is 10 times more likely to develop anemia than a boy. Teenagers are at the highest risk of anemia during their adolescent growth spurt. Among girls, however, menstruation increases the risk for iron deficiency anemia throughout their adolescent and childbearing years. An important risk factor for iron deficiency anemia is heavier than normal menstrual bleeding, which affects about 10% of women in the United States (Lloyd Van Winkle, 2019).

A community based cross- sectional study was carried out among 250 adolescent girls aged 13-19 years in an urban community of Gulbarga to assess the health problems and suggest measures for improvement of health status of adolescent girls. The overall prevalence of anemia was found to be 94% and was higher in the age group of 17-19 years96.7% as compared to other age groups 13-15 years of age 95.1% and in the age group of 15-17 years 88.2% (Indupalli.A.S.,2014).

2.2 Haemoglobin Estimation by Cyanmethaemoglobin Method: A cross-sectional survey was conducted in an urban area under Urban Health Training Center, Department of Preventive and Social Medicine, Government Medical College and Hospital, Nagpur to estimate the prevalence of anemia among adolescent females and to study the socio-demographic factors associated with anemia. Hemoglobin estimation was done by the cyanmethaemoglobin method using a Klett-Summerson photoelectric colorimeter with green filter and the prevalence of anemia was found to be 35.1% (Sanjeev. M. Chaudhary, 2018).

A study was conducted to assess the prevalence of anemia among the prevalence of anemia amongst the primary school age children 6-11 years of age in National Capital Territory of Delhi. Haemoglobin estimation was carried on by indirect cyan-methaemoglobin method within a week of collection of blood sample The children having Haemoglobin levels < 7,7-< 10.5 and 10.5-< 11.5, 11.5 and more gm/dl were classified as having severe, moderate, mild and no anemic respectively. The prevalence of mild moderate and severe anemia in this age group was reported as 22%, 43% and 4% respectively (Sethi.G.,2022).

A study was conducted to assess the nutritional status of adolescent girls at the Government Senior Secondary School in village Chandawli of District Faridabad in Haryana among students of Classes six to twelve. Haemoglobin was estimated by cyan-methaemoglobin method using a calorimeter. Known standards were run along with the test samples for maintaining quality control. The prevalence of anemia was noted to be 39.6% (Anand.K. 2018).

A study was conducted on identification of an appropriate strategy to control anemia in adolescent girls of poor communities. The investigations included measurements of height, weight and haemoglobin levels, haemoglobin status were estimated by cynamethaemoglobin method using the filter paper technique. Since a major part of the study was carried out in distant village. This technique was found feasible (Sharma Anshu, 2020).

An epidemiological survey was conducted to find out the prevalence of anemia among adult males and non-pregnant females in rural North India.The haemoglobin status was estimated by direct cynamethaemoglobin method. The prevalence of anemia among females was 50% while among males it was 44.3% (Malhotra.P.,2013).

A study was carried on by the Indian council of medical research to assess the status of anemia among pregnant women and adolescent girls from 16 districts of 11 states of India. Anemia was diagnosed by estimating the hemoglobin concentration in the blood with the use of the indirect cyanmethaemoglobin method method.The survey showed that 84.9% were anemic (Toteja.G.S., 2016).

To accurately measure the haemoglobin photoelectric devices are used to assess the amount of light absorbed by a blood sample. Cyanmethaemoglobin method is the international standard for haemoglobin determination as stable reference solutions are available for calibration. Sensitivity approach is100% and specificity is greater than 90%(Path ,2019)

A hospital based study was conducted at a rural area in Haryana To compare the hemoglobin estimates obtained from filter paper cyanmethemoglobin and hemocue method. It was revealed that the hemocue method overestimated the hemoglobin values when compared to the filter paper cyanmethemoglobin method by 1.8 g/dl (Pathak, Kapoor et al.,2019).

2.3 Dietary Supplements to Prevent and Control Anemia: A randomized, controlled double-blind trial conducted in 2007 at a state-run school in Sobral, Brazil, among children aged 2-3 years. The study objective was to evaluate whether regular consumption of rapadura (jaggery) as a natural sweetener in fruit juices (mixed with ascorbic acid) is capable of preventing or treating anemia in preschool children. The study was carried out over 12 weeks among two groups of children aged 2–3 years. One group was given cashew fruit juice sweetened with 25 g of jaggery mixed with 40 mg of ascorbic acid, while the other group received the same quantity of cashew juice and ascorbic acid sweetened with refined sugar. The study took place over 56 school days .The jaggery -fortified beverage and the beverage sweetened with refined sugar were offered to the intervention group and the control group, respectively, in individual (200-ml) portions. For the group consuming the jaggery –fortified beverage mixture, mean Hb 11.1 ± 1.09g/dl at baseline and 11.6 ± 2.10 g/dl after intervention. For the control group, mean Hb was 10.2 ± 1.20 g/dl 3.11% at baseline and 10.3 ± 1.26 after the intervention (Gopi.Ghosh.N ., 2016)

A longitudinal human feeding trial was conducted to evaluate the use local foods for increasing heamoglobin level. One ragi based diet and one rice based diet was evaluated, 25 pregnant women received ragi based diet and 25 received rice based diet and 25 served as non supplement control group. These women were followed through pregnancy, delivery and 18 months of lactation their infants were also monitored from growth to school age. An improving trend in health status of women and growth pattern of their children was noticed compared to the control counterparts. For the multi generational study 35 young women who were in the earlier study were followed up during their first pregnancy and data was compared with those from their own mothers. Remarkable improvement in birth weight and other measures were evident. Heamoglobin level of the intervention group in second generation was 13.8 gm/dl and first generation intervention group was 8.5gm/dl. Heamoglobin level of the control group in second generation was 10.0gm/dl and first generation control group was 8.3gm/dl (Devadas. R.P., 2021)

A quasi experimental study was conducted to develop an iron rich supplement with locally available foods and to test its feasibility in school going children (7-9 years) belonging to low income families. Children from the upper primary school in Rajendra Nagar were screened for haemoglobin levels and 36 children having haemoglobin levels below 11 g/dl were selected. A supplement food was developed using locally available foods like jaggery, processed rice flakes, cress seeds, and amaranth seeds (45 : 40 : 10 : 5). The, children were given one ladoo per day for a period of 60 days. Effect of supplement on haemoglobin levels, height and weight were assessed. Significant increase in hemoglobin levels was observed in both the boys and girls after 30 days of supplementation only. The increase was comparatively more in the first 30 days than the second 30 days. In majority of the subjects progression from one Haemoglobin levels to the next higher level was observed (Sood, 2022).

An experimental study was conducted at three primary schools in Salem district to assess the effect of weaning biscuits supplementation of the nutritional parameters and cognitive performance of the selected children. Eighty Grade II malnourished primary school children were divided into four groups with twenty subjects in each group and given the weaning biscuits. 20 children kept as control group they are on home diet only. 20 children supplemented with Potato flour biscuits. 20 children supplemented with Wheat biscuits. 20 children supplemented with Ragi biscuits. Each supplemented groups received six biscuits comprising the weight of 60 grams daily for three months. Anthropometric measurements like height and weight, clinical picture for signs of anemia were studied before and after supplementation Supplementation with potato biscuits, wheat and ragi biscuits had wiped out the symptoms of pot belly and oedema (symptoms related to PEM) where as in control group there symptoms still existed. Reduction in anaemia related symptoms of brittle and spoon shaped nails were notable in supplementation group, and this may be a reflection of the increased hemoglobin level. In general, reduction in all the clinical symptoms of nutritional disorders was observed in supplemented groups than in the control group (Peerkhan Nazni, 2010).

A study was conducted on children in the age group of 7 - 9 years from primary corporation school located in the urban areas of Chennai district to reduce the prevalence of iron deficiency anemia and also to improve the immune status, school performance through dietary supplementation with micronutrient rich foods. The children with moderate anemia were divided into three groups of 50 children each to receive the food based supplement micronutrient rich balls prepared from wheat germ (60 g), gingelly seeds (5 g) and rice flakes (15 g) mixed with jaggery syrup (11gm) and made to balls, second group synthetic supplement Riconia tablet a micronutrient fortified tablet and the third group constituted the control group. The supplementation was for a period of six months children received 50gm of two balls daily. At the end of the supplementation study, all the children who received iron supplements in the form of food recorded the highest increments (5.5 g/dl) in blood haemoglobin level. At the end of the study all the children except those in the control group had more than 12 g/dl of haemoglobin indicating normal iron nutritional status (Narayanasamy Sangeetha , 2019)

The best sources of iron among the cereals are ragi and bajra. At least twice a week, you can take it in the form of porridge, preferably every day. Use jaggery instead of sugar to sweeten milk, desserts, etc as jaggery has a high iron content. (Lily Madlok, The Hindu, May 26, 2003).

CHAPTER III

MATERIALS AND METHODS

The present study is designed to determine the effectiveness of ragi porridge in increasing haemoglobin among adolescent girls with anemia. This chapter includes the research design, setting, population and sampling, sample size determination, criteria for selection of samples, instruments and tools for measuring variables, techniques of data collection, methods of data analysis and the report of pilot study and needed changes to be incorporated for the main study.

3.1 One - Group Pretest - Posttest Design: One group pretest and posttest design is a type of quasi-experimental design. It is developed to explain relationships and examine causality between selected independent and dependent variable (Burns.N., 2007). In this study, this research design was selected to explain the relationship and causality between administration of ragi porridge and increase in haemoglobin level. Pre- assessment of haemoglobin level was done for the entire study population and the adolescent girls with mild anemia were selected as the sample for the study, base line information was collected from the adolescent girls and signs and symptoms of anemia was examined. Supplementation of ragi porridge was given for three weeks and post- assessment of haemoglobin level was carried on at the end of three weeks (Figure 3.1).

3.2 Setting: The study was conducted at Government Girls Higher Secondary School, Thondamuthur, Coimbatore, Tamilnadu. The Government Girls Higher Secondary School, Thondamuthur comprises of classes starting from 6^{th} to 12^{th}.The school is located in rural area about 25kms away from the centre of Coimbatore.

Figure 3.1

One Group Pretest - Posttest Design

Pre-test

(Pre-Assessment of haemoglobin level)

→

Treatment

(Supplementation with Ragi Porridge)

→

Post- test

(Post-Assessment of haemoglobin Level)

The total strength of school is 1163. The strength of 9th standard is 207. In 9th standard there were four sections with Tamil as medium of instruction and one section with as English as medium of instruction. In four Tamil medium sections there were 60 students in each and in English medium 27 students. The working hour of school is for 1 hour 40 minutes with lunch brake for 45 minutes.

3.3 Population and Sampling: The population of the study was 198 adolescent girls studying in 9th standard who attained menarche. Haemoglobin estimation was done by cyanmethaemoglobin method for 198 adolescent girls and among them 87 adolescent girls with mild anemia of haemoglibin level 10.0-11.9gm/dl was included as samples in the study. Adolescent girls with moderate anemia of haemoglobin level 7.0-9.9gm/dl, girls with severe anemia of haemoglobin level < 7.0gm/dl and girls not anemic with normal haemoglobin level of 12.0-14.0g,m/dl were not included in the study.

3.4 Criteria for Selection of Samples:

3.4.1 Inclusion Criteria:

Adolescent girls with mild anemia with a hemoglobin level of 10.0gm/dl to 11.9gm/dl.

3.4.2 Exclusion Criteria:

3.4.2.1. Adolescent girls with moderate haemoglobin level of 7.0gm/dl to 9.9gm/dl and with severe anemia haemoglobin level less than 7gm/dl.

3.4.2.2. Adolescent girls not attained menarche.

3.4.2.3. Adolescent girls on treatment for anemia.

3.5 Variables of the Study:

3.5.1Independent Variable: The independent variable in this study refers to administration of ragi porridge for the participants in the study.

3.5.2 Dependent Variable: The dependent variable in the study refers to the haemoglobin level of the participants in the study.

3.6 Instruments and Tool for Data Collection: The instruments used for collection of data were cyanmethaemoglobin method for analysis of haemoglobin, questionnaire to collect the base line information and factors related to anemia and general examination of signs and symptoms of anemia.

3.6.1 Cyanmethaemoglobin Method: Haemoglobin estimation was done with the help of lab technician for the diagnosis of anemia, from each child the blood sample was collected by finger prick method using a sterile lancet. The first two drops were discarded on a glass slide. Then 20 µl of blood was pippeted and transferred to a glass bottle containing 5 ml Drabkins reagent. Hemoglobin estimation was done by the cyanmethaemoglobin method using a Klett-Summerson photoelectric colorimeter.

3.6.2 Questionnaire to Assess the Baseline Information: The questionnaire framed is to have two sections. Contents included in these sections are, the first section included the basic demographic details, the second section included questions on factors related to anemia like menstrual history, dietary pattern and history of worm infestation.

3.6.3 General Examination: In general examination, history was collection on symptoms of anemia, anthropometric measurements height and weight was assessed and physical examination was done to rule out the signs of anemia.

3.7 Administration of Ragi Porridge: 200ml of Ragi porridge was prepared from 20gm of ragi and 40 gm of jaggery and administered to the adolescent girls with anemia for three weeks. The iron content of 20gm of ragi is 1.08mg and the iron content in 40gm of jaggery is 4.58mg. Hence the tot amount of iron supplemented each day was 5.7mg.

3.8 Technique of Data Collection: Informed consent was obtained and the prevalence of anemia was studied among 198 adolescent girls by haemoglobin estimation with cyanmethaemoglobin method. The haemoglobin estimation was done for first three days. Among the 198 girls, 87 girls were identified to have mild anemia with haemoglobin level of 10.0-11.9gm/dl, they were selected as participants' for the study. Then base line data regarding the demographic profile and details on factors related to anemia, like their menstrual history, dietary history and history of worm infestation was collected. General examination was also carried on, history was collected on symptoms of anemia, height and weight were measured and physical examination was done to note the signs of anemia. 200ml of ragi porridge supplementation was given for three weeks. After three weeks of supplementation post assessment of haemoglobin was done for 84 adolescent girls by cyanmethaemoglobin method. Three samples dropped out from the study one had intolerance to ragi,one was not willing to continue to be the subject and one girl was absent for the post –assessment.

3.9 Method of Data Analysis and Interpretation: Both descriptive and inferential statistics are used to analyze the data. Data is presented in frequency tables. Statistical analysis of't' test is applied to test the effectiveness of ragi porridge in increasing haemoglobin level.

3.9.1 Paired't' test: This test is used to identify whether there is significant difference in pre and post assessment values of haemoglobin level among adolescent girls with anemia.

$$'t' = \frac{d}{SD/\quad n}$$

d =Mean difference between pre assessment and post assessment score

SD= Standard deviation between pre assessment and post assessment score.

n = Number of sample.

3.9.2 Karl Pearson Coeeficient of Correlation: This test is done to find the relationship between signs of anemia on pre-assessment value of haemoglobin level.

$$'r' = \frac{\sum XY}{\sum(x-x)^2(y-y)^2}$$

X=Difference in postassessment value of haemoglobin level.

Y=Factors related to anemia

3.10 Reliability and Validity of the Tool: The tool is prepared with the help of various literature review and experts guidance. The practicability of the tool was tested through the pilot study.

3.11 Report of the Pilot study: Pilot studywas conducted to test the validity and practiicability of the tool and feasibility of conducting the study. The pilot study was conducted at the high school. Prevalence of anemia was studied among 21 adolescent girls studying in 9th standard. Among the 21 adolescent girls, 12 girls had mild anemia,with the haemoglobin level of 10.0gm/dl-11.9gm/dl were included as samples in the pilot study. Two girls were absent and hence they were dropped out from the study samples dropped out from the study. The haemoglobin analysis was done by cyanmethaemoglobin method, base line data regarding the demographic profile and details on factors related to anemia, like their menstrual history, dietary history and history of worm infestation was collected. General examination was carried on, history was collected on symptoms of anemia, height and weight were measured, and physical examination was done to note the signs of anemia. 200ml of ragi porridge was administered in morning and evening for ten days. Post assessment of haemoglobin analysis was done after ten days. On the first day ragi porridge was prepared with 25gm of ragi and 30gm of jaggery,the iron content of the supplement was 5mg. But the amount of porridge was excess and hence on the second day the ragi content was reduced to 20 gm and jaggery content was increased to 40gm, the iron content of the porridge was 5.7mg. The total amount of iron supplemented in a day through ragi porridge was 11.4mg. After the data collection the data was tabulated and analyzed. The findings highlighted that among 21adolescent girls 12 girls had mild anemia and 6 girls had moderate anemia none had severe anemia. The mean difference in hemoglobin after administration of ragi porridge was 1.3 gm/dl. The findings showed that there was significant difference in the pre assessment and post assessment of haemoglobin level ('t'value was at 0.05 level of significance). Hence, there was a significant increase in the haemoglobin level after administration of ragi porridge.

3.12 Changes Brought after Pilot Study: In tool, no modification was brought after pilot study. The girls were not able to mention the correct amount of food items consumed in dietary diary for 24 hrs only the name of food items were mentioned, hence the dietary diary was dropped. Due to practical difficulty in preparation of porridge for a large sample, it was decided to administer once a day.

CHAPTER IV

DATA ANALYSIS AND INTERPRETAION

Data analysis is the systematic organization and synthesis of research data and testing of research hypothesis using those data. Interpretation is the process of making sense of the result of a study and examining their implication (Denis, P.F., 2004). Analysis is the method of rendering qualitative data as meaningful and providing intelligent information. The research problem can be studied and tested including the relationship between variables.

In this study, effectiveness of ragi porridge in increasing haemoglobin level among adolescent girls with anemia was assessed. The data was collected, assembled, analyzed and tested individually and described. The findings based on the statistical analysis are presented in this chapter.

4.1 Prevalence of Anemia among Adolescent Girls: A total of 198 adolescent girls studying in 9th standard were assessed for prevalence of anemia. Haemoglobin level estimation was done by cyanamethaemogloin method. The study population included 198 adolescent girls, among them 99 (50%) of adolescent girls were observed to have normal haemoglobin level of above 12gm/dl, 87 (44%) girls had mild anemia with a haemoglobin level of 10.0gm/dl-11.9gm/dl, 12(6.1%) girls had moderate anemia with a haemoglobin level of 7.0gm/dl-9.9gm/dl and no one had severe anemia with a haemoglobin level of <7.0gm/dl. The mean haemoglobin level was 11.3, mode value was 12.1, median12.1and standard deviation was 1.59 (Table 4.1&Figure 4.1)

4.2 Baseline Data of Adolescent Girls with Anemia: Among 84 adolescent girls with mild anemia included as sample in the study, the age of adolescent girls ranged between 12 to 15 years .Only 1 (1.2%) girl was 12 years of age, 28 girls were 13 years of age, 51 (60.7%) girls were 14 years of age and 4 (4.8%) were 15 years of age. The majority of adolescent girls 51 were 15 years of age (Table 4.2Fig 4.2).

Majority 74 (88%) adolescent girls were Hindus and 10 (12%) were Christians (Table4.2 &Figure 4.3)

The data on type of family revealed that, majority 57(68%) of adolescent girls belonged to nuclear family, 25(30%) belonged to joint family and only 2(2.4%) belonged to extended family (Table 4.2 & Figure 4.4).

With regard to number of members in the family, 9(11%) girls had 2-4 members in their family,54(64.3%) girls had 4-6 members in their family,15(18%) girls had 6-8 members in their family, 4(5%) girls had 8-10 members in the family and 2 (2.4%) girls had more than 10 members in the family (Table4.2&Figure 4.5).

4.3 Demographic Status of Parents:

Education status of adolescent girls parents portrayed that 16(19%) mothers and 6(7.1%) fathers are uneducated, 30(36%) mothers and 29(35%) fathers had primary education, 28(33.3%) mothers and 23(27.4%) fathers had high school education, 5(6%) mothers and 14(17%) fathers had completed higher secondary education,4(5%) mothers and 6 (7.1%) fathers were graduate and 1 (1.2%) girl had no mother, 6 (7.1%) girls had no father(Table4.3&Figure 4.6).

With regard to occupation of adolescent girls parents,29(35%) fathers and 28(33.3%) mothers were coolie workers, 7(8.3%) fathers and 3(4%) mothers were mill workers, 20(24%) fathers and 10 (12%) mothers were working in private concern,1(1.2%) father was government employee, 16(19 %) fathers had their own business, 3(4%) fathers were agricultures, 4(5%) mothers were house maids, 2(2.4%) fathers were unemployed, 38(45.2%) mothers were homemakers (Table 4.4&Figure 4.7,4.8).

With regard to family' monthly income, majority 43(51.2%) girls had a family income of less than 5,000, 7(9.3%) of girls had family income of more than 10,000 and 34 (40.5%) of girls had family income of 5,000-10,000 (Table4.5&Figure 4.9).

4.4 Factors Related to Anemia:

4.4.1 Menstrual History: Among 84 girls, majority 79 (94%) girls had regular flow of menstruation and 5(6%) girls had irregular menstrual flow, only 1(1.2%) girl had excess flow of menstruation (Table4.6& Figure 4.10).

4.4.2 Dietary History: Among 84 girls, 11(13.1%) girls were vegetarian and 73(86.9%) were non-vegetarian. Majority 64(76.2%) girls had the habit of drinking coffee/tea, 39(46.4%) girls had habit of drinking once a day, 23(27.4%) had habit of drinking twice a day and 2(2.4%) girls had habit of drinking coffee/tea more than two times in a day and 20(23.8%) girls had no habit of drinking coffee/tea (Table4.7 & Figure 4.11).

4.4.3 History of Worm Infestation: Only 5(6%) girls had done de-worming in the past, 79(94%) girls had not done de-worming in the past. Among the 5 girls who have done de-worming, 3 girls had done before six months and 2 girls had done within the last 6 months (Figure 4.12). Data on method of excreta disposal at home showed that, 51(61%) girls had toilet facility at home, 26(21.5%) practiced open field defecation and 7(5.9%) used the public toilet (Figure 4.13). In school all the 84(100%) girls used the toilet facility.79(94%) girls used chappals while going to toilet, 5(6%) used no chappals while going to toilet. 46(54.8%) girls washed hands with soap and water after each defecation, 38(45.2%) girls washed with plain water after defecation (Table4.8& Figure 4.14).

4.5 General Examination of Adolescent Girls with Anemia:

4.5.1Symptoms: History collection on symptoms of anemia revealed that 36(42.9%) girls had history of shortness of breath on exertion, 36(42.9%) girls had easy fatigability, 30(35.7%) girls had history of dizziness, 28(33.3%) girls had history of palpitations, 66(78.8%) girls had the complaints of hair loss, 9(10.7%) girls had the complaints of constipation, and 41(48.8%) girls had loss of appetite(Table4.9& Figure 4.15).

4.5.2Body Mass Index: Majority of the girls, 51(60.7%) were under weight, 31(36.9%) girls had normal body mass index and only 2(2.4%) girls were overweight (Table4.10& Figure 4.16).

4.5.3Physical examination: Physical examination of adolescent girls with mild anemia depicted that, 72(85.7%) girls were active and 12 (14.3%) girls were lethargic. Majority of girls 70(83.3%) had normal skin and 14(16.7%) girls had pale skin.70 (83.3%) girls had normal appearance of face, 14(16.7%) had pale face. 36(42.9%) girls had pink color conjunctiva, 48 (57.1%)girls had pale conjunctiva. Appearance of tongue was pink in color for 50(59.5%) girls and pale color for 34(40.5%) girls. Capillary refilling was normal for 82(97.6%) girls and delayed for only 2(2.4%) girls (Table4.11& Figure 4.17).

4.6 Comparison of Haemoglobin Level before and after Administration of Ragi Porridge:

The initial assessment of haemoglobin level before administration of ragi porridge showed that 10 girls had haemoglobin level of range from 10.0-10.5gm/dl, 23 girls had haemoglobin level of range from 10.5-11.0gm/dl, 17 girls had haemoglobin level of range from 11.0- 11.5gm/dl and 34 girls had haemoglobin level of range from 11.5 – 12.0gm /dl. After the administration of ragi porridge for three weeks, 9 girls had haemoglobin level of range from 11.0- 11.5gm/dl, 14 girls had haemoglobin level of range from 12.0-12.5gm/dl,24 girls had haemoglobin level of range from 12.5-13.0gm/dl,9 girls had haemoglobin level of range from 13.0-13.5gm/dl,11girls had haemoglobin level of range from 13.5- 14.0gm/dl,3 girls had haemoglobin level of range from 14.0- 14.5gm/dl,1 girl had haemoglobin level of 10.2gm/dl and one girl had haemoglobin level of 10.8gm/dl(Table4.12& Figure 4.18).

The mean haemoglobin level before the administration of ragi porridge was 11.24 and standard deviation was 0.59. The mean haemoglobin level after the administration of ragi porridge was 12.52 and standard deviation was 0.89.The mean difference in haemoglobin level was 1.28. This assessment shows that there is increase in haemoglobin level after the administration of ragi porridge (Table 4.13).

4.7 Range of Increase in Haemoglobin Level from Pre-assessment Haemoglobin Value after Administration of Ragi Porridge:

Among the 84 girls, majority 24(29%) girls had increase in haemoglobin level in the range of 1.0gm/dl-1.5gm/dl. For 6 (7.1%) girls the increase was < 0.5 gm/dl, 16(19%) girls had increase of 0.5-1.0gm/dl,17(20.2%) girls had increase of 1.5- 2.0gm/dl,9(11%) girls had increase 2.0-2.5gm/dl,3(4%) girls had increase 2.5-3.0gm/dl, 2(2.4%) girls had increase 3.0-3.5gm/dl , for 1(1.2%) girl increase in haemoglobin level was 3.7gm/dl and there was no increase in haemoglobin level for 6(7.1%) girls(Table4.14& Figure 4.19).

4.8 Comparison of Haemoglobin Level before and after Administration of Ragi Porridge through Paired "t" Test:

Hypothesis: There will be a significant difference in the haemoglobin level before and after administration of ragi porridge.

$$\text{'t'} = \frac{\bar{d}}{SD / \sqrt{n}}$$

$$\text{'t'} = \frac{1.28}{0.80 / \sqrt{84}}$$

The calculated value of t is 14.22, which is more than the tabulated value a p<0.001 level. This shows that there is a significant difference in haemoglobin level before and after administration of ragi porridge (Table4.15).

4.9 Influence of Frequency of Signs of Anemia on Pre-assessment Haemoglobin Value among adolescent girls with mild anemia: Karl Pearson coefficient was used to calculate the influence of frequency of signs of anemia on pre-assessment haemoglobin value among adolescent girls with anemia.

Hypothesis: There is a positive relationship between signs of anemia and the pre-assessment haemoglobin value.

$$r = \frac{\sum xy}{\sqrt{\sum (x-\bar{x})(y-\bar{y})}}$$

R= -44.46/ 193.24)27.22=-0.051

A negative correlation was found between the frequency of signs of anemia and the pre-assessment haemoglobin value among adolescent girls with mild anemia. Hence, the presence of signs of anemia has an impact on the pre-assessment haemoglobin value of adolescent girls with mild anemia.

4.10 Influence of number of members in adolescent girls family on Pre-assessment Haemoglobin Value among adolescent girls with mild anemia: Karl Pearson coefficient was used to calculate the influence of number of members in adolescent girl's family on Pre-assessment Haemoglobin Value among adolescent girls with mild anemia.

Hypothesis: There is a positive relationship between number of members in adolescent girl's family on Pre-assessment Haemoglobin Value.

$$r = \frac{\sum xy}{\sqrt{\sum (x-\bar{x})(y-\bar{y})}}$$

$$r = \frac{-0.98}{\sqrt{(0.54)(0.32)}}$$

=-o.03

A negative correlation was found between number of members in adolescent girl's family on Pre-assessment Haemoglobin Value among adolescent girls with mild anemia. Hence, the number of members in adolescent girl's family has an impact on the pre-assessment haemoglobin value of adolescent girls with mild anemia.

Descriptive and statistical analysis shows that there is high prevalence of mild anemia among adolescent girls and there is significant increase in the haemoglobin level after administration of ragi porridge.

Fig 4.1

Prevalence of Anemia among Adolescent Girls

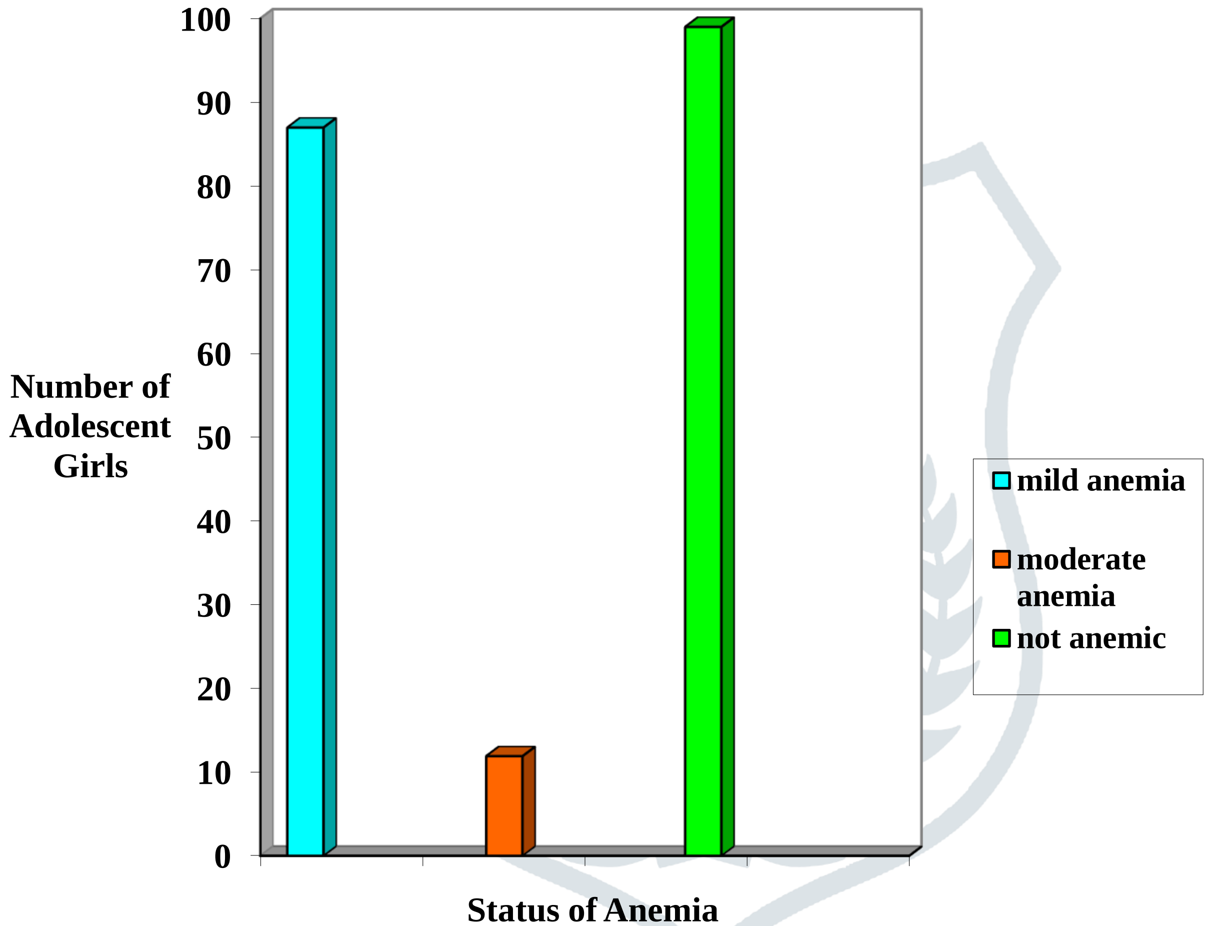

Fig 4.2

Age of Adolescent Girls with Anemia

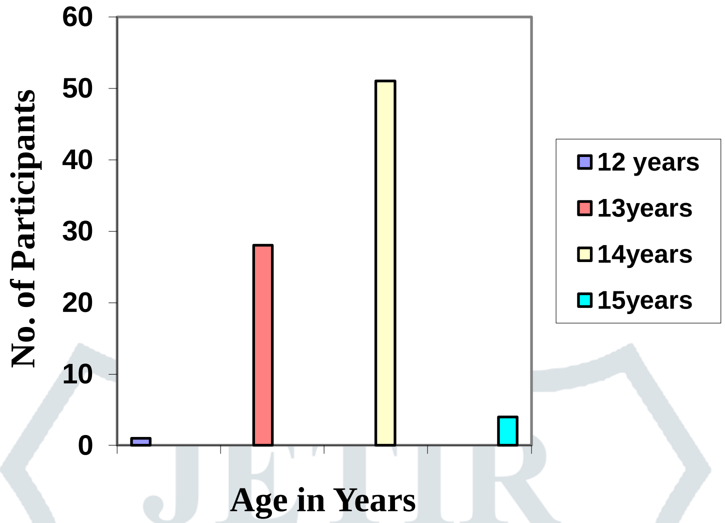

Fig 4.3

Religion of Adolescent Girls with Anemia

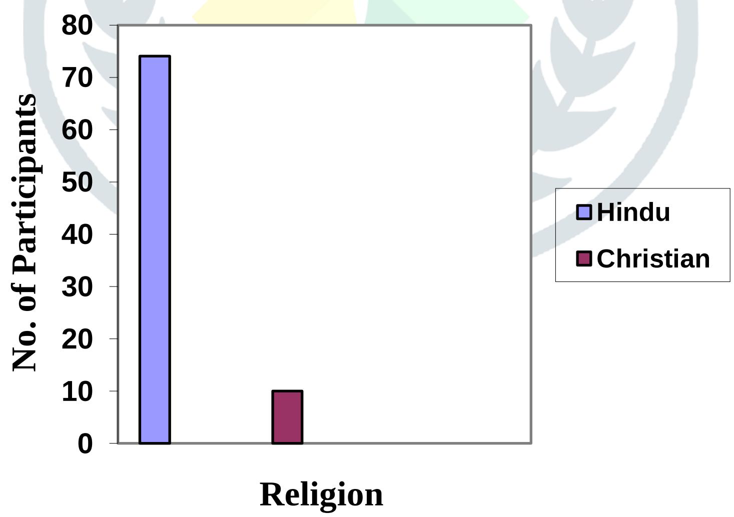

Figure 4.4

Type of Family of Adolescent Girls with Anemia

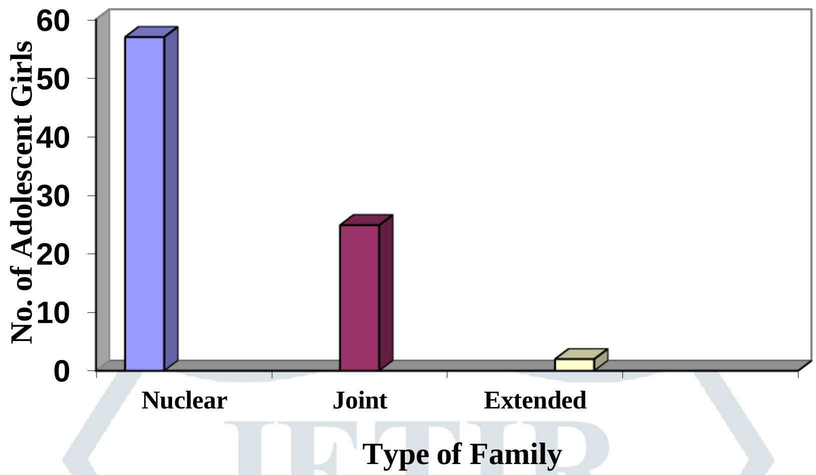

Figure 4.5

Number of Members in Family of Adolescent Girls with Anemia

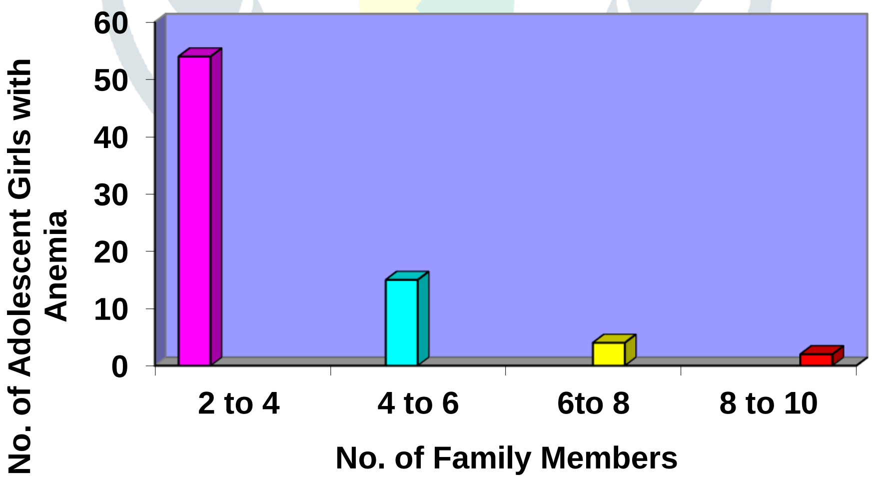

Figure 4.6

Education of Parents of Adolescent Girls with Anemia

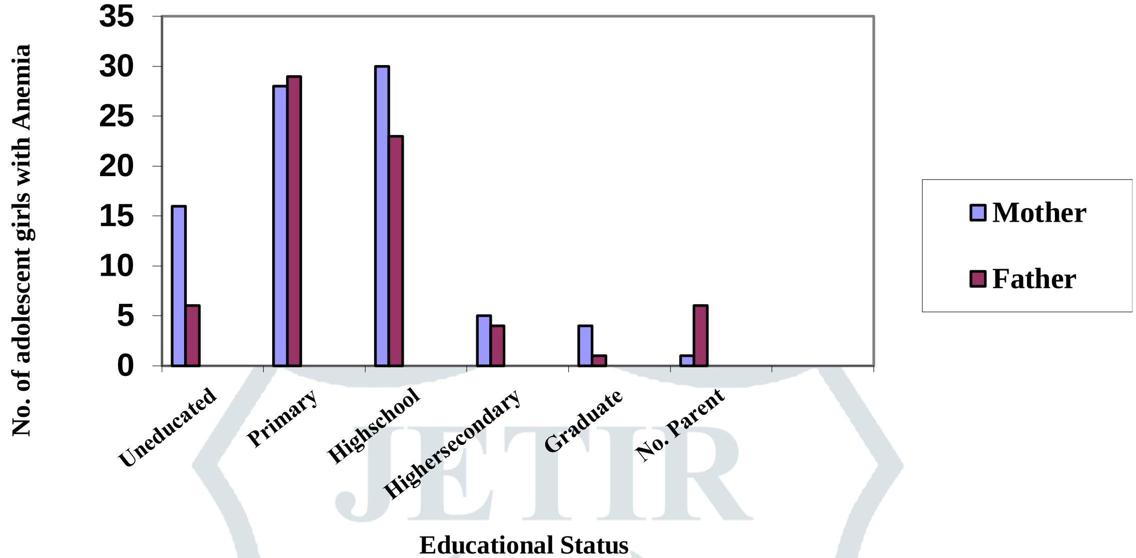

Figure 4.7

Occupation of Father of Adolescent Girls with Anemia

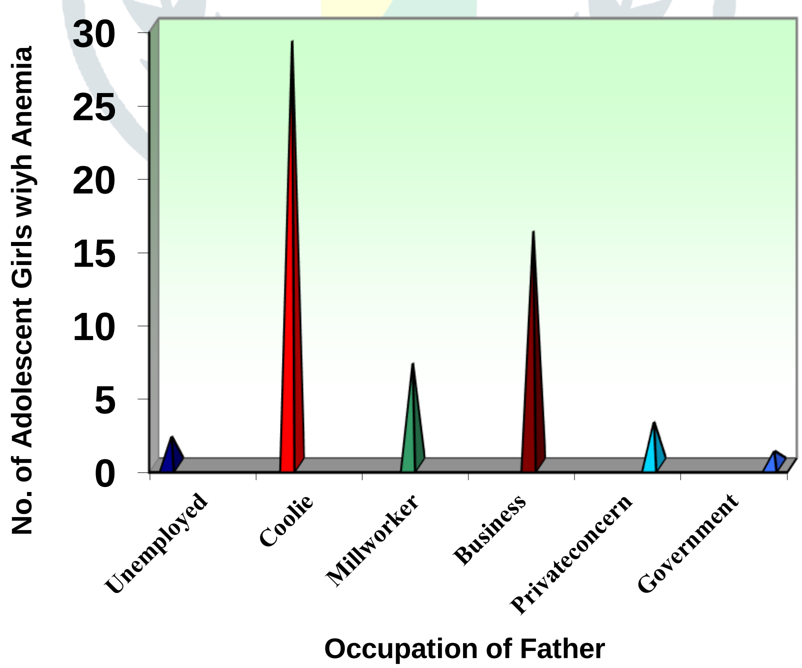

Figure 4.8

Occupation of Mother of Adolescent Girls with Anemia

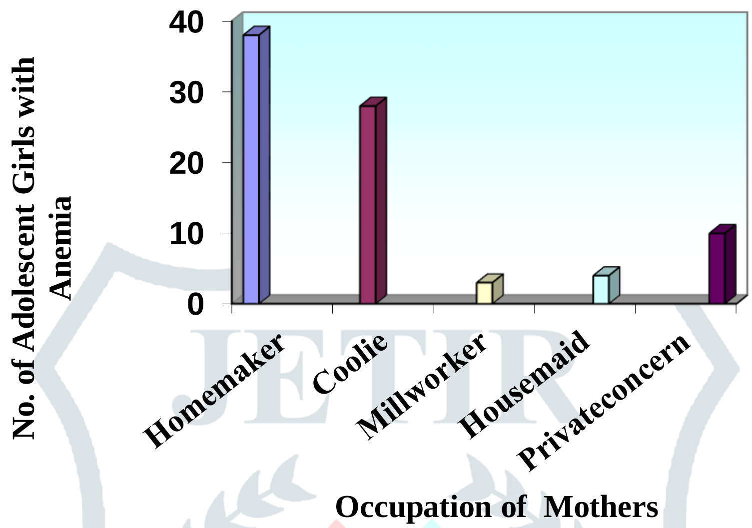

Figure 4.9

Family Monthly Income of Adolescent Girls with Anemia

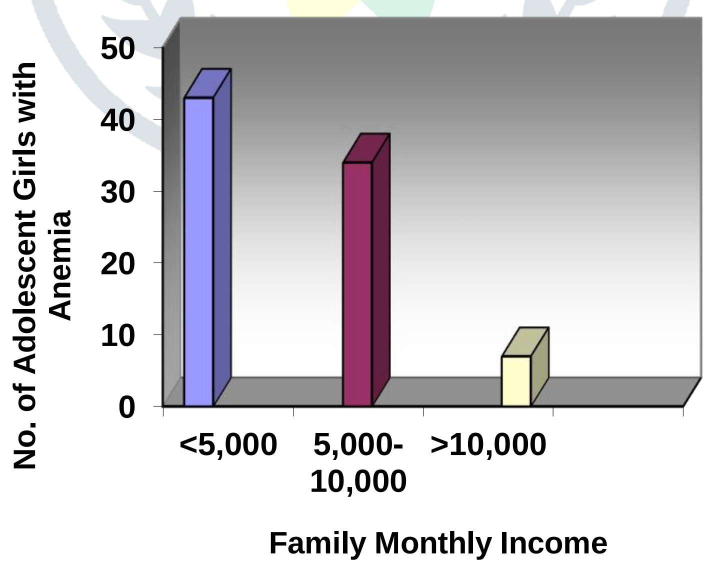

Figure 4.10

Menstrual History of Adolescent Girls with Anemia

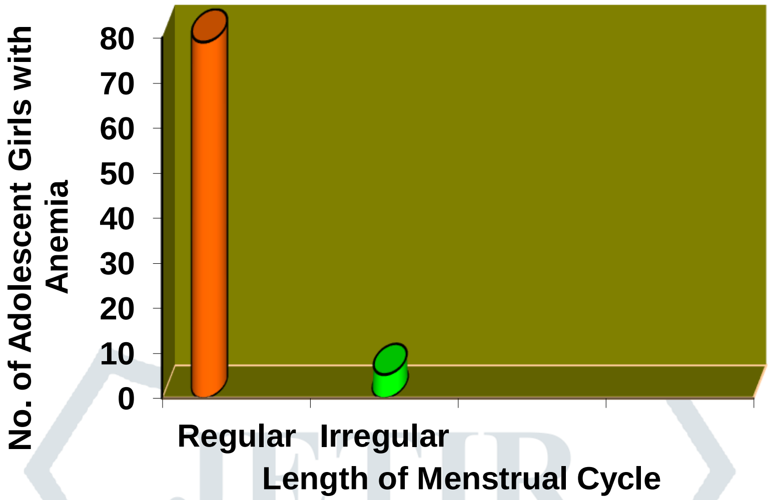

Figure 4.11

Dietary Pattern of Adolescent Girls with Anemia

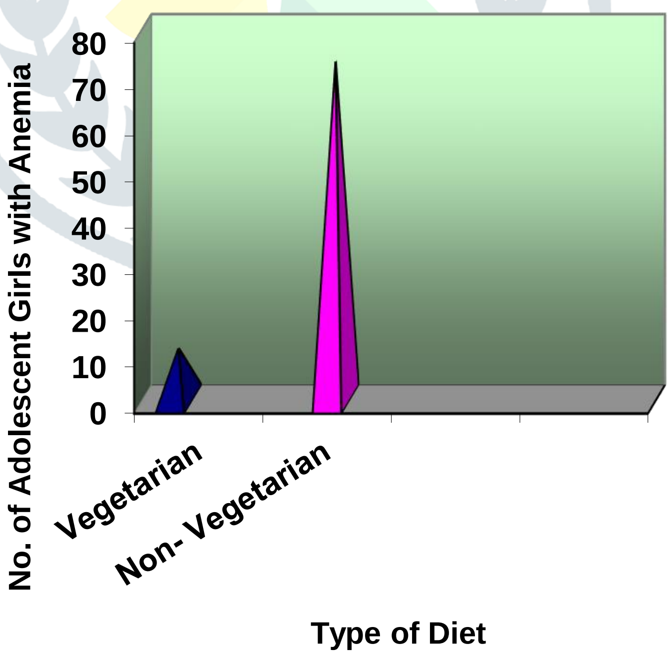

Figure 4.12

History of De-worming among Adolescent Girls with Anemia

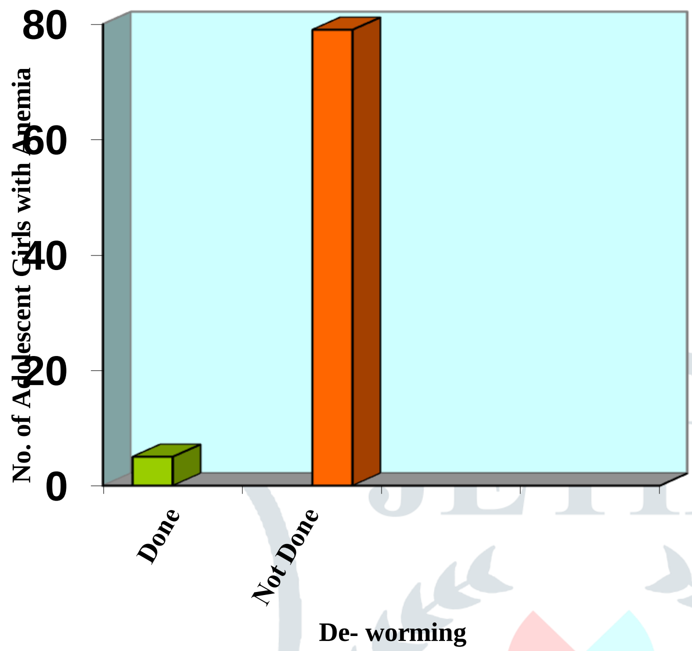

Figure 4.13

Method of Excreta Disposal at Home of Adolescent Girls with Anemia

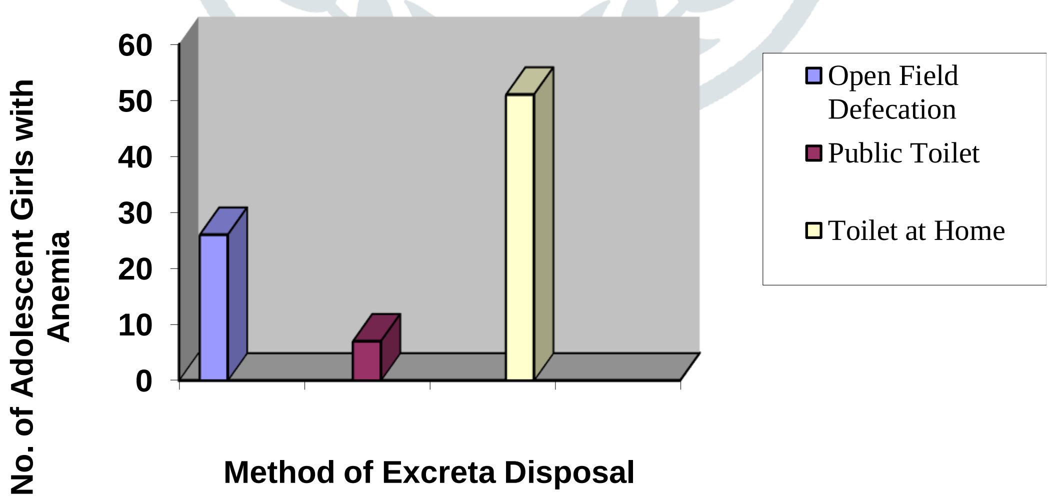

Figure 4.14

Habit of Washing Hands with Soap and Water after Defecation among Adolescent Girls with Anemia

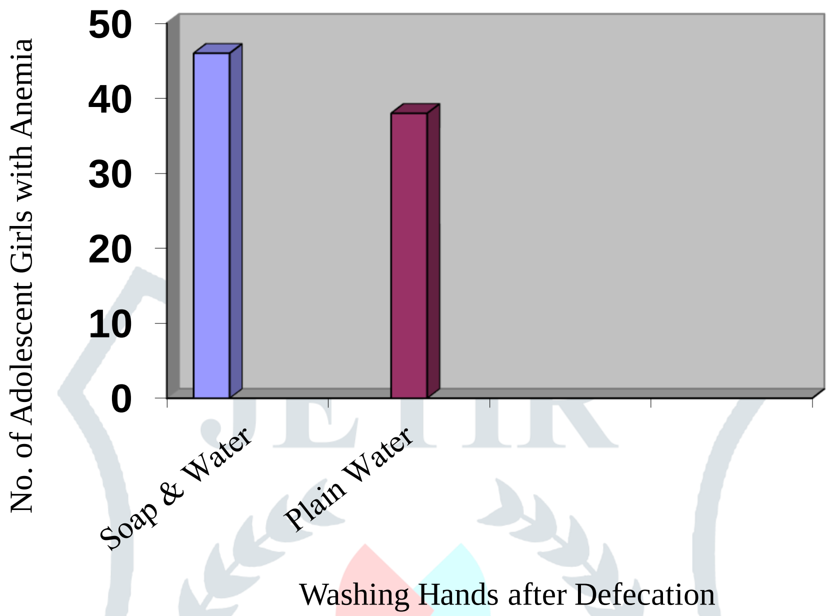

Figure 4.15

Symptoms of Adolescent Girls with Anemia

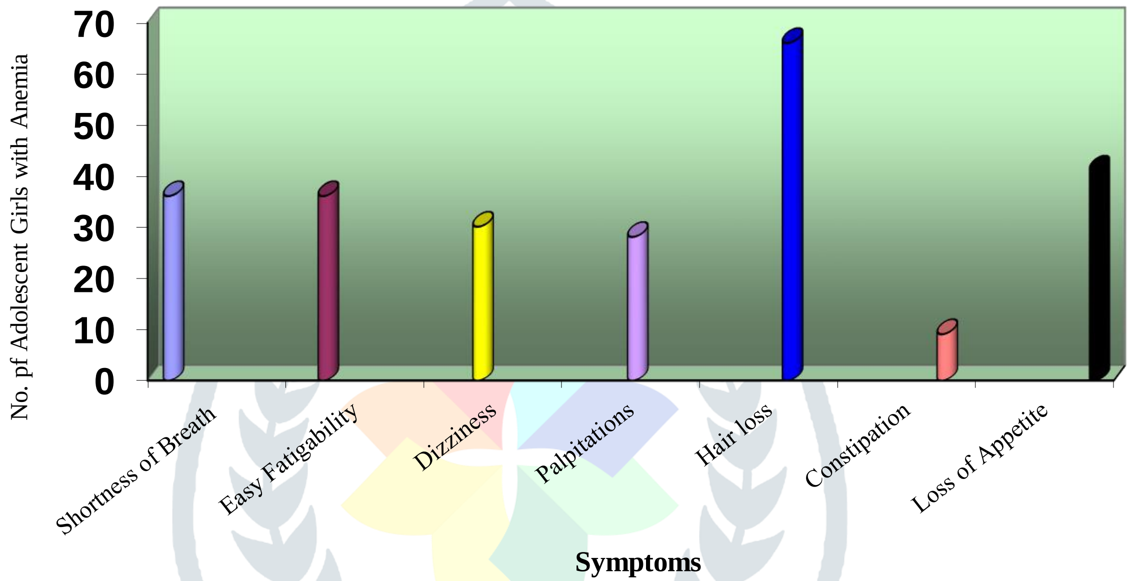

Figure 4.17

Physical Examination of Adolescent Girls with Anemia

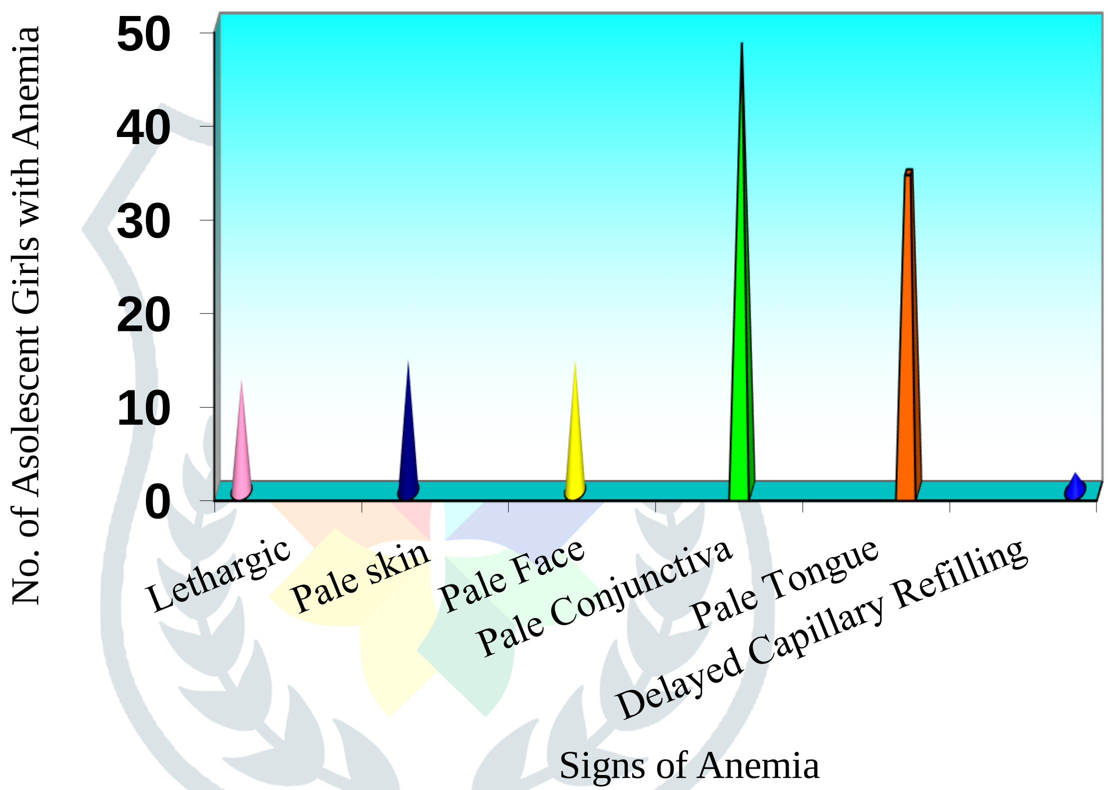

Figure 4.16

Body Mass Index of Adolescent Girls with Anemia

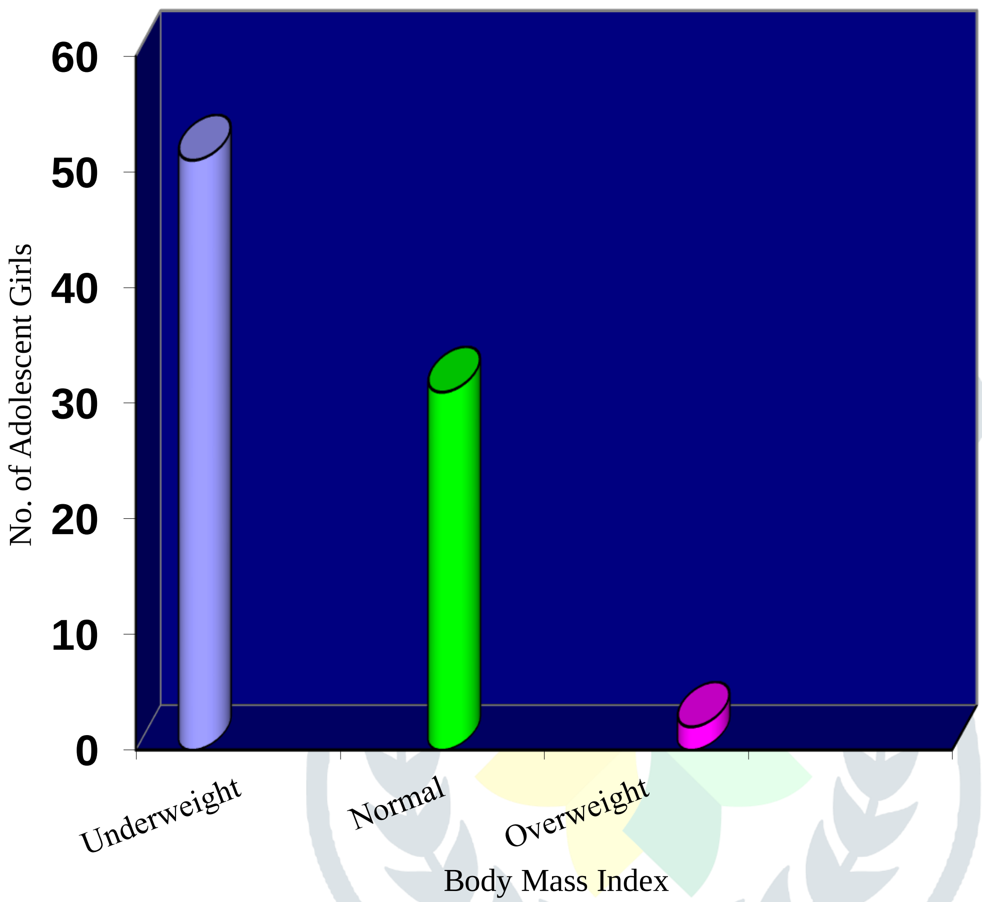

Figure 4.19

Difference in Haemoglobin Level after the Administration of Ragi Poridge

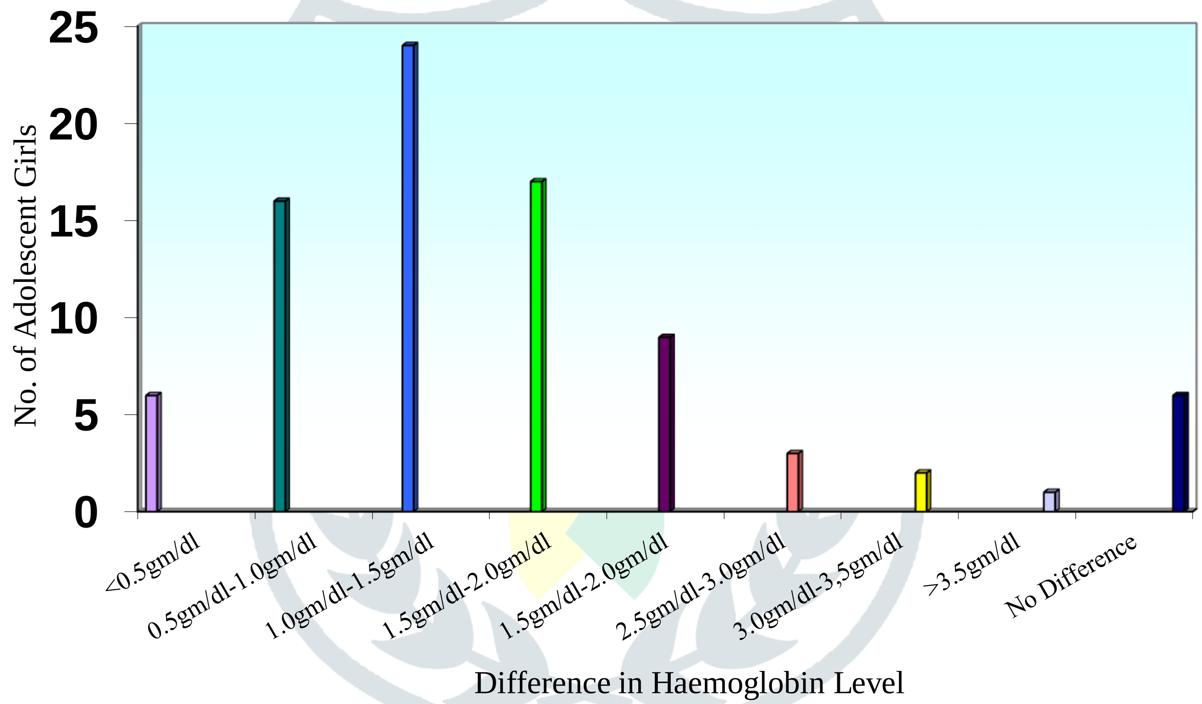

Table 4.1

Prevalence of Anemia among Adolescent Girls

N=198

S.No.	Status of anemia	No. of Girls	%
1.	Mild anemia (10.0-11.9 gm/dl)	87	44
2.	Moderate anemia (7.0-9.9gm/dl)	12	6.1
3.	Severe anemia (<7.0gm/dl)	0	0
4.	No anemia	99	50

Table 4.2

Baseline Data of Adolescent Girls with Anemia

S.No.	Demographic Characteristics	No. of Girls	%
1.	**Age in years**	n=84	
	12 years	1	1.2
	13 years	28	33.3
	14 years	51	60.7
	15 years	4	4.8
2.	**Religion**	n=84	
	Hindu	74	88
	Christian	10	12
3.	**Type of family**	n=84	
	Nuclear	57	68

	Joint	25	30
	Extended	2	2.4
4.	**Numbers of members in family**	n=84	
	2-4 members	9	11
	4-6members	54	64.3
	6-8 members	15	18
	8-10 members	4	5
	>10 members	2	2.4

Table 4.3

Education Status of Parents

S.No	Characteristics	No. of Girls	%
1.	**Mothers education**	n =84	
	Uneducated	16	19
	Primary	30	36
	High School	28	33.3
	Higher Secondary	5	6
	Graduate	4	5
	No mother	1	1.2
2.	**Fathers education**	n =84	
	Uneducated	6	7.1
	Primary	29	35

	High School	23	27.4
	Higher Secondary	14	17
	Graduate	6	7.1
	No father	6	7.1

Table 4.4

Occupation of Adolescent Girls Parents

S.No	Characteristics	No. of Girls	%
1.	**Fathers occupation**	n =84	
	Unemployed	2	2.4
	Coolie	29	35
	Mill worker	7	8.3
	Business	16	19
	Private concern	3	4
	Government	1	1.2
	No father	6	7.1
2.	**Mothers occupation**	n =84	
	Homemaker	38	45.2
	Coolie	28	33.3
	Mill worker	3	4
	House maid	4	5
	Private concern	10	12

Table 4.5

Adolescent Girls Family Monthly Income

n =84

S.No.	Family monthly income	No. of Girls	%
1.	<5,000	43	51.2
2.	5,000 – 10,000	34	40.5
3.	>10,000	7	8.3

Table 4.6

Menstrual History of Adolescent Girls with Anemia

n =84

S.No.	Characteristics	No. of Girls	%
1.	**Length of Menstrual Cycle**	n =84	
	Regular	79	94
	Irregular	5	6
2.	**Flow of Menstruation**	n =84	
	Normal Flow	83	98.8
	Excess	1	1.2

Table 4.7

Dietary History of Adolescent Girls with Anemia

n =84

S.No.	Characteristics	No. of Girls	%
1.	**Type of Diet**	n =84	
	Vegetarian	11	13.1
	Non-Vegetarian	73	86.9
2.	**Consumption of Coffee/Tea in a Day**	n =84	
	Once	39	32.8
	Twice	23	19.3

	More than Twice	2	1.7
	No Consumption	20	16.8

Table 4.8

History of Worm Infestation among Adolescent Girls with Anemia

n=84

S. No.	Characteristics	No. of Girls	%
1.	**Last Done De-worming**	n =84	
	6 Months before	3	2.5
	Within 6 Months	2	1.7
	No History of De- worming	79	94
2.	**Method of Excreta Disposal at Home**	n =84	
	Toilet Facility Available at Home	51	61
	Open Field Defecation	26	21.8
	Public Toilet	7	5.9
3.	**Toilet Facility at School**	n =84	
	Available	84	100
	Not Available	0	0
4.	**Use Chappals when Going to Toilet**	n =84	
	Use Chappals	79	94
	Not Use Chappals	5	6
5.	**Washing Hands after Defecation**	n =84	
	Wash Hands with Soap and Water	46	54.8
	Wash Hands with Plain Water	38	45.2

Table 4.9

Symptoms of Adolescent Girls with Anemia

n=84

S.No.	Symptoms	No. of Girls	%
1.	Shortness of Breath	36	42.9
2.	Easy Fatigability	36	42.9

3.	Dizziness	30	35.7
4.	Palpitations	28	33.3
5.	Hair Loss	66	78.8
6.	Constipation	9	10.7
7.	Loss of Appetite	41	48.8

Table 4.10

Body Mass Index of Adolescent Girls with Anemia

n= 84

S.No.	**Body Mass Index**	**No. of Girls**	**%**
1.	Underweight BMI< 18	51	60.7
2.	Normal BMI 18-25	31	36.9
3.	Overweight BMI > 25	2	2.4

Table 4.11

Physical Examination of Adolescent Girls with Anemia

n= 84

S. No.	**Signs of Anemia**	**No. of Girls**	**%**
1.	**Activity**	n= 84	
	Active	72	85.7
	Lethargic	12	14.3
2.	**Skin**	n= 84	
	Normal	70	83.3
	Pale	14	16.7
3.	**Face**	n= 84	
	Normal	70	83.3
	Pale	14	16.7
4.	**Conjunctiva**	n= 84	
	Pink	36	42.9
	Pale	48	57.1
5.	**Tongue**	n= 84	

	Pink	50	59.5
	Pale	34	40.5
6.	**Capillary Refilling**	n= 84	
	Normal	82	97.6
	Delayed	2	2.4

Table 4.12

Haemoglobin Level before and after Administration of Ragi Porridge

n=84

S. No.	Haemoglobin level	Pre-assessment	Post-assessment
1.	10gm/dl-10.5gm/dl	10	1
2.	10.5gm/dl-11.0gm/dl	23	1
3.	11.0gm/dl-11.5gm/dl	17	9
4.	11.5gm/dl-12.0gm/dl	34	12
5.	12.0gm/dl-12.5gm/dl	0	14
6.	12.5gm/dl-13.0gm/dl	0	24
7.	13.0gm/dl-13.5gm/dl	0	9
8.	13.5gm/dl-14.0gm/dl	0	11
9.	14.0gm/dl-14.5gm/dl	0	3

Table 4.13

Comparison of Mean and Mean Difference of Haemoglobin Level before and after Administration of Ragi Porridge

n=84

S.No.	Characteristic	Pre-assessment		Post -assessment		Mean Difference
		Mean	SD	Mean	SD	
1.	Haemoglobin Level	11.24	0.59	12.52	0.89	1.28

S.No.	Difference in Hemoglobin Level	No. of Girls	%
1.	<0.5gm/dl	6	7.1
2.	0.5gm/dl-1.0gm/dl	16	19
3.	1.0gm/dl-1.5gm/dl	24	29

Table 4.14 Difference in Haemoglobin Level after the Adminisitration of Ragi Porridge

n =84

4.	1.5gm/dl-2.0gm/dl	17	20.2
5.	2.0gm/dl-2.5gm/dl	9	11
6.	2.5gm/dl-3.0gm/dl	3	4
7.	3.0gm/dl-3,5gm/dl	2	2.4
8.	>3.5gm/dl	1	1.2
9.	No Difference	6	7.1

Table 4.15

Comparison of Haemoglobin Level before and after Adminisitration of Ragi Porridge through Paired'‘t’ Test

S.No.	Characteristic	Mean	SD	‘t’ Value	Level of Significance
1.	Haemoglobin Level	1.28	0.80	14.22	0.001

CHAPTER V

RESULTS AND DISSCUSSION

This chapter deals with the discussion based on objectives, study findings and conclusion by relating with the conclusion of previous studies. Iron deficiency anemia is a major public health problem in India widely prevalent among adolescent. To combat the micronutrient deficiencies especially iron deficiency anemia several intervention programmes have been initiated. The most commonly adopted strategy is the dietary supplementation could be an effective, preventive and curative strategy, in contrast to dietary diversification and food fortification, in providing immediate relief (Parman et al., 2020).

The present study is focused to determine the effectiveness of ragi porridge in increasing haemoglobin level among adolescent girls with anemia.

5.1 Prevalence of Anemia among Adolescent Girls: The adolescent girls for the study were selected from the Thondamuthur Government Girls Higher Secondary School.

One hundred and ninety eight adolescent girls studying in ninth standard were assessed for prevalence of anemia. Among them 99 (50%) of adolescent girls were observed to have normal haemoglobin level of above 12gm/dl, 87 (44%) girls had mild anemia with a haemoglobin level of 10.0gm/dl-11.9gm/dl, 12(6.1%) girls had moderate anemia with a haemoglobin level of 7.0gm/dl-9.9gm/dl and no one had severe anemia with a haemoglobin level of <7.0gm/dl. Among adolescent girls between 10 and 15 years of age, iron deficiency anemia was detected in 85% of adolescent girls. Mild, moderate, and severe grades of anemia were 63.25%, 12.5%, and 5.3% respectively (Indian Institute of Health and Family Welfare Annual Report, 2003). In this study, it was observed that the overall prevalence of anemia was 50% and the mean haemoglobin level was 11.3gm/dl. In Arasur , rural part of Coimbatore the prevalence of anemia among teen age girls was 61.4%(Anila P. Joseph,Caroline Susan George et al., 2005).

5.2 Baseline Data of adolescent girls with anemia: Age of the adolescent girls with anemia varied between 12 years to 15 years. Only one (1.2%) girl was 12 years of age, 28 girls were 13 years of age, 51 (60.7%) girls were 14 years of age and four (4.8%) were 15 years of age. The present study revealed that the prevalence of anemia increased with the age of adolescent girls the majority of girls 60.7%

were 14 years of age and only 1.2% was 12 years of age. A study conducted on prevalence of anemia among adolescent girls of scheduled caste community, the study revealed an age differential in the prevalence of anemia. The prevalence of anemia increases with age and becomes maximum in the age group 15+. The frequency of mild anemia was displayed to the maximum by age group 11+ and the minimum by age group 15+. The largest number of girls fell in the category of moderate anemia, with maximum present in age group 14+ as compared to age group 11+ where the number of lowest . Maximum level of severity of anemia was seen to be present in age group 15+ (Sharda Sidhu et al., 2015).

Majority 74(88%) adolescent girls belonged to Hindu religion only 10 (12%) girls were Christians. The highest prevalence of anemia among the Northeastern states was observed among girls from households with a low standard of living, non-Christian girls, girls from Scheduled Tribes.The highest percentages of girls with normal hemoglobin were reported among Christian Scheduled Tribes (Manoranjan Pal et al., 2019).

The data on type of family highlighted that majority of girls 57(68%) live in nuclear family and 25(30%) girls belong to joint family and only (2.4%) girls were from extended family. The data on number of members in the family of adolescent girls revealed that major proportion of adolescent girls 54(64.3%) had 4-6 members in the family and only few girls 9(11%) had 2-4 members in the family. A negative relationship was found between the number of family members and haemoglobin level, which showed that increase in number of members in the adolescent girl's family, had an impact on the status of anemia. In a study conducted on pervasiveness of anemia in adolescent girls of low socio-economic group, the prevalence of anemia was found lower in nuclear families than joint families. Further, size of family also affects the prevalence of anemia. As both quality and quantity of food consumption get affected by number of members in family especially with limited income sources(Kochar, G.K.,2009) .A high prevalence of anemia was found in adolescent girls belonging to families having family size >three than in those girls from families of family size <three (Rawat, C. M. S. et al., 2021).

5.4 Demographic Status of Parents: Education status of adolescent girl's parents portrayed that majority 30(36%) mothers had primary education, only four (5%) mothers were graduates, 28(33.3%) mothers had high school education, 5(6%) mothers had higher secondary education and 16(19%) mothers were uneducated. Majority 29(35%) fathers had primary education only six (7.1%) fathers were graduates, 23(27.9%) father had high school education, 14 (17%) father had higher secondary education, and six (7.1%) father were uneducated. The majority of mothers (36%) of adolescent girl's with anemia had only primary education. A study on socio demographic factors causing anemia among adolescent girls revealed that prevalence of anemia was maximum in adolescent girls whose mother were educated up to primary level and prevalence progressively decreased with an increase in educational status of mother, being minimum, in adolescent girls whose mothers were graduate and above (Rita Singh, 2015).

With regard to occupation of adolescent girls parents , majority 29(35%) fathers and 28(33.3%) mothers were coolie workers, 7(8.3%) fathers and 3(4%) mothers were mill workers, 20(24%) fathers and 10 (12%) mothers were working in private concern,1(1.2%) father was government employee, 16(19 %) fathers had their own business, 3(4%) fathers were agricultures, 4(5%) mothers were house maids . Two (2.4%) fathers were unemployed and 38(45.2%) mothers were homemakers. In the present study, majority of fathers (35%) of adolescent girls with anemia were coolie workers and majority of mothers (45.2%) were homemakers. In a study on socio –demographic factors causing anemia, the prevalence of anaemia was found to be maximum 48.1 per cent in adolescent girls whose father's worked as labourers while it was 41.8 per cent in private service, 27.5 per cent in business, 38.4 per cent in government service and minimum 17.8 per cent in professionals(Rita Singh, 2015)

In the present study, family' monthly income of a major proportion 43(51.2%) girls was less than 5,000, 7(8.3%) girls had family income of more than 10,000 and 34(40.5%) girls had family income of 5,000-10,000. Studies reported prevalence of anemia was lower in adolescent girls where the household income was more than Rs. 5000 per month and a higher prevalence where the household income was less than Rs. 5000 per month (Sabita Basu et al., 2014)

5.5 Factors Related to Anemia:

5.5.1 Menstrual History: Among 84 girls, 79(94%) girls had regular flow of menstruation and 5(6%) girls had irregular menstrual flow, only 1(1.2%) girl had excess flow of menstruation her haemoglobin level was 10.2 gm/dl. Among girls, however, menstruation increases the risk for iron deficiency anemia throughout their adolescent and childbearing years. An important risk factor for iron deficiency anemia is heavier menstrual bleeding (Lloyd Van Winkle, 2019).

5.5.2 Dietary History: Most of the girls 73(86.9%) were non-vegetarian and 11(13.1%) girls were vegetarian. Majority 64(76.2%) girls had the habit of drinking coffee/tea, 39(46.4%) girls had habit of drinking once a day, 23(27.4%) had habit of drinking twice a day and 2(2.4%) girls had habit of drinking coffee/tea more than two times in a day and 20(23.8%) girls had no habit of drinking coffee/tea. Anemia was found to be higher among girls with the attributes of those with habit of post meal consumption of tea/coffee (Verma, A., 2021).

5.5.3 History of Worm Infestation: With regard to history of worm infestation, only five (6%) girls had done de-worming in the past, majority 79(94%) girls had not done de-worming in the past. Most of the girls, 51(61%) had toilet facility at home, 26(21.5%) girls practiced open field defecation and only 7(5.9%) used the public toilet. In school all the 84(100%) girls used the toilet facility.79(94%) girls used chappals while going to toilet, 5(6%) used no chappals while going to toilet.46(54.8%) girls washed hands with soap and water after each defecation,38(45.2%) girls washed with plain water after defecation. A study on epidemiology of iron deficiency anemia in Zanzibari schoolchildren reported that worm infestation has influence on anemia largely. It was found that 25% of all anemia, 35% of iron deficiency anemia and 73% of severe anemia was attributable to hookworm infection (Stoltzfus et al., 2016).

5.6 General Examination of Adolescent Girls with Anemia:

5.6.1 Symptoms: History collection on symptoms of anemia revealed that majority 36(42.9%) girls had history of shortness of breath on exertion, 36 (42.9%) girls had complaint of easy fatigability, and 41(48.8%) girls had loss of appetite. In a study on supplementation effect of iron and folic acid capsule on anemic adolescent girls it was reported, that majority of subjects participated in the study complained for lethargy (72.22%) and breath-less ness on exertion (64.81 %) Problem of anorexia was faced by about (35.18%) of the subjects (Neetu Gupta, 2019).

Among 84 girls, 30(35.7%) girls had history of dizziness, 28(33.3%) girls had history of palpitations. In another study on prevalence of anemia, it was observed that the signs and symptoms headache, fatigue, dyspnoea, palpitations, and syncope attacks were significantly more prevalent in anemic subjects (Goel. S., 2021).

In this study a major proportion 66(78.8%) girls had the complaints of hair loss. A study on prevalence of anemia and the frequency of common anemia-related symptoms among schoolchildren revealed that symptoms of anemia predominated among anemic and healthy teenage girls (87.5% vs 73%), Paleness predominated among 6–8-year-old children (35.1%) and shedding of hair(41.1%) among teenage girls (Izolda Kriviene , 2010)

5.6.2 Body Mass Index: In the study majority of the girls 51(60.7%) with anemic were under weight, 31(36.9%) girls had normal body mass index and only 2(2.4%) girls were overweight. The proportion of thinness was significantly higher among subjects who suffered from iron deficiency anaemia.

Furthermore, thin subjects had a 5 fold higher risk of suffering from iron deficiency anaemia than non-thin subjects (Kurniawana et al., 2019)

5.6.3 Physical Examination: Physical examination of adolescent girls with mild anemia depicted that, majority of girls 48 (57.1%) girls had pale conjunctiva. Appearance of tongue was pale color for 34(40.5%) girls. 14 (28.6%) girls had pale skin and pale face. A negative correlation was found between the frequency of signs of anemia and the level of haemoglobin (ranging from 10.0gm/dl-11.9gm/dl). In a study on supplementation effect of iron and folic acid capsule on anemic adolescent girls the symptoms of anemia were observed among all the subjects with wide range of variation. Paleness of eyes was in maximum number of the subjects (62.96 %). However, the paleness of skin and flat nails were found in (66.66%) and (33.33%) percent of subjects respectively (Neetu Gupta, 2019).

5.7 Comparison of Mean Difference Haemoglobin Level: The mean haemoglobin level before the administration of ragi porridge was 11.24. The mean haemoglobin level after the administration of ragi porridge was 12.52.The mean difference in haemoglobin level was 1.28. This assessment shows that there is increase in haemoglobin level after the administration of ragi porridge. The mean difference of pre and post haemoglobin level was 1.28 gm/dl. A study was conducted to evaluate whether regular consumption of rapadura (jaggery) as a natural sweetener in fruit juices is capable of preventing or treating anemia in preschool children, in the group consuming the jaggery –fortified beverage mixture, mean haemoglobin was 11.1 ± 1.09g/dl at baseline and 11.6 ± 2.10 g/dl after intervention. For the control group, mean haemoglobin was 10.2 ± 1.20 g/dl 3.11% at baseline and 10.3 ± 1.26 after the intervention (Gopi.Ghosh.N ., 2016).

5.8 Range of Increase in Haemoglobin Level from Pre-assessment Haemoglobin Value after Administration of Ragi Porridge:

Among the 84 girls, majority 24(29%) girls had increase in haemoglobin level in the range of 1.0gm/dl-1.5gm/dl, the increase in haemoglobin level was 3.7gm/dl for only one (1.2%) girl. There was no increase in haemoglobin level for 6(7.1%) girls.

5.9 Comparison of Haemoglobin Level before and after Administration of Ragi Porridge through Paired "t" Test: The calculated value of t is 14.22, which is more than the tabulated value a $p<0.001$ level. This shows that there is a significant difference in haemoglobin level before and after administration of ragi porridge. A study was conducted to test a supplement food developed using locally available foods like jaggery, processed rice flakes, cress seeds, and amaranth seeds in school going children belonging to low income families. The, children were given one ladoo per day for a period of 60 days. Effect of supplement on haemoglobin levels, height and weight were assessed. Significant increase in hemoglobin levels was observed in both the boys and girls after 30 days of supplementation only. In majority of the subjects, progression from one haemoglobin levels to the next higher level was observed (Sood, 2022).

5.10 Theoretical Framework: Effectiveness of Ragi Porridge in Increasing Haemoglobin Level among Adolescent Girls with Anemia: Modified Widen Bach's helping art Model was adopted to assess the effectiveness of ragi porridge in increasing haemoglobin level among adolescent girls with anemia. Initial assessment of haemoglobin was done for 198 adolescent girls and 84 adolescent girls with mild anemia were selected as subjects for the study. 200ml ragi porridge was administered for them for 3 weeks and reassessment of haemoglobin was done by cynamethaemoglobin method. The mean haemoglobin level before the administration of ragi porridge was 11.24. The mean haemoglobin level after the administration of ragi porridge was 12.52. The mean difference of pre and post haemoglobin level was 1.28 gm/dl (Fig 5.1).

CHAPTER VI

SUMMARY AND CONCLUSION

This study was conducted to analyze the effectiveness of ragi porridge in increasing haemoglobin level among adolescent girls with anemia.

Literature was reviewed regarding the prevalence of anemia, factors related to anemia and dietary supplements to treat anemia. It revealed that iron deficiency anemia among adolescent girls was a major global problem and more in the developing countries. Many factors like socio-economic factors, menstrual pattern, dietary factors, and worm infestation contributed to the high prevalence of anemia. Dietary supplementation with iron rich food helped in control of anemia.

The research design adopted for the study was one group pretest and posttest design. The study was conducted in Government girls' higher secondary school, Thondamuthur. The prevalence was studied among 198 adolescent girls in 9th standard and 84 adolescent girls who had mild anemia with haemoglobin level of 10.0-11.9 gm/dl were selected for the study by using purposive sampling.

Validity and reliability of the tool was tested through pilot study. Based on the objectives the questionnaire was prepared to obtain the base line information, factors related to anemia, history of symptoms of anemia. Physical examination was done to identify the signs of anemia. Cynamethaemoglobin method was used to analyze the haemoglobin level.

Data was collected from adolescent girls with mild anemia who were willing to participate in the study. In the first two days, haemoglobin analysis was done for 198 adolescent girls by cynamethhaemoglobin method with the help of lab technician and the prevalence of anemia was found out. The adolescent girls with mild anemia with haemoglobin were selected as subjects for the study. Information on base line data, factors related to anemia was collected and physical examination was carried out. 200 ml of ragi porridge was administered once a day for three weeks. Post assessment of haemoglobin level was done at the end of three weeks by cynamethaemoglobin method. All adolescent girls identified to have anemia were given education on iron rich diet,iron supplementation and monitoring of haemoglobin level.

Collected data were tabulated and analyzed by using descriptive and analytical statistics. Paired't' test was used to compare the pre and post assessment of haemoglobin level. Karl Pearson coefficient was used to analyze the relationship between signs of anemia and haemoglobin level.

6.1Major Findings of the Study:

1. The overall prevalence of anemia among 198 girls was 50%, 87(44%) girls had mild anemia with haemoglobin level of 10.0gm/dl-11.9gm/dl, 12(6.1%) girls had moderate anemia with haemoglobin level of 7.0gm/dl-9.9gm/dl and no one had severe anemia haemoglobin level <7.0gm/dl.
2. The age of the adolescent girls ranged between 12 years-15 years. The prevalence of anemia increased with the age of adolescent girls the majority of girls 60.7% were 14 years of age and only 1.2% was 12 years of age.
3. Major proportion of adolescent girls 54(64.3%) had 4-6 members in the family and only few girls 9(11%) had 2-4 members in the family.
4. Family' monthly income of a major proportion 43(51.2%) girls was less than 5,000.
5. Majority 64(76.2%) girls had the habit of drinking coffee/tea.
6. Only five (6%) girls had done de-worming in the past, majority 79(94%) girls had not done de-worming in the past.
7. History collection on symptoms of anemia revealed that, majority 36(42.9%) girls had history of shortness of breath on exertion, 36 (42.9%) girls had complaint of easy fatigability, and 41(48.8%) girls had loss of appetite, 30(35.7%) girls had history of dizziness, 28(33.3%) girls had history of palpitations and major proportion 66(78.8%) girls had the complaints of hair loss.
8. Majority of the girls 51(60.7%) with anemic were under weight.
9. Physical examination of adolescent girls with mild anemia depicted that, majority of girls 48 (57.1%) girls had pale conjunctiva. Appearance of tongue was pale color for 34(40.5%) girls. 14 (28.6%) girls had pale skin and pale face.
10. The mean difference in haemoglobin level was 1.28 after administration of ragi porridge.
11. The paied 't' test value (t = 14.22) is greater than the tabulated value at p< 0.00i level. This shows that there is a significant difference in haemoglobin level before and after administration of ragi porridge.

12. A negative relation was found between the frequency of signs of anemia and the haemoglobin level.

13. A negative relation was found between the number of family members and the haemoglobin value.

6.2 Limitation:

6.2.1 The complete dietary pattern of adolescent girls not monitored.

6.3 Suggestions:

6.3.1 A similar study can be conducted with a comparison group.

6.3.2 A study can be performed to determine the epidemiological factors related to prevalence of anemia among adolescent girls.

6.3.3 A comparative study can be done on adolescent boys and girls.

6.3.4 A similar study can be conducted on a long term basis.

6.4 Recommendations:

6.4.1 In-service education can be organized to health workers on need for screening the adolescent girls for anemia and the importance of dietary supplements in combating anemia.

6.4.2 Yearly once haemoglobin analysis can be done in schools.

6.4.3 School authority can be recommended to give the supplementary diet to the students.

6.4.4 Yearly twice mass de worming can be recommended.

Conclusion: The study highlights the magnitude of the problem of anemia among the adolescent girls and the need to address the problem. Mild grade anemia in apparently healthy population may appear to be innocuous but could lead to significant morbidity and health problems. Early detection and adequate dietary supplementation with iron rich diet will minimize the consequences of the condition. The best approach to prevent the development of anemia in general population would be through food fortification, creating awareness about benefits of dietary diversification and consumption diet rich in iron.

This study review showed that ragi porridge was a most effective iron rich supplement diet to treat mild anemia. This recipe can be introduced as a supplement for mild anemia.

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