ORIGINAL ARTICLE

# Effect of whey guava beverage supplementation on haemoglobin level of school going children

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## Abstract

**Introduction:** Iron deficiency is estimated to affect one-half of the school going children in developing countries and school years are opportune time to intervene. **Rationale:** No coherent, co-ordinate and effective health services are available in the country for below 16 years. So attempt was made to know real scenario of iron deficiency. **Objectives:** To assess the effect of whey guava beverage supplementation on the haemoglobin level of school going children. **Methodology:** An experimental research design was taken to conduct the study in which 200 children of 6≥and7≥ years in low socio economic status of both the genders were taken. For hemoglobin testing Sahil's hemoglobinometer was used. Each child in experimental group was given 200ml of whey guava beverage for 90 days except holidays. **Results and Discussion:** The initial mean Hb levels of 6≥and7≥ year's old boys and girls of control groups and experimental groups were ranging from 9.50 to 10.24 which were 79.17% to 85.33%. The results revealed that almost all the respondents were anaemic. After 90 days of feeding supplement the final mean Hb levels of 6≥7 years old boys and girls of control group ranged from 10.10 to 10.65 which was 84.17% to 88.75%. Whereas in experimental group it ranged from 11.06 to 11.42 which were 91.92% to 95.17%. The study clearly evidences that the respondents in experimental group had improved with more Hb levels when compared to control group. Also children who were suffering from anaemia in experimental group became normal. **Conclusion:** Distribution of whey guava beverage through school feeding program may prove as an outstanding strategy to combat iron deficiency in school children.

## Key Words:

Whey guava beverage; supplementation; haemoglobin; school going children

## Introduction

Iron deficiency is estimated to affect one-half of the school going children in developing countries and school years are opportune time to intervene. No coherent, co-ordinate and effective health services are available in the country for below 16 years. There is, thus, an urgent need for meeting their requirements through the development of biologically balanced supplementary foods, which are reasonably priced and which can be prepared at home at the community level. Whey is a dairy waste source protein which contains approximately 6% protein of which 80% is casein and remaining 20% is whey. Economic utilization of whey is still a real challenge for the dairy industry. The availability of fruit, excellent nutritive value, flavor and medicinal properties of guava fruit show great potential for processing into valuable products. Market demand for beverages is growing all over the world and India is no exception to it. Whey beverages have been recognized as a genuine thirst quencher, light, refreshing, healthy and nutritious and economical.

## Aims & Objectives

To assess the effect of whey guava beverage supplementation on the haemoglobin level of school going children.

## Material and Methods

The sample comprised of 200 children belonging to low socio economic status aged 6≥and7≥ years. They were selected randomly from four government schools located around Vijay Nagar i.e., urban area of Ghaziabad city in U.P. Then from these four schools (comprising a total of two hundred respondents); children of two schools were considered as experimental group (n=100) while the children of the other two schools were considered as control group (n=100). In each group out of 100 children, 50 respondents were 6 years and 50 respondents were 7 years, each group having equal number of boys and girls (n=25) each. For haemoglobin testing Sahil's hemoglobinometer was used. It was compared with the standard of ICNND (1985). The respondents were classified into different grades of anaemia by using WHO standards (1989). For the preparation of whey guava beverage, Whey (400 ml) was heated to dissolve sugar (60gm) thereafter; guava pulp (200 ml) was thoroughly mixed with the above mixture. The mixture was heated for around 700 C to 800 C approximately for 15 minutes. After this the whole mixture was filtered by double layered muslin cloth, cooled to 50 C and filled in the bottle and stored at refrigerator. Each child in experimental group was given 200ml of whey guava beverage for 90 days except holidays. The beverage was given between breakfast and lunch at 11 to 11:30 am in their schools.

## Results

**Mean blood haemoglobin levels:** Initial and final haemoglobin measurements of children are represented in table 1 and fig I which showed that after 90 days of feeding supplement of whey guava beverage the mean increments in haemoglobin values of 6≥ and 7≥ years old boys of experimental group was 1.33 gm/dl and 1.18 gm/dl and in control group was 0.49 and 0.52 gm/dl. The mean increments in girls of 6≥ and 7≥ years old in experimental group were 1.36 and 1.25 gm/dl and whereas in control group were 0.60 and 0.55 gm/dl. There was a significant improvement in haemoglobin level in all the experimental groups when compared with the control groups. The suggested desirable value for haemoglobin among 6-7 years old children according to WHO is 12 gm/dl.

Percentage and frequency distribution of haemoglobin level of children are represented in table 2 & table 3 and figure II & figure III. The children in the study were grouped into four categories according to the degree of anaemia. The above mentioned data represents the data regarding the progression of children from one category to other at the end of the study period.

After 90 days of the study period it could be noticed that severe anaemia had disappeared in almost all the groups. Children from severe anaemic categories had shifted to moderate anaemic grade and children in moderate anaemic grade shifted to mild anaemic grade. The total number of children in the normal and mild anaemic categories increased in experimental group. The changes show encouraging trend because shifting from moderate degree of anaemia to milder degree of anaemia is more challenging than registering mild increments in blood hemoglobin levels alone.

## Discussion

The findings of the present study indicate that daily supplement of whey guava beverage registered significant increase in haemoglobin level of children from experimental group in terms of blood hemoglobin levels when compared to the control group children. An increase in additional iron with micronutrients in the health drink may be beneficial towards increasing the haemoglobin values which in turn will promote a sense of well being and improve all round physical and mental performance among the children.

Vasanthawani, G. et al., (2009) carried out a study on 300 children living in selected service institution in the age group of 5-17 ≥ years from Coimbatore. Hemoglobin estimation was done using the Cyanomethaemoglobin method for a sub sample of 30 children. The results obtained from Cyanomethaemoglobin test on 30 children showed that 9 children were suffering from anemia with only 7-10 gm/dl of hemoglobin as per the classification suggested by WHO and 16 children showed mild anemia with hemoglobin level between 10 & 12 gm/dl. Only 5 children had normal hemoglobin level of more than 12 gm/dl. Nalwade et al., (2004) supplemented diets of school children with iron and vitamin A supplement containing papaya (150 gm), carrot (50 gm) for vitamin A and roasted rice flakes chiwda (75 gm) and sesames chikki (65 gm). The supplement was given for 90 days. Hemoglobin content of children in experimental group ranged

from 5.22-9.78 gm/dl with a mean value of 6.70 ± 1.10 gm/dl before supplementation which was found to be significantly increased after the supplementation (10.80 ±1.80 gm/dl). Whereas the mean blood hemoglobin level of the control group children remained unaltered (9.71 ± 1.90 gm/dl to 9.73 ± 1.93 gm/dl).

## Conclusion

The study had highlighted the fact that school children from Ghaziabad district of U.P. in India are anaemic due to deficits in their consumption of nutrients from different food groups. There is a clear need to bridge this nutrient gap in these children's diet with an enjoyable form of food. The present study attempted to do so by supplementing the school children's diet with whey guava beverage for 90 days. Encouraging findings from the present study demonstrate the beneficial effect of the whey guava beverage on the haemoglobin level of 6-7 years old children. This study exhibits that the supplementation of the beverage in the children's diet attributed to significantly increased blood hemoglobin levels. Therefore it can be concluded that a simple addition of whey guava beverage in most days to a diet of even low socio economic status children has a promising potential towards improving their haemoglobin level.

## Recommendation

1. Parents of all socio economic classes need to be educated about the malnutrition problem in children and various ways of overcoming them through nutrients intake and balanced diet.
2. Parents can be educated about the effective utilization of whey which is available at home by making whey based recipes rather than discharging it as waste.

## Limitation of the study

1. As the intervention study period in our case was ninety days which is a short period for complete assessment of any benefit derived from nutrients. Hence an intervention study for a longer period would further reveal more beneficial aspects of whey based beverages.
2. The intervention study was restricted to a specific area in Ghaziabad. The same can be extended to other places also.
3. The intervention study was targeting 6≥ & 7≥ year's old children. The same can be studied on other age group children.

## Relevance of the study

The whey guava beverage supplementation developed by us is a very good source of low cost supplement food. The supplement is made out of whey water which is a daily waste product and has high nutrient contents required for children. This is a very affordable form of drink which is tasty, refreshing, nutritious and acceptable by children.

## Authors Contribution

D: Substantial contribution towards conception, design, acquisition of data, analysis and interpretation of data and drafting the article. Final approval of the version to be published. SC: Drafting the article or revising it for important intellectual content and final approval of the version to be published.

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## Tables

**TABLE 1MEAN HAEMOGLOBIN LEVEL OF 6 ≥ YEARS AND 7 ≥ YEARS OLD BOYS AND GIRLS OF CONTROL GROUP AND EXPERIMENTAL GROUP AT PRE AND POST INTERVENTION STAGE**

| Age And Gender | Reference Values | Control Group | | | Experimental Group | | | Comparative Groups | "t" Value |
|---|---|---|---|---|---|---|---|---|---|
| | | Initial Value | Final Value | Increment | Initial Value | Final Value | Increment | | |
| **6 ≥ years old boys** | >12 g/dl | 9.78±1.46 (6.5-12.0) 81.50% | 10.27±1.30 (7.25-12.25) 85.58% | 0.49 | 9.73±1.41 (6.5-12.5) 81.08% | 11.06±1.22 (8.5-13.5) 92.17% | 1.33 | Cont Pre Vs. Ex Pre<br>Cont Post Vs. Ex Post | 0.12 NS<br>**2.16* S** |
| **6 ≥ years old girls** | >12 g/dl | 9.50±1.57 (6.5-12.0) 79.17% | 10.10±1.51 (7-12.25) 84.17% | 0.60 | 9.67±1.43 (7-12) 80.58% | 11.03±1.21 (8.5-13.5) 91.92% | 1.36 | Cont Pre Vs. Ex Pre<br>Cont Post Vs. Ex Post | 0.39 NS<br>**2.34* S** |
| **7 ≥ years old boys** | >12 g/dl | 10.13±1.48 (8-13.5) 84.42% | 10.65±1.42 (8.5-13.75) 88.75% | 0.52 | 10.24±1.25 (8.25-12.25) 85.33% | 11.42±0.99 (10-13.5) 95.17% | 1.18 | Cont Pre Vs. Ex Pre<br>Cont Post Vs. Ex Post | 0.28 NS<br>**2.17*S** |
| **7 ≥ years old girls** | >12 g/dl | 9.78±1.38 (6.5-12.0) 81.50% | 10.33±1.33 (7-12.25) 86.08% | 0.55 | 9.82±1.12 (7.25-12.0) 81.83% | 11.07±0.92 (9.0-12.50) 92.25% | 1.25 | Cont Pre Vs. Ex Pre<br>Cont Post Vs. Ex Post | 0.11 NS<br>**2.23* S** |

NB: Figures in parenthesis indicate range of haemoglobin level

**TABLE 2 FREQUENCIES AND PERCENTAGE DISTRIBUTION OF HAEMOGLOBIN IN DIFFERENT GRADES OF NUTRITION OF 6 ≥ YEARS OLD BOYS AND GIRLS IN CONTROL GROUP AND EXPERIMENTAL GROUP AT PRE AND POST INTERVENTION STAGE**

| S.no | Grades | 6 ≥ years OLD BOYS n=50 | | | | 6 ≥ years OLD GIRLS n=50 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Control group Pre n=25(%) | Control group Post n=25(%) | Experimental group Pre n=25(%) | Experimental group Post n=25(%) | Control group Pre n=25(%) | Control group Post n=25(%) | Experimental group Pre n=25(%) | Experimental group Post n=25(%) |
| **1** | >12 g/dl Normal | 1 (4) | 2 (8) | 2 (8) | 7 (28) | 2 (8) | 2 (8) | 2 (8) | 8 (32) |
| **2** | 10-11.9 g/dl Mild anemia | 14 (56) | 15 (60) | 13 (52) | 15 (60) | 12 (48) | 14 (56) | 12 (48) | 14 (56) |
| **3** | 8-9.9 g/dl Moderate anemia | 8 (32) | 7 (28) | 8 (32) | 3 (12) | 7 (28) | 7 (28) | 9 (36) | 3 (12) |
| **4** | <8 g/dl Severe anemia | 2 (8) | 1 (4) | 2 (8) | - | 1 (16) | 2 (8) | 2 (8) | - |

NB: Figures in parenthesis indicate percentage

**TABLE 3 FREQUENCIES AND PERCENTAGE DISTRIBUTION OF HAEMOGLOBIN IN DIFFERENT GRADES OF NUTRITION OF 7 ≥ YEARS OLD BOYS AND GIRLS IN CONTROL GROUP AND EXPERIMENTAL GROUP AT PRE AND POST INTERVENTION STAGE**

| S.No | Grades | 7 ≥ years OLD BOYS n=50 | | | | 7 ≥ years OLD GIRLS n=50 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Control group Pre n=25 | Control group Post n=25 | Experimental group Pre n=25 | Experimental group Post n=25 | Control group Pre n=25 | Control group Post n=25 | Experimental group Pre n=25 | Experimental group Post n=25 |
| **1** | >12 Normal | 2 (8) | 6 (24) | 3 (12) | 8 (32) | 1 (4) | 1 (4) | 1 (4) | 5 (20) |
| **2** | 10-11.9 Mild anemia | 11 (44) | 11 (44) | 15 (60) | 17 (68) | 14 (56) | 17 (68) | 14 (56) | 18 (72) |
| **3** | 8-9.9 Moderate anemia | 12 (48) | 8 (32) | 7 (28) | - | 8 (32) | 5 (20) | 8 (32) | 2 (8) |
| **4** | <8 Severe anemia | - | - | - | - | 2 (8) | 2 (8) | 2 (8) | - |

NB: Figures in parenthesis indicate percentage

## Figures

**FIGURE 1**

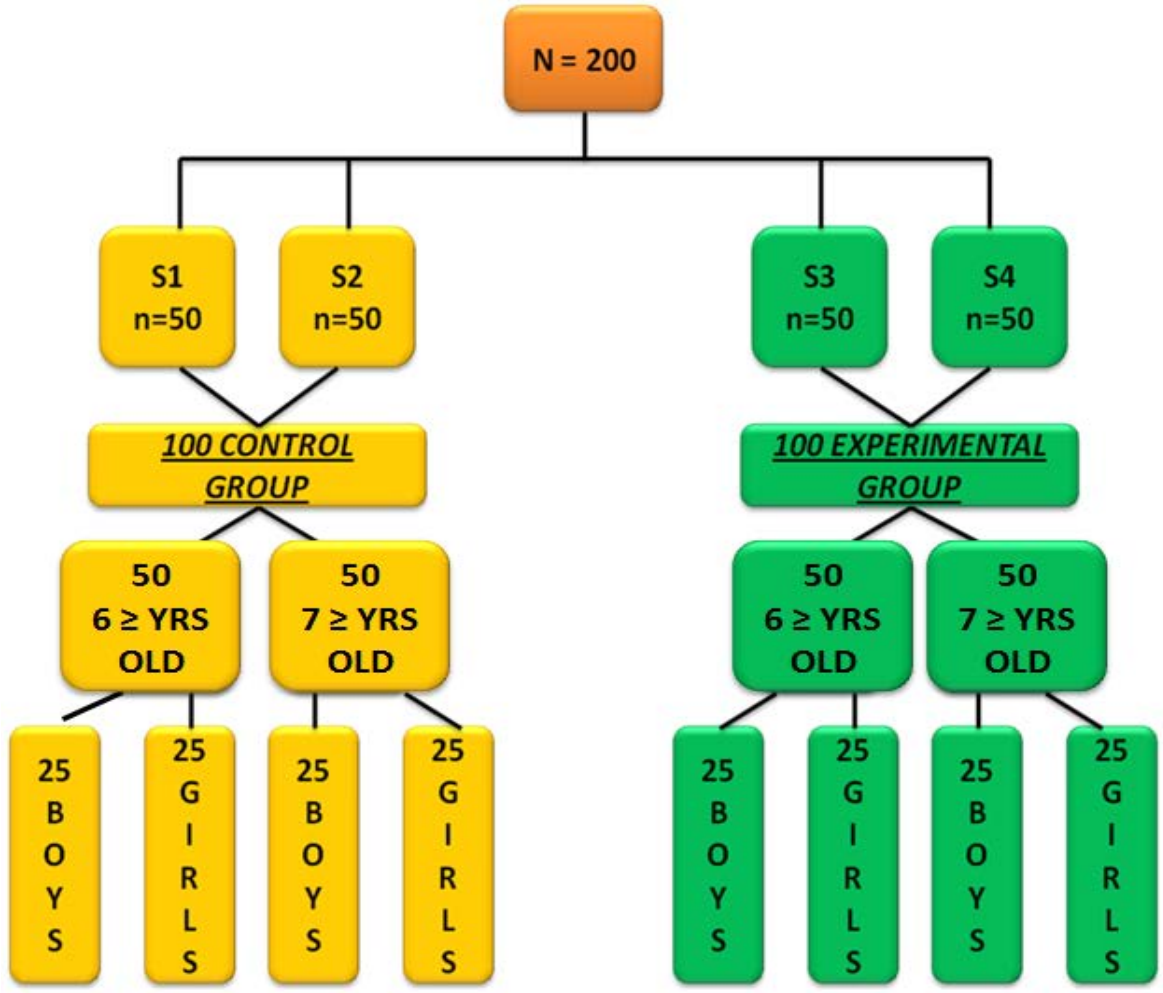


**FIGURE 2MEAN HAEMOGLOBIN LEVEL OF 6 ≥ & 7 ≥ YEARS OLD BOYS AND GIRLS OF CONTROL GROUP AND EXPERIMENTAL GROUP AT PRE AND POST INTERVENTION STAGE**

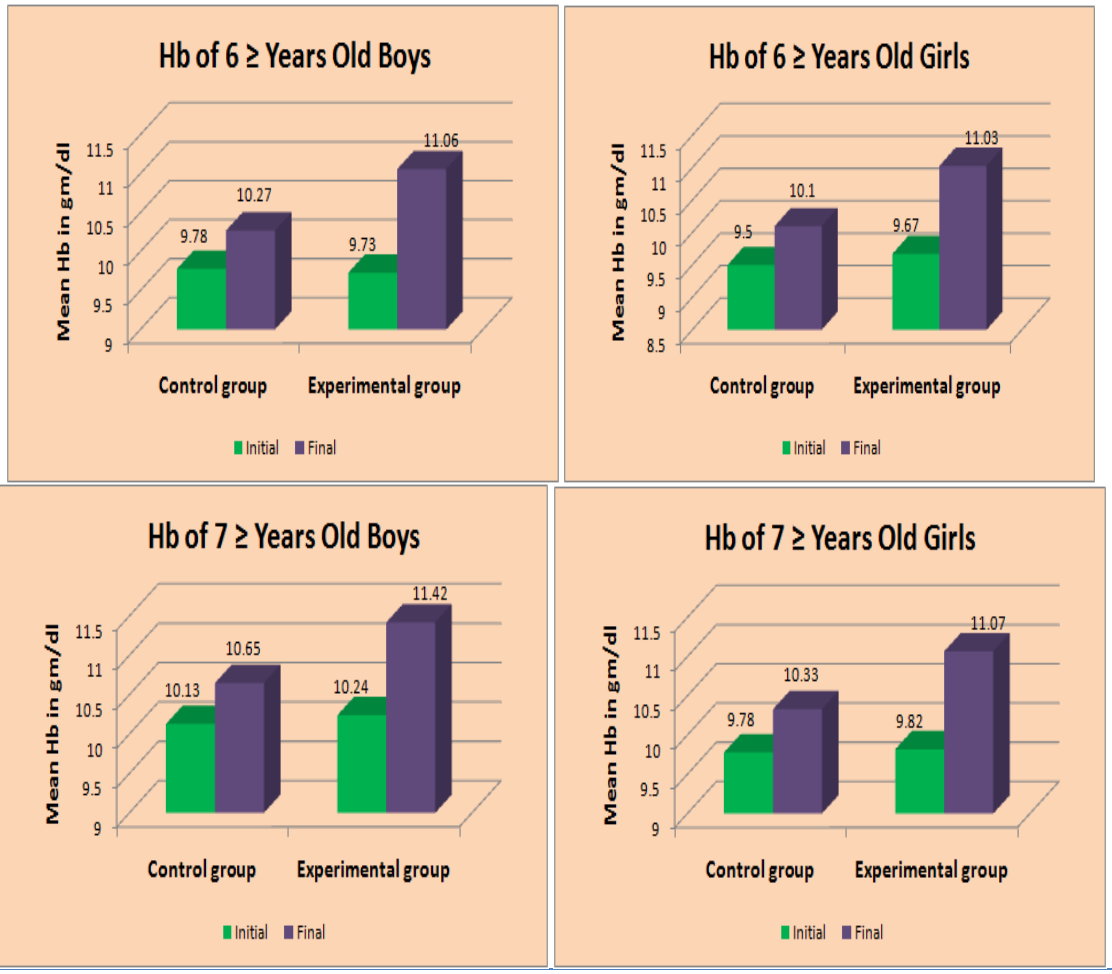
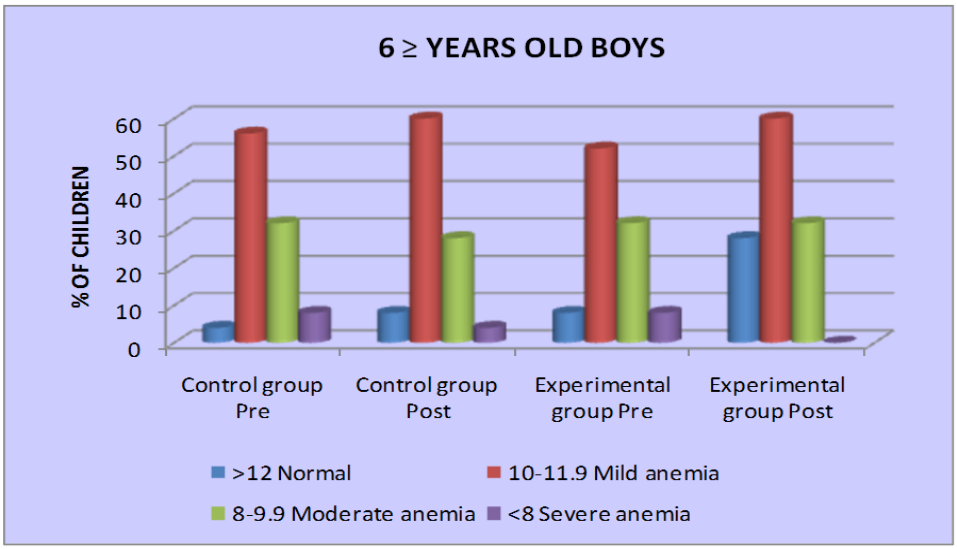



**FIGURE 3 FREQUENCIES AND PERCENTAGE DISTRIBUTION OF HAEMOGLOBIN IN DIFFERENT GRADES OF NUTRITION OF 6 ≥ YEARS OLD BOYS AND GIRLS IN CONTROL GROUP AND EXPERIMENTAL GROUP AT PRE AND POST INTERVENTION STAGE**



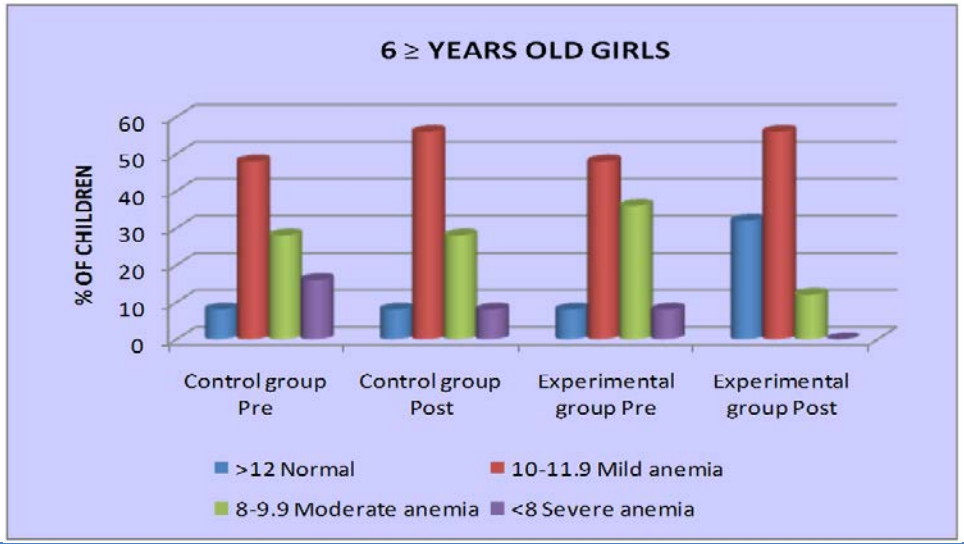



**FIGURE 4FREQUENCIES AND PERCENTAGE DISTRIBUTION OF HAEMOGLOBIN IN DIFFERENT GRADES OF NUTRITION OF 7 ≥ YEARS OLD BOYS AND GIRLS IN CONTROL GROUP AND EXPERIMENTAL GROUP AT PRE AND POST INTERVENTION STAGE**