**Effect of Finger Millet (Ragi) Consumption on Haemoglobin Level among Adolescent Girls of Jalaun District**

**Abstract**

The adolescent years are a golden opportunity to tackle nutritional deficiencies, especially in rural Jalaun District, where anaemia is rampant among adolescent girls due to poverty and limited healthcare access. Finger millet, or ragi, a drought-resistant, iron-rich cereal, was studied to see its impact on haemoglobin levels and BMI in 60 girls aged 13–16 from Rura Mallu Gram and Kukargoan. Split into two groups, the experimental group ate 50 grams of ragi porridge twice daily for 90 days, while the control group didn’t. The results were striking: the ragi group’s haemoglobin jumped significantly from 10.5 g% to 11.5 g% (t-value 5.59, p<0.05), unlike the control group’s slight, non-significant rise from 9.5 g% to 9.9 g%. No BMI changes were noted in either group. Affordable and nutritious, ragi—whether as porridge, roti, or dumplings—proved a game-changer for fighting anaemia, calling for greater awareness to make it a dietary staple for healthier futures.

**Keywords:** Ragi, Adolescence, Haemoglobin, Body Mass Index, Nutrition

### Introduction

Adolescent age group is the window of opportunity to correct nutritional status of children. If we intervene correctly during this period, we can prevent future consequences of nutritional deficiencies. The period between 10 and 19 years of age has been defined as adolescence by the World Health Organization. This period has been considered as the transitional phase from childhood to adulthood. During this phase, major psychological, behavioral, and physical developments ensue; because of marked physical activity and rapid growth spurt adolescence needs additional nutritional requirements. According to recent statistics, there were about 1.2 billion adolescents worldwide, who constitute one-fifth of the total world's population and the figures are escalating. Adolescents constitute over 21.4% of the population in India and adolescent girls constitute about 10 percent of the Indian population. Anemia accounts for majority of the nutritional problem across the globe and it is principally engendered by deficiency of iron. Although it occurs in all the age group, prevalence is on a higher side among women of childbearing age. India had reported high prevalence of anemia among adolescent girls, which is apparently higher when compared with the other developing nations.

Presently, the prevalence of anemia among adolescent girls is on the rise in India. Since adolescent period signalizes the beginning of menstrual period in girls, they are at a higher risk for nutritional anemia. In rural areas of India, girls get married and become pregnant during the late adolescent period, thus increasing the risk of adolescent anemia and low birth weight babies.

There were many studies focused on anemia among pregnant women and children, but only few studies were available on anemia among adolescent girls. This study was aimed to find out the effect of consumption of finger millet (Ragi) on the level of hemoglobin and Body Mass Index among adolescent girls in a rural area Jalaun district of Uttar Pradesh. Adolescent girls are chosen for the study as by improving anemia and awareness among adolescent girls, maternal morbidity, and mortality especially during pregnancy can be improved.

The prevalence of anemia is inordinately higher among rural area of Jalaun District regarding adolescent girls, because of low socioeconomic status and indigent access to the healthcare services. Finger millet *(Eleusine coracana)* commonly known as ragi and mandua in India is the most widely grown small millet in the world. It has assumed a status of important staple food in East and Central Africa and in India (Jenkins et al.1982). India is the major producer of finger millet contributing nearly 60% of the global production. It is better adapted to higher rainfall areas (600–1,200 mm) particularly acid soils and matures within 100 to 130 days. One of the striking features of finger millet is its ability to adjust in different agro-climatic conditions which is reflected in having highest productivity among millets (Gopalan et al., 2002). Finger millet is extensively grown in the states of Karnataka, Tamil Nadu, Andhra Pradesh and parts of North India (Vijayakumari et al. 2003). It also occupies third important place after rice and wheat in Uttarakhand. In India, it is consumed generally by a small segment of the population in the form of dumpling, porridge and roti. In recent years, finger millet has gained importance, because of its nutritional strength in terms of dietary and functional fiber, starch pattern, as well as high calcium and iron contents. The calcium and iron contents in finger millet varieties have been reported to be 220–450 and 3–20%, respectively (Balakrishna Rao et al., 1973). Lakshmi and Sumathi (2002) reported that consumption of finger millet based diet resulted in significantly lower plasma glucose levels, mean peak rise and area under the curve. Low glycemic index nutritious food products prepared from millets can be used as an effective supportive therapy in the management of diabetes mellitus (Arora and Srivastava, 2002).

### Finger millet is considered one of the most nutritious cereals. Finger millet is a very good source of natural Iron and its consumption helps in recovery of Anemia. The Ragi based foods are highly suited for expectant adolescence and mothers due to their high calcium and iron content.

### Materials and Methods

### About the area

District Jalaun is surrounded by the three rivers, Yamuna, Betwa and Pahuj. The land being an undulated plain has been suitable for human inhabitation. The ancient history of this district has been closely linked with the history of the entire Bundelkhand region. The district is situated between parallels of 25° 46 and 26° 27’ north latitude and 78° 56’ and 79° 52’ east longitude and forms a compact tract of territory of rectangular shape. Farmers in Jalaun prefer the mono cropping farming system. “Mixed farming in the combination of agriculture and livestock is also quite common in all the areas. Jowar-wheat, bajra-wheat, fallow-wheat, fallow-chickpea, fallow-field pea, fallow-lentil, soybean-wheat are the important crop rotations followed in different areas. Mixed cropping with sorghum + arhar, barley gram + mustard is also common. Tomato, onion, vegetable pea and chilies are important vegetables that are cultivated in this area. Both resource rich and resource poor farmers cultivate vegetable crops. Jalaun mainly consists of four types of soil. Top produced crops in Jalaun are wheat, and peas etc”

### Aim

This study was carried out to find out the effect of consumption of finger millet (Ragi) on the level of hemoglobin and Body Mass Index- BMI among adolescent girls.

### Sample Selection

An experiment study was conducted among 60 adolescent girls of Rura Mallu Gram and Kukargoan of district of Jalaun. Adolescent girls in the age range of 13 to 16 years were randomly selected and divided into two groups T1- control group and T2- experimental group. Relevant clinical examination of participants was done. Blood samples were analysed using an auto-analyser and Adolescent girls were tested for Hemoglobin mg/dl level and height & weight were taken for BMI before and after intervention.

**Statistical analysis**

Data analysis was done using statistical tools and t-test to determine if there is a significant difference between the means of two groups. The level of significance was fixed at p-value of < 0.05.

**Results And Discussion**

In the present study, the majority of adolescent girls in the experiment and in control group were between the age group of 13-16 years as this group is at a high risk for anemia.High prevalence of anemia in this age group has been reported in various states of India. The nutritional quality of food plays a critical role in maintaining overall human physical well-being, as it contributes to sustained health and development while maximizing human genetic potential. Therefore, addressing deep-rooted food insecurity and malnutrition requires a focus on dietary quality (Singh & Raghuvanshi, 2012).This study sought to establish the effect of ragi in improving hemoglobin level and body mass index among adolescent schoolgirls. Sixty adolescent girls were randomly selected and divided into experiment (n = 30) and control groups (n = 30).

Table 1: Comparison of the mean scores and standard deviation and t-test for haemoglobin

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Group** | **Stage** | **Mean** | **SD** | **t-test** | **df** | **p-value** |
| T1- (Control group) n=30 | Pre | 9.5 | 1.345 | -1.59 | 29 | 0.10 |
|  | Post | 9.9 | 0.289 |
| T2- (Experiment group) n=30 | Pre | 10.5 | 0.195 | -5.59 | 29 | 0.0001\* |
|  | Post | 11.5 | 0.960 |
| T1+T2= Control group+ Experiment group  n=30+30 =60 | Pre | 9.9 | 1.283 | 2.15 | 58 | 0.975 |
|  | Post | 11.5 | 1.414 |

*\*Statistically significant*

*df-degree of freedom, pre- hemoglobin level on day1, post- hemoglobin level on day90, SD- standard deviation,*

The effect of dietary 50 gm twice per day supplementation of ragi porridge on hemoglobin level was evaluated on the experiment group at 90 days. Both groups were also monitored for changes in body mass index as shown in Table 1, the result shows a statistically significant increase in hemoglobin levels was observed in the experiment group after 90 days from a mean of 10.5 g% to 11.5 g%. The absolute t-test value is 5.59 for hemoglobin level. In control group slight increase in the values of hemoglobin level from 9.5gm% to 9.9gm% was observed which was not statistically significant. Bhatt et al. (2003) reported the calcium content of finger millet as 344 mg%. The iron content of finger millet ranged from 3.3 to 14.8 mg% (Babu et al., 1987). Singh and Srivastava (2006) reported the iron content of 16 finger millet varieties ranged from 3.61 mg/100g to 5.42 mg% with a mean value of 4.40 mg/100g. According to Vijayakumari et al. (2003) finger millet is the richest source of calcium and iron. Calcium deficiency leading to bone and teeth disorder, iron deficiency leading to anemia can be overcome by introducing finger millet in our daily diet. Singh and Srivastava (2006) observed that the zinc content of the sixteen varieties of finger millet ranged from 0.92 to 2.55 mg% with a mean value of 1.34 mg%. The phosphorous content ranged from 130 to 295 mg% with a mean value of 180.43 mg% (Singh and Srivastava, 2006).

Table 2: Comparison of the mean scores and standard deviation and t-test for body mass index

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Group** | | **Mean** | **SD** | **t-test** | **df** | **p-value** |
| T1 | Control group | 16.7 | 0.283 | 2.30 | 58 | 0.975 |
| T2 | Experiment group | 17.35 | 1.061 |

There is no significant difference of both control and experiment group for BMI to find the effectiveness of ragi supplement from a mean of 16.7 to 17.35. The absolute t-test value was 2.30 for BMI, which was greater than the critical value (2.04) at a 97.5% confidence interval with a degree of freedom of 58. No statistically significant differences between the two groups were observed for mean body mass index.

**Conclusion**

Finger millet grain is highly nutritious, being richer in protein, fat and minerals especially calcium and iron compared to rice. The data show that daily dietary supplementation either in the form of flour-based food as porridge/dumpling, ragi balls or roti is good for health. With its cost effectiveness, ragi is a healthy food and has a positive effect on hemoglobin levels in adolescent girls. The products made from composite flours are nutritionally superior to their respective controls and can be successfully used for supplementary feeding programmers. Efforts should be made to educate people about nutritive value and health benefits of finger millet and its food products (Singh *et al*., 2012). So, finger millet is an extremely nutritious cereal and is very beneficial for maintaining a good health.

**Recommendation**

Finger millet (Eleusine coracana), also known as ragi or mandua, is one of the oldest food grains and is one of the widely available food sources in India. Therefore, awareness among the people is required for their potential role as functional foods and encourages the use of ragi. The regular use of finger millet as a nutrient and its products helps in managing different disorders of body by maintaining blood glucose homeostasis. Also, the whole meal-based finger millet products may be desirable due to the protective role of seed coat matter that has health enhancing benefits.

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