ISSN: 0975-833X

Available online at http://www.journalcra.com

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

International Journal of Current Research
Vol. 13, Issue, 11, pp.19560-19564, November, 2021

DOI: https://doi.org/10.24941/ijcr.42539.11.2021

RESEARCH ARTICLE

EFFECTIVENESS OF NUTRITIONAL INTERVENTION IN IMPROVING INTELLIGENCE AMONG ADOLESCENT GIRLS

[1*]Kalaichelvi, D. and [2]Nalini Jeyavantha Santha

[1]PhD Nursing, Professor, Mother Teresa College of Nursing, Durg
[2]PhD Guide, Principal, Sacred Heart Nursing College, Madurai

ARTICLE INFO

Article History:
Received 25th August, 2021
Received in revised form
19th September, 2021
Accepted 24th October, 2021
Published online 26th November, 2021

Key Words:

Nutritional Intervention , Intelligence, Adolescent Girls, Effectiveness.

[*]Corresponding author:
Kalaichelvi, D.

ABSTRACT

Iron deficiency anemia is most common nutritional deficiency disorder in India and remains a formidable health challenge. Iron deficiency leads to many health disturbances which include growth and development, depressed immune function in infants; reduces physical work capacity; decreases the cognitive function in adolescents. The study was conducted to assess the effectiveness of nutritional intervention in improving intelligence among adolescent girls.

Objectives of the study

- To assess the iron deficiency anemia and intelligence among adolescent girls with anemia.
- To find out the effectiveness of nutritional intervention on intelligence among adolescent girls with anemia.
- To find out the relationship between iron deficiency anemia and intelligence among adolescent girls with anemia.
- To find out the association between the demographic variables and post test intelligence level of adolescent girls with anemia.

***Methods*:** A quantitative approach with true experimental, pre test and post test control group design was used for the study. Adolescent girls in the age group of 12–15 years studying in seventh to ninth standard were selected. Peripheral blood smear and hemoglobin level was estimated. For assessing the intelligence MALIN'S Intelligence Scale was used. In MALIN‟S scale, verbal response and performance were assessed. In verbal response, general information, arithmetic, similarities and digit span and in performance, picture completion, object assembly, coding and maize was used. ***Results*:** Majority (50%) of the study subjects had mild anemia and average intelligence level in the pretest of experimental and control group. Their intelligence level also increased in verbal response especially in arithmetic and digit span, the pretest mean value was 86.88 and post test - II mean value for digit span.

Citation: Kalaichelvi, D. and Nalini Jeyavantha Santha. *"*Effectiveness of nutritional intervention in improving intelligence among adolescent girls*", 2021. International Journal of Current Research, 13, (11), 19560-19564.*

INTRODUCTION

Nutrition is one of the significant indicators of the health and the overall status of adolescents. Adolescence is a period of transition between childhood and adulthood, is a golden period, period of dreams and a period to live out their role models, a time of rapid physical, cognitive, social and emotional maturation as the boy prepares for manhood and the girl prepares for womanhood. In this period, adolescence begins with the gradual appearance of secondary sex characteristics at about 11 to 12 years and cessation of body growth occurs at 18 to 20 years (Vijaya Lakshmi, 2013).

The World Health Organization (WHO) defines adolescence both in terms of age (spanning the ages between 10 and 19 years) and in terms of a phase of life marked by special attributes. There are three main stages of adolescence can be discerned (i) Early adolescence (9 – 13 years), (ii) Mid adolescence (14 –15 years), (iii) Late adolescence (16 – 19 years). Adequate nutrition is more important for the growth of an adolescent. Iron deficiency anemia is caused by insufficient iron supply, increased demand of iron, insufficient iron intake, impaired iron absorption and blood loss. Insufficient intake of dietary iron and socioeconomic status is the common cause for iron deficiency anemia. The signs and symptoms of anemia are unusual tiredness, dizziness, headache, paleness of

conjunctiva, nail and skin, weakness, irritability, fatigue, anorexia, flattened and brittle nails, pica, reduced mascular endurance, shortness of breath and palpitations, delayed growth and development (Marlow, 2002).Complications of iron deficiency anemia are delayed growth and development, shortened attention span, learning disabilities, decreased social interaction, lead poisoning, infections and behavioral problems. The alternative therapy in treating anemia is consumption of iron rich diet. Rice flakes also found to be rich in iron, Vitamin B, Vitamin C and dietary fibre. It helps to improve hemoglobin level and also builds immunity. Consumption of jaggery helps to reduce iron deficiency anemia. Amla or Indian gooseberry is rich in vitamin C which helps in absorption of iron.

Statement of the Problem: A study on effectiveness of nutritional intervention in improving intelligence among adolescent girls.

Objectives

- To assess the iron deficiency anemia and intelligence among adolescent girls with anemia.
- To find out the effectiveness of nutritional intervention on intelligence among adolescent girls with anemia.
- To find out the relationship between iron deficiency anemia and intelligence among adolescent girls with anemia.
- To find out the association between the demographic variables and post test intelligence level of adolescent girls with anemia.

Hypothesis

H_1 - The mean posttest intelligence level of adolescent girls with anemia in experimental group who had nutritional intervention will be significantly higher than the mean pretest intelligence level of adolescent girls with anemia.

H_2 - The mean posttest intelligence level of adolescent girls with anemia in the experimental group who had nutritional intervention will be significantly higher than the mean posttest intelligence level of the control group.

H_3 - There will be a significant relationship between the hemoglobin level and intelligence level of adolescent girls with anemia.

H_4 - There will be a significant association between the posttest intelligence level and selected demographic variables of adolescent girls with anemia in the experimental and control group.

RESEARCH METHODOLOGY

A quantitative approach with true experimental, pre test and post test control group design was used for the study. By using the lottery method, four schools were selected homogenously with same criteria such as age, class, medium of instruction, student's strength, fee structure, socio economic status and physical facilities of the school. Two schools were assigned randomly to experimental group and two schools were assigned randomly to control group.

Totally 240 adolescent girls with anemia were selected among which 120 samples in experimental group and 120 samples in control group were assigned randomly. Samples were selected based on the criteria of age group from 12 to 15 years, Hb level of 7 to 12gms/dl, whohave hypochromic and microcytic anemia by assessing the peripheral blood smear. By using stratified sampling technique, 20 samples were selected from 12 to 13 years, 20 samples from >13 to 14 years and 20 samples from >14 to 15 years. Pretest was conducted for four weeks period. By using cynmethemoglobin method, hemoglobin level was checked. The adolescent who had hemoglobin level of 7 to 12 gms/dl were selected for the study. Demographic data was collected and psychologist assessed the intelligence among 10 adolescent girls with anemia every day by using MALIN'S intelligence scale for two weeks. The nutritional intervention was given for eight weeks to the experimental group. The control group was maintained by regular dietary practices. No intervention was given. On ninth week and tenth week, post test-I was conducted.At thirteenth and fourteenth week, post test-II was conducted among 10 adolescent girls with anemia per day.

Research Tool

Tool consists of five parts.

- **Part I-** It comprised of demographic variables.
- **Part II -** It consists of bio – physiological approach to estimate the haemoglobin status among adolescent girls using cynmethaemoglobin method.
- **Part III-** It consists of bio – physiological approach to estimate the Peripheral blood smear among adolescent girls to assess the hypochromic and microcytic anemia.
- **Part IV-** MALIN'S intelligence scale for Indian children was used to assess the intelligence of the adolescent girls. In MALIN"S scale, verbal response and performance were assessed. In verbal response, general information, arithmetic, similarities and digit span and in performance, picture completion, object assembly, coding and maize was used.

Scoring interpretation

75 – 89 = Borderline or dull, 90 – 109 = Average, 110 – 125 = Superior,126 – 139 = Very superior, Above 140 = Genius.

Nutritional intervention: It refers to the administration of 100 gms of nutritional ball which is made by the mixture of 60 gms of roasted rice flakes and 40 gms of jaggery. It provides 13.14 mgs of iron. For the absorption of iron, vitamin C that is 4gms of amla fruit powder was given.

Validity and reliability of the tool: The validity of the tool was established in consultation with nursing experts, nutritionist, pediatrician, psychologist and biostatistician. The reliability was established by intra rater reliability for the physiological measurement. Karl Pearson's correlation coefficient formula was used. The obtained 'r' value for hemoglobin level was 0.87, 0.84 for peripheral blood smear and for MALIN'S intelligence scale was 0.91.

RESULTS AND DISCUSSION

With regard to the age, 40 (33.3%) were in the age group of 12 to 13 years, >13 to 14 years and >14 to 15 years both in the experimental and control group. Regarding educational status, 40(33.3%) were studying 7th, 8th and 9th standard both in the experimental and control group. Related to father's educational status, 62 (51.7%) in the experimental group and 66 (55%) in the control group were graduates. With regard to mother's educational status, 46 (38.3%) in the experimental group and 43 (35.8%) in the control group were graduates. Regarding the father's occupational status, 36 (30%) were self-employed in the experimental group and 42 (35%) were private employees in the control group.

Regarding mother's occupational status, 54 (45%) in the experimental group and 49 (40.8%) in the control group were private employees. With regard to religion, 87 (72.5%) in the experimental group and 79 out of 120 (65.8%) in the control group were Hindus. The majority of the subjects 48 (40%) had an income of above Rs.30,000 in the experimental group and 62 (51.7%) had an income of Rs. 20,000– Rs.30, 000 in the control group. Related to area of residence, the majorityof the subjects 105 (87.5%) in the experimental group and 114 (95%) in the control group belong to rural area. Regarding dietary pattern, 94 (78.3%) in the experimental group and 103 (85.8%) in the control group were non vegetarians. With regard to type of family, 112 (93.3%) in the experimental group and 117 (97.5%) in the control group were from nuclear families.

Objective 1: To assess the iron deficiency anemia and intelligence among adolescent girls with anemia.

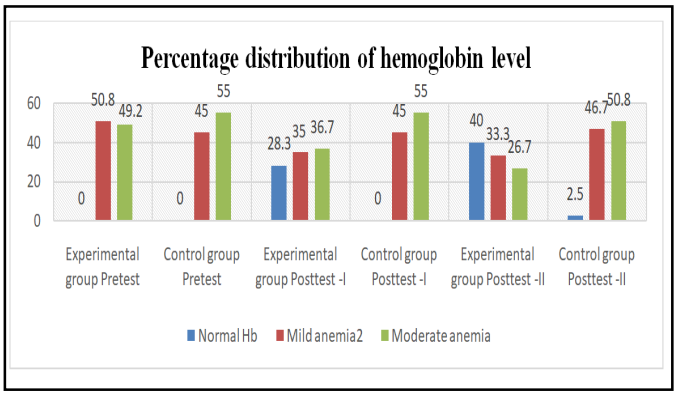

Fig 1. Percentage distribution of hemoglobin level in pretest, posttest –I and posttest –II among adolescent girls with anemia in experimental group and control group

Fig -1: summarizes that in the experimental group, 28.3% had a normal hemoglobin level, 35% had mild anemia and 36.7% of adolescent girls had moderate anemia in the post test-I, whereas in the control group, 45% of adolescent girls had mild anemia and 55% of adolescent girls had moderate anemia in post test-I.

In the experimental group, 40% had normal hemoglobin level, 33.3% had mild anemia and 26.7% of adolescent girls had moderate anemia in the post test-II. In the control group, 2.5% had normal hemoglobin levels, 46.7% had mild anemia and 50.8% of adolescent girls had moderate anemia in the post test-II.

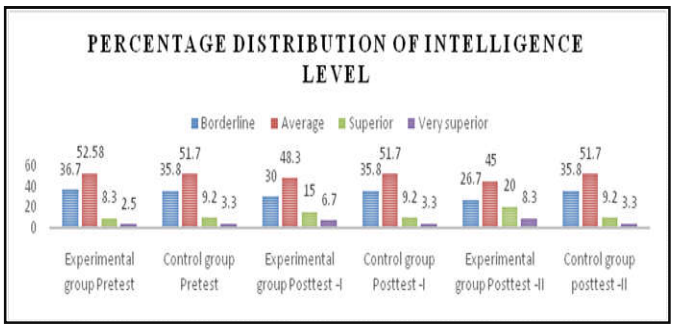

Fig 2. Percentage distribution of intelligence level in pretest, posttest –I and posttest –II among adolescent girls with anemia in experimental group and control group

Fig-2: Represented that in the experimental group, 2.5% of adolescent girls had very superior intelligence in the pretest 6.7% had very superior intelligence in the post test I, 20% had superior and 8.3% had very superior intelligence in the post test II. In the control group, there was no change in posttest-I and post test-II intelligence level.

Objective 2: To find out the effectiveness of nutritional intervention on intelligence among adolescent girls with anemia.

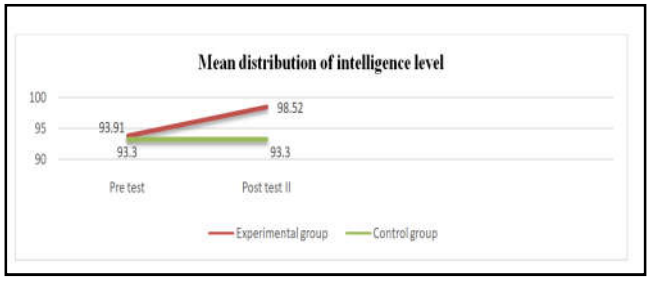

Fig 3. Line diagram showing mean distribution of intelligence level in pretest and post test –II of adolescent girls with anemia in the experimental group and control group

Fig 3: depicts that the mean posttest–II intelligence level (98.52) was higher than the mean pretest intelligence level (93.91) in the experimental group. There is no change in intelligence level in the control group in pre test and post test-II.

There was a significant difference in intelligence level between the pretest and posttest-II in the experimental group which was statistically highly significant (t=.2.010, $p < 0.05$).
It summarizes comparison between the experimental group and control group of posttest-I intelligence level, the obtained 't' value was 12.792 significant at P<0.001and in the posttest-II intelligence level, the obtained 't' value was 31.788 which was very highly significant at P<0.001. Repeated anova measure used to compare the total mean difference between the pretest, post-test-I and posttest-II intelligence level in the experimental and control group. The obtained 'F' ratio was 21.615, was significant P<0.01 level and indicated that the nutritional intervention is effective. Hence, it was concluded that the mean posttest intelligence level of adolescent girls with anemia in the experimental group who had nutritional intervention was significantly higher than the mean posttest intelligence level of the control group.

Table 1. Comparison of pretest and posttest intelligence level between the experimental and control group of adolescent girls with anemia. (n=240)

Intelligence level	Group	Mean	Std deviation	Independent T value	F value
Pretest	Experiment	93.91	9.690		F(2,476)=
	Control	93.30	9.659		21.615*
	Total	93.61	9.67		P<0.01**
Posttest- I	Experiment	97.26	9.861	12.792	
(9^{th}& 10^{th} week)	Control	93.30	9.659	P<0.001***	
	Total	95.28	9.76		
Posttest-II	Experiment	98.52	9.926	31.788	
(13^{th}& 14^{th} week)	Control	93.30	9.659	P<0.001***	
	Total	95.91	9.792		

P < 0.001 level*** - Very Highly Significant; P<0.01**Highly Significant

Objective 3: To find out the relationship between iron deficiency anemia and intelligence among adolescent girls with anemia. Correlation analysis between hemoglobin level and intelligence score was 0.84 at P<0.01 level. The results showed that there was a significant relationship between hemoglobin level and intelligence.

Objective 4: To find out the association between the demographic variables and post test intelligence level of adolescent girls with anemia. There was a significant association between age in years, education status and post test-II hemoglobin level in the experimental group. There was a significant association between mother's education and post test-II intelligence in the experimental group.

Major findings of the study

- Majority (50%) of the study subjects had mild anemia and average intelligence level in the pretest of experimental and control group.
- Their intelligence level also increased in verbal response especially in arithmetic and digit span, the pretest mean value was 102.03, 86.88 and post test - II mean value for arithmetic and digit span was 111.09, 98.25. The study findings showed that the nutritional intervention was effective in treating iron deficiency anemia and improving intelligence.
- There was a significant correlation between hemoglobin level and intelligence level at p<0.01 level.

Implications for Nursing Practice: A nurse has to play key role in identifying high risk adolescent girls by conducting regular health assessment at community level and outpatient department in pediatric hospital, provide adequate information about available iron rich foods such as ragi, rice flakes, green leafy vegetables and jaggery in improving anemic status, importance of iron in the diet and the effective use of nutritional intervention at the community level

Implications for Nursing Education: The study enables the nursing personnel to give more emphasize on physical assessment as an approach to determine the level of iron deficiency anemia among adolescents. The continuing nursing education program needs to be implemented to learn updated information.

Implications for Nursing Research

- Extensive research can be done to identify the risk factors and methods of primary prevention.
- Meta analysis need to be conducted to find out appropriate evidence-based interventions, measures to control and prevent the morbidity of iron deficiency anemia.
- Epidemiological studies can be conducted in primary care settings to prevent iron deficiency anemia and its complication.

Implications for Nursing Administration: The nurse administrators give more emphasize on conducting health checkups once in six months among adolescents in the schools to detect iron deficiency anemia& promote knowledge on detecting and treating iron deficiency anemia for school teachers and village health guides.

RECOMMENDATIONS

- A longitudinal study can be conducted to assess iron deficiency anemia.
- A similar evaluative research study can be conducted in community settings.
- A similar study can be conducted on nutritional intervention by using other iron rich foods.
- A comparative study can be conducted between the urban and rural population.
- A similar study can be conducted with other age group.

Conclusion

Globally iron deficiency anemia is one of the most prevalent nutritional problem and also widespread public health problems in developing countries. Iron deficiency, iron deficiency anemia, and non-iron deficiency anemia may cause some cognitive deficits, but it remains unclear if those deficits are the same. These cognitive deficits may appear at any age. There is need to initiate programme for supplementation of iron and folic acid to school going adolescent girls for the prevention of hematological and non-hematological consequences of iron deficiency with government and private organizational efforts.

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