National Journal of Physiology, Pharmacy and Pharmacology

RESEARCH ARTICLE

Does effective counseling play an important role in controlling iron deficiency anemia among pregnant women

Jayanta Saha[1], Sahana Mazumder[2], Amalendu Samanta[3]

[1]Department of Physiology, University of Calcutta, Kolkata, West Bengal, India, [2]Department of Physiology, Rammohan College (P.G. Studies), University of Calcutta, Kolkata, West Bengal, India, [3]Ex. ARO Physiologist, All Indian Institute of Hygiene & Public Health Calcutta, Kolkata, West Bengal, India

Correspondence to: Jayanta Saha, E-mail: jsaha4130@gmail.com

Received: January 21, 2018; **Accepted:** February 05, 2018

ABSTRACT

Background: Anemia during pregnancy is a common problem in most developing countries. According to the World Health Organization (1968), iron deficiency anemia (IDA) was present in 40–99% of pregnant women. Although many government projects have been introduced to eliminate this public health menace, non-compliance of iron and folic acid (IFA) supplementation due to various reasons made the projects unsuccessful. Hence, it is time to reexamine the problem of anemia in pregnancy, to assess more carefully the local etiological factors for prevailing and responsible for IDA, and then to design new strategies for prevention of the same. **Aims and Objectives**: The main of this study is to provide counseling to IDA pregnant women by effective communication and to study the impact of counseling on hematological indices. **Materials and Methods:** Pregnant women of rural population were first screened for IDA and then IDA women were grouped into experimental and control group. The experimental group women received counseling regarding benefits of regular IFA supplementation and good hygiene practices while the women in the control group were devoid of such counseling. Data on hematological parameters, hygiene practices, and IFA supplementation were taken from both groups and also after the end of the study. Data were then analyzed for statistical significance. **Results:** Our study showed statistically significant improvement in anemic status among pregnant women of the experimental group. **Conclusion**: In our study, it can be concluded that community-based interventions by means of effective communication help in improving anemic status in pregnant women.

KEY WORDS: Iron Deficiency Anemia; Pregnant Women; Iron and Folic Acid Compliance; Hygiene Practices

INTRODUCTION

Pregnancy is a physiological condition, and there is usually no side effect on general health of a pregnant woman. Pregnancy results in hematological and hemodynamic changes. Changes such as increased total blood volume and hemostatic changes are indeed very helpful to combat the hazards of hemorrhage during the time of delivery.[1] The increase of plasma volume is less in iron deficient women than in those with optimum iron reserves. In some iron deficient women, this inability to expand plasma volume may sometimes even mask a decrease in hemoglobin (Hb) concentration.[2]

Access this article online	
Website: www.njppp.com	Quick Response code
DOI: 10.5455/njppp.2018.8.0104305022018	

Iron requirements are greater in pregnancy. Although iron requirements are reduced in the 1st trimester in absence of menstruation, these raise steadily thereafter as high as ≥10 mg/day.[3] The amounts that can be absorbed from even an optimal diet, however, are less than the iron requirement in

later pregnancy and women must enter pregnancy with iron stores of >300 mg if she is to meet her requirement fully. This is more than most women possess especially in developing countries.[4]

Etiology of Iron Deficiency Anemia (IDA)

Nutritional deficiencies, mainly of iron, caused by inadequate diet are the predominant cause of anemia in the South East Asia region (SEAR).[5] Intestinal parasites cause anemia by causing blood loss in the stool, lack of appetite, increased motility of food through the intestine, competition for nutrients, and damage to the intestinal wall that leads to decreased absorption of nutrients, including iron, Vitamin B12, and folic acid.[6,7]

Open defecation, the practice of defecating outside without a toilet or latrine, may be an important cause of hemoglobin deficiency around the world, and particularly in regions of sub-Saharan Africa and SEAR which continue to have the lowest sanitation coverage.[8] Failing of good hygiene practices may lead to fecal-oral route of transmission of pathogens leading to environmental enteropathy. In a recent systematic review, it was observed handwashing with soap in 19 countries, that only 19% of people worldwide wash their hands after potential contact with excreta.[9]

Consequence of IDA Among Pregnant Women

IDA early in pregnancy may increase the risk of having a premature delivery or a low birth weight baby.[10] When maternal iron stores are depleted, the fetus also cannot accumulate much iron resulting in decrease in fetal iron stores. Studies have suggested that behavioral abnormalities occur in children with iron deficiency, which are related to changes in the concentration of some chemical mediators in the brain.[11] Hence, iron supplements are widely recommended and used during pregnancy worldwide.[12]

Past Efforts and Current Scenario

Iron deficiency during pregnancy is still common in developed countries.[13-15] It is projected that India has the utmost prevalence of anemia, i.e., 57–96.2%, among the South Asian countries.[16-18] To combat the high prevalence of IDA several government programs and state level schemes were rolled out in various states of India. National nutritional anemia prophylaxis program 1970, national anemia control program 1991, 12/12 initiative 2007 are some of the nationwide initiatives. Few state-specific schemes include "Madilu" scheme, "Thayi bhagya" scheme, and "Janani suraksha yojana," but these program have not made the desired impact due to irregular supply of iron-folic acid (IFA) tablets as well as non-adherence by the pregnant women.[19-22] In spite of government's persistent and prolonged efforts, the problem continues to fester as is documented by recent surveys of National Family Health Survey (NFHS): In NFHS-3 (2005–06) data the problem even increased from 49.7% (NFHS-2, 1998–99) data to 57.9%. In Chhattisgarh, according to NFHS-3 data anemia among pregnant women was 63.7%.[23]

Present Aims of the Study

As per existing knowledge, there have been no randomized controlled trials regarding the impact of education/counseling on rural population especially in the state of Chhattisgarh, regarding negative impact of IDA, benefits of adherence to IFA supplementation and also benefits of good hygiene practices among anemic pregnant women. In view of the above, this study was, hence, undertaken with a view that such a trial would make an important contribution to the literature on the determinants of anemia among rural pregnant women.

MATERIALS AND METHODS

This is a longitudinal interventional study done on IDA pregnant women of rural population.

Place of Study

District Mungeli of state Chhattisgarh.

Period of the Study

This study was from November 2014 to January 2016.

With due discussion with program officers of women and child development office of the district and block medical officer, five villages of were chosen for this study where anemia prevalence was suspected to be more common among women, and those place which are not endemic to malaria. With the due consent of the pregnant women who volunteer for the study, the screening test was first done to find out the women suffering from anemia, and then those found to be anemic were screened for IDA.

The CDC/WHO expert groups on May 7, 2004, recommended that hemoglobin and serum ferritin are the most valuable indicators of the impact program to control iron deficiency.[24]

Exclusion Criteria

Women who have been found to be suffering from a chronic inflammatory disease or have history of such after questioning them about such diseases were excluded from the study as an inflammatory disease would interfere with the ferritin results.

Non-pregnant lactating and pregnant and lactating women were excluded as a lactating mother also have more demand for iron and may interfere in our study results.

Furthermore, women informing having recent major surgery or hemorrhagic incident were excluded.

Inclusion Criteria

Apparently healthy non lactating pregnant women who were in their first trimester of pregnancy and were detected suffering from IDA were included in the study.

Sample Size

A total of 250 women who were in their first trimester of pregnancy were screened for hemoglobin out of which 80% that is 200 were found to be anemic. Anemic pregnant were then tested for ferritin test out of which 68% that is 136 pregnant women were found to be suffering from IDA.

According to the classification of the World Health Organization (WHO), pregnant women with hemoglobin levels <11.0 g/dl in the first and third trimesters and <10.5 g/dl in the second trimester are considered anemic.

WHO graded anemia in 1st and 3rd trimester of pregnancy as mild, moderate, and severe (at sea level) when hemoglobin range is between 10.0 and 10.9 g/dl, 7.0–9.9 g/dl and lower than 7.0 g/dl of blood, respectively.

IDA was considered when hemoglobin values (during the first trimester) fall below 11.0 g/dl of blood and ferritin value <12.0 ng/ml of blood.[25,26]

At the baseline, purposive random sampling done in pregnant women and divided in the experimental group and control group, containing 68 women in each group.

At the beginning of the study, basic demographic information such as age, level of education, and socioeconomic status was noted for all pregnant women by interviewing them.

Information regarding registration with antenatal care center (ANC), compliance of supplementation of IFA tables, was taken into account.

Baseline hematological study includes estimation of Hb, ferritin, total iron binding capacity (TIBC) estimation of women. Practice of good hygiene predictors such as use of latrine for defecation, use of slippers during defecation, regular trimming of nails, washing of hands before taking meals and washing of hand after defecation, or when hands get contacted with excreta were taken into account of both experimental and control group by interviewing the pregnant women in the study.

Hemoglobin was estimated by cyanmethemoglobin method by commercially available Drabkin's reagent solution (Sigma-Aldrich Co USA.), ferritin by radioimmunoassay kit (Beckman Coulter USA). TIBC was estimated by estimated by iron and TIBC kit (Coral, Tulip diagnostic India) in semi autoanalyzer, by Ferrozine method.[27,28]

The Hb levels were not required to be adjusted for smoking, as all of the pregnant women were non-smokers. No adjustment for the altitude of the enumeration areas was made because the place of study in Chhattisgarh is at an altitude below 1,000 meters.

Blood Sample Collection

Blood samples were taken to perform Hb and to determine serum concentrations of ferritin and TIBC. Each sample consisted 5 mL of blood taken from the antecubital vein of the arm after cleaning of the zone with isopropyl alcohol. From this, 4 mL was used to obtain serum, and 1 mL was treated with EDTA for hemoglobin. Serum samples were obtained by centrifugation of blood samples, within 4 hrs of extraction. Serum was kept at optimum temperature and protected from light until analysis.

Intervention Techniques

Counseling includes basic health concepts about IDA as public health problems.

Counseling them to get themselves registered in local ANC centers, eliminating different myths prevailing regarding regular consumption of IFA supplementation, and benefits of IFA supplementation to them and their coming newborn child.

Our focus was also to provide counseling to women in the experimental group to inculcate good hygiene practices. To educated them about sources of parasitise infection and how it leads to IDA, fecal-oral route of parasite infection transmission and how better hygiene practices can be adopted for the prevention of the same. Hygiene practice that was counseled to them was the use of latrine for defecation, use of slippers during defecation, trimming of nails, washing of hands before eating and washing of hands with soap after defecation or when in contact with excreta. Easily available and economical tools were suggested to them so that the counseling does not become burdensome and unacceptable to them. Interactions with the women were done in the local language in a very simple communicable way. Posters regarding hygiene practices were used for better understanding. Intervention was only for the pregnant women in the experimental group, while the pregnant women of the control group were not provided any such intervention.

After baseline study, at the 2nd trimester, ANC registration and regular IFA supplementation were again studied for both the groups, but only in the experimental group those women still found not registered with ANC or irregular intake of IFA supplementation were again re-counseled but not those

women in control group. At the 8th month/3rd trimester (end of the study), the data of both experimental and control group were statistically analyzed to study the impact of counseling on the hematological indices.

Necessary ethical approval was taken for this study.

Statistical Analyses

The Kolmogorov-Smirnov test was used to assess normality of the continues (hematological) data. Since our Kolmogorov-Smirnov test results showed that our data were not normally distributed, we opted for non-parametric tests.[29]

Mann–Whitney U-test was conducted to compare the median of hematological indicators, namely, Hb, Ferritin, and TIBC. Chi-square test of significance was run between the two groups for categorical data. All statistical tests were two-tailed, and differences were considered significant at $P < 0.05$ at 95% CI. Statistical analysis was done by SSPS version 22.[30]

RESULTS

Demographic profile of women. At the end of the study that is after the third trimester (8th months) of pregnancy 9 women opted out of the study in the experimental group that is 59 women were left, and 5 women opted out from the control group. To keep the sample size equal, we kept sample size of both group at 59.

Mean age of women in the experimental group was 22.7 years ± 2.9 and ranging from 19 years to 29 years and for control group the mean age was 22.8 years ± 3.1 years and ranging from 19 years to 29 years.

As per religion, all women were predominately Hindu. Nearly, all the subjects were from families engaged in agriculture or agriculture labor.

Socioeconomic data were taken by Aggarwal *et al*. method, and accordingly, the population was classified into poor, lower middle, middle and high-income group.[31] In experimental group 13 (22%), 23 (39%), 21 (35.6%), and 02 (3.4%) subjects were in poor, lower middle, middle, and high-income group, respectively, while in control group 11 (18.6%), 27 (45.8%), 19 (32.3%), and 02 (3.4%) subjects were in poor, lower middle, middle, and high income group, respectively.

In terms education in experimental group 15 (25.4%), 19 (32.2%), 16 (27.1%), and 9 (15.3%) subjects completed education till 5th standard, 10th standard, 12th standard and graduation level, respectively, while in control group 14 (23.7%), 22 (37.3%), 16 (27.1%), and 7 (11.9%) subjects completed education till 5th standard, 10th standard, 12th standard and graduation level, respectively. None of the women in both groups were illiterate.

In the experimental Group 2, 12, and 45 pregnant women were in their 1st, 2nd, and 3rd month of pregnancy and out of 59 pregnant women, only 41 (69.5%) of them got themselves registered in local ANC centers. Out of 41 registered women 1 (2.4%), 2 (4.9%), and 38 (92.7%) pregnant women got themselves registered in their 1st, 2nd, and 3rd month of pregnancy.

In the control Group 2, 15, and 42 pregnant women were in their 1st, 2nd, and 3rd month of pregnancy and out of 59 pregnant women only 38 (64.4%) of them got themselves registered in local ANC centers. Out of 38 registered women, none (0.0%), 3 (7.9%), and 35 (92.1%) pregnant women got themselves registered in their 1st, 2nd, and 3rd month of pregnancy.

Table 1 shows the Mann–Whitney U-test results. Median Hb scores (10.4) for experimental group and Hb scores (9.2) for control group were statistically significant in experimental then in control $\mu = 1064.5$, $Z = -3.6$, $P < 0.001$.

Median ferritin score (8.70), for experimental group and ferritin score (7.90) for control group were statistically significant in experimental then in control $\mu = 886.0$, $Z = -4.60$, $P < 0.001$.

Median TIBC score (540.0), for experimental and, TIBC score (567.0) for control group was statistically significant in experimental then in control $\mu = 3211.0$, $Z = 7.93$, $P < 0.001$.

Tables 2 and 3 show the changes in hygiene practices among the experimental and control group. Table 2 shows that after receiving counseling there was an improvement of latrine

Table 1: Mann–Whitney U-test output of hematological indicators after the end of the study (3rd trimester/8th months of pregnancy) between experimental and control groups

Hematological indicators	Interventional group (experimental group) *n*=59			Control group *n*=59			Mann-Whitney	Z value	*P* value
	Median	SD	Mean rank	Median	SD	Mean rank			
Hemoglobin (g/dl)	10.4	0.95	70.96	9.2	0.98	48.04	1064.5	−3.68	*P*=0.001
Ferritin (ng/ml)	8.70	0.74	73.98	7.90	0.72	45.02	886.0	−4.60	*P*=0.001
TIBC (µg/dl)	540.0	13.0	34.58	567.0	18.8	84.42	3211.0	7.93	*P*=0.001

n: Number of pregnant women, SD: Standard deviation

use by the pregnant women in the experimental group from baseline 25.4 to 37.35% at the end of the study while in the control group the improvement was from 23.7% to only 25.4%, though the improvement was not statistically significant $P > 0.05$.

There were a statistically significant changes in regard to use of slippers during defecation $X^2(1) = 9.13$ from 10.2 to 42.4% in experimental group while in control group the change was from 13.6% to 16.9%, $P = 0.003$. Table 3 shows in respect to regular trimming of nails, there was a statistically significant changes $X^2(1) = 12.29$ in experimental group from 40.7% to 69.5% $P < 0.001$ while in control group the change was from 32.2% to 37.3%. There were also statistically significant changes among experimental and control group with respect to washing of hands before eating food $X^2(1) = 7.24$ $P = 0.007$ and in respect to washing of hands after defecation or when hands come in contact with excreta $X^2(1) = 8.70$ $P = 0.003$.

During the 2nd trimester, all women of both groups have registered themselves in their local ANC centers.

Table 4 shows the changes in regular consumption of IFA tablets among the experimental and control group. The table shows that after receiving counseling there was improvement of regular consumption of IFA tablets by the pregnant women in the experimental group from baseline 5.1 to 55.9% at the

Table 2: Frequency and percentage distribution of regular uses of latrine and uses of slippers during defecation among pregnant anemic women between experiment and control group along with the Chi-square test results

Personal hygiene indicators	Baseline (first trimester)		After 8 months (3rd trimester)		*P* value	X^2 value
In terms of frequency and percentage	Experimental *n*=59	Control *n*=59	Experimental *n*=59	Control *n*=59		
Latrine use						
Frequency (%)	15 (25.4)	14 (23.7)	22 (37.3)	15 (25.4)	0.165	1.92
No use of latrine						
Frequency (%)	44 (74.6)	45 (76.3)	37 (62.7)	44 (74.6)		
Shoe use						
Frequency (%)	06 (10.2)	8 (13.6)	25 (42.4)	10 (16.9)	0.003	9.13
No use of shoe						
Frequency (%)	53 (89.8)	51 (86.4)	34 (57.6)	49 (83.1)		

n: Number of pregnant women

Table 3: Frequency and percentage distribution of regular trimming of nails, regular washing of hands before taking of food and washing of hands with soap after defecation among anemic pregnant women between experiment and control group along with the Chi-square test results

Personal hygiene indicators	Baseline (1st trimester)		After 8 months (3rd trimester)		*P* value	X^2 value
	Experimental *n*=59	Control *n*=59	Experimental *n*=59	Control *n*=59		
Regular trimming of nails					0.001	12.29
Frequency (%)	24 (40.7)	19 (32.2)	41 (69.5)	22 (37.3)		
No regular trimming of nails						
Frequency (%)	35 (59.3)	40 (67.8)	18 (30.5)	37 (62.7)		
Washing of hand before eating					0.007	7.24
Frequency (%)	32 (54.2)	30 (50.8)	45 (76.3)	31 (52.5)		
Non-washing of hand before eating						
Frequency (%)	27 (45.8)	29 (49.2)	14 (23.7)	28 (47.5)		
Washing of hand with soap after defecation					0.003	8.70
Frequency (%)	24 (40.7)	20 (33.9)	36 (61.0)	20 (33.9)		
Non-washing of hand with soap after defecation						
Frequency (%)	35 (59.3)	39 (66.1)	23 (39.0)	39 (66.1)		

n: Number of pregnant women

end of the study while in the control group the improvement was from 3.4% to only 10.2% a statistically significant change $X^2(1) = 27.92$ $P < 0.005$.

From Table 5, it can be stated that there is a statistically significant change $X^2(1) = 5.73$ $P = 0.017$ at the end of the study in anemic status among pregnant women in experimental and control group.

DISCUSSION

Our results show a statistically significant increase in compliance with IFA supplementation and hygiene practices among pregnant women of the experimental group which in turn also significantly benefited the hematological indices of them. From our results, it may be stated that our goal was successful in reducing the condition of anemia among the anemic pregnant women.

Our results echo similar results from studies of Mora, Sanghvi *et al*., in Nicaragua where anemia rates in pregnant women reduced nationwide from 23.7% to 11.2% in 5

years.[32,33] In Nepal, similar study by Pandey *et al*. showed that IFA coverage increased from 27% during 2nd trimester to 73% in just 3 years.[34]

Adherence or compliance with medication (IFA tablets) regimen is usually defined as the extent to which patients take medications as prescribed by their healthcare providers.[35] Reasons for non-compliance with iron deficiency treatment include: Inadequate program support; insufficient service delivery; and patient factors (as misunderstanding instructions, side effects, frustration about the frequency and number of pills taken, fear of having big babies, nausea that accompanies pregnancy, and the subtlety of anemia which makes demand for treatment low).

Although ANC programs distribute iron supplements to pregnant women; poor compliance with iron treatment (e.g., failure to take pills) is the probable reason for the ineffectiveness of such programs.[36] Previously unavailability of iron supplements was also the most common reason why women did not take iron supplements,[37] though nowadays care has been taken to solve this problem. Care has also been taken about the side effects that women might experience during iron therapy. Successful management of anemia in pregnancy depends on accurate and acceptable methods of detecting anemia, assessing its severity and monitoring response to treatment.[36] In women with mild-to-moderate anemia, timely treatment is likely to prevent the development of more severe anemia and, therefore, reduce the need for blood transfusion with its associated risks.[38]

Strength and Limitation of this Study

The main strengths were that we not only counsel about regular IFA supplementation but also counseled about good hygiene practices among pregnant women both which are beneficial for reducing anemia. Limitation of our study is that there were chances of recall bias among the study subjects regarding skipping of IFA doses.

Table 4: Shows the counts and percentage changes in regular intake of IFA supplementation among pregnant women of experimental and control groups in different stages of the study along with the Chi-square test results

Groups	Baseline (1st trimester)		2nd trimester		8 months (3rd trimester		*P* value	X^2 value
	Yes	No	Yes	No	Yes	No		
Experimental *n*=59							0.001	27.92
Counts (%)	3 (5.1)	56 (94.9)	19 (32.2)	40 (67.8)	33 (55.9)	26 (44.1)		
Control *n*=59								
Counts (%)	2 (3.4)	57 (96.6)	3 (5.1)	56 (94.9)	6 (10.2)	53 (89.8)		

n: Number of pregnant women, Yes: Regular intake of IFA tablets, No: Irregular intake of IFA tablets

Table 5: Shows the frequency and percentage changes in anaemic status of pregnant women in experimental and control groups in different stages of the study along with the Chi-square test results after 8 months

Category of anemia	Baseline (1st trimester)		8 months (3rd trimester)		*P* value	X^2 value
	Experimental *n*=59	Control *n*=59	Experimental *n*=59	Control *n*=59		
Mild						
Count (%)	22 (37.3)	26 (44.1)	37 (62.7)	24 (40.7)	0.017	5.735
Moderate						
Count (%)	37 (62.7)	33 (55.9)	22 (37.3)	35 (59.3)		

n: Number of pregnant women

CONCLUSION

Diverse religions, cultures, languages, food habits, lifestyle, and traditions present a challenge to the implementation of the health program. Hence, there is a continuing requirement for county-specific or more precisely region specific harmonized guideline for the control of IDA in India. From our study, it may be tentatively concluded that more practical approach like counseling through effective communication would increase the compliance of IFA supplementation and good hygiene practice necessary for controlling anemia among pregnant women.

REFERENCES

1. Hytten FE, Pfaintain DB. Increase in plasma volume during normal pregnancy. J Obstet Gynaecol Br Commonw 1963;70:402-7.
2. Letsky EA. The Hematological system. Clinical Physiology in Obstetric. 3rd ed. Oxford: Blackwell; 1998. p. 71-110.
3. Hallberg L. Iron balance in pregnancy. In: Berger H, editor. Vitamins and Minerals in Pregnancy and Lactation. New York: Raven Press: 1988. p. 115-27.
4. Mcfee JC. Iron metabolism and iron deficiency during pregnancy. Clin Obstet Gynecol 1997;22:799-808.
5. Stevens GA, Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F, *et al*. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: A systematic analysis of population-representative data. Lancet Glob Health 2013;1:E16-25.
6. Ngure FM, Reid BM, Humphrey JH, Mbuya MN, Pelto G, Stoltzfus RJ. Water, sanitation, and hygiene (wash), environmental enteropathy, nutrition, and early child development: Making the links. Ann N Y Acad Sci 2014;1308:118-28.
7. Rosenberg I, Bowman B. Intestinal physiology and parasitic diseases. Rev Infect Dis 1982;4:763-7.
8. WHO/UNICEF. Water, Sanitation and Hygiene in Health care Facilities: Status in Low-and Middle-Income Countries and Way Forward. Geneva: World Health Organization; 2015. Available from: http://who.int/water_sanitation_health/publications/wash-health-care-facilities/en. [Last accessed on 2016 Aug 10].
9. Freeman MC, Stocks ME, Cumming O, Jeandron A, Higgins JP, Wolf H, *et al*. Hygiene and health: Systematic review of hand washing practices worldwide and update of health effects. Trop Med Int Health 2014;19:906-16.
10. Scholl T, Reilly T. Anemia iron and pregnancy outcome. Am J Nutr 2000;130:443-7.
11. Lozoff B, Brittenham GM, Wolf AW. Iron deficiency Anemia and iron therapy. Effects on infant developmental test performance. Pediatrics 1987;79:981-95.
12. Centers for Disease Control and Prevention (CDC). Recommendations to prevent and control Iron deficiency in the United States. MMWRMorb Mortal Wkly Rep 1998;77:1-29.
13. Beard JL. Iron deficiency: Assessment during pregnancy and its importance in pregnant adolescents. Am J Clin Nutr 1994;59:502S.
14. Milman N, Clausen J, Byg KE. Iron status in 268 Danish women aged 18–30 years: Influence of menstruation, contraceptive method, and iron supplementation. Ann Hematol 1998;77:13-9.
15. Bergmann RL, Gravens-Mu ¨ller L, Hertwig K, Hinkel J, Andres B, Bergmann KE, *et al*. Iron deficiency is prevalent in a sample of pregnant women at delivery in Germany. Eur J Obstet Gynecol Reprod Biol 2002;102:155-60.
16. Prevalence of Anemia Among Pregnant Women (%) 2016. Available from: Available from: http://www.data.worldbank.org/indicator/SH.PRG.ANEM. [Last accessed on 2017 Jan 10].
17. District Level Household Survey (DLHS-2) on Reproductive and Child Health. India- 2002-04. Nutritional Status of Children and Prevalence of Anaemia Among Children, Adolescent Girls and Pregnant Women. Ministry of Health and Family Welfare Government of India. International Institute for Population Sciences; 2006. Avilable from: http://www.dspace.sctimst.ac.in/jspui/bitstream/123456789/1730/1/399.pdf. [Last accessed on 2014 Oct 12].
18. National Nutritional Monitoring Bureau. Prevalence of Micronutrient Deficiencies. Hyderabad, India: National institute of Nutrition, Indian Council of Medical Research, Available from: http://www.nnmbindia.org/NNMB%20MND%20REPORT%202004-Web.pdf. [Last accessed on 2014 Oct 12].
19. Agarwal DK, Agarwal KN, Roychoudhary S. Targets in national anemia prophylaxis programme for pregnant women. Ind J Pediatr 1988;25:319-22.
20. Vljayaraghavan K, Brahmam GN, Nair KM, Akbar D, Rao NP. Evaluation of national nutritional anemia prophylaxis programme. Ind J Pediatr 1990;57:183-90.
21. Gautarn VP, Bansal Y, Taneja DK, Ingle CK. A study on compliance to iron-folic acid therapy and its effects on anemia during pregnancy. Indian J Prev Soc Med 2005;36:103-7.
22. Kriplani A. Management of Iron Deficiency Anemia in Pregnancy. FOGSI General Clinical Practice Recommendations; 2016. Avilable from: http://www.fogsi.org/wp-content/uploads/2016/05/The-recommendations-IDA-Pregnancy-24-May-2016-Clean-4.pdf. [Last accessed on 2016 Oct 15].
23. National Family Health Survey (NFHS-3). India; 2005-2006. Ministry of Health and Family Welfare Government of India. International Institute for Population Sciences; 2007. Available from: http://www.rchiips.org/NFHS/pdf/India.pdfkeyindicatorsfornhfs3india; http://www.rchiips.org/NFHS/pdf/Chhattisgarh.pdfnhfs3keyindicators for Chhattisgarh. [Last accessed on 2014 Oct 10].
24. WHO/CDC. Best Indicators to Assess iron Deficiency, a Major Cause of Anemia. 7th May 2004. Available from: http://www.who.int/. [Last accessed on 2015 Jan 05].
25. Abel R, Rajaratnam J, Sampathkumar V. Anemia in pregnancy. Impact of iron Deworming and IEC. Vellor: RUSH Depatment Tamil Nadu CMC Vellor; 1999.
26. Sharma JB, Shankar M. Anemia in pregnancy. JIMSA 2010:23:253-60.
27. International Committee for Standardization in Haematology. Protocol for type testing equipment and apparatus used for haematological analysis. Br J Haematol. 1967:13, 68-75.
28. Siedel J, Wahlefeld AW, Ziegenhorn J. A new iron ferrozine reagent without deproteinization. Clin Chem 1984;30:975.

29. Siegal S, Castellan NJ Jr. Non-parametric Statistics for the Behavioral Sciences. New York: McGraw-Hill Inc.; 1988. p. 190-216.
30. SPSS Inc. The SPSS Guide to Data Analysis. Chicago: SPSS, Inc.
31. Aggarwal OP, Bhasin SK, Sharma AK, Chhabra P, Aggarwal K, Rajoura OP. A new instrument (scale) for measuring the socioeconomic status of a family: Preliminary study. Indian J Community Med 2005;30:10-2.
32. Mora JO. Integrated Anaemia Control Strategy Has Significantly Reduced Anemia in Women and Children in Nicaragua. Canada: Final Report, Micronutrient Initiative; 2007. Available from: http://www.micronutrient.org/CMFiles/MI%20Around%20the%20World/Americas/Nicaragua_Anemiacontrolprog_finalrpt.pdf. [Last accessed on 2017 Aug 07].
33. Sanghvi TG, Harvey PW, Wainwright E. Maternal iron–folic acid supplementation programs: Evidence of impact and implementation. Food Nutr Bull 2010;31 2 Suppl: S100-7.
34. Pandey S, Maharjan MR, Thapa M, Mathema P, Shrestha RK. Community-based integrated interventions improve coverage of and compliance with iron supplementation in Nepali women. Micronutrient Initiative. Available from: http://www.micronutrient.org/CMFiles/What%20we%20do/Folic%20Acid/Poster-2-Sarada-Pandey-Iron.pdf. [Last accessed on 2017 Aug 07].
35. Steiner JF, Earnest MA. The language of medication-taking. Ann Intern Med 2000;132:926-30.
36. Gallway R, Mcguire J. Determinants of compliance with iron supplementation: Supplies, side effects, or psychology? Soc Sci Med 1994;39:381-90.
37. World Health Organization. Prevention and Management of Severe Anemia in Pregnancy. Geneva: World Health Organization; 1993. Available from: http://www.whqlibdoc.who.int/publications/2008/9789241596657_eng.pdf. [Last accessed on 2014 Oct 15].
38. Ibrahim ZM, Abdel S, Mikhail H, El-Hamid SA, Khattab MS. Assessment of adherence to Iron and folic acid supplementation and prevalence of anemia in pregnant women. Med J Cairo Univ 2011;79:115-21.

How to cite this article: Saha J, Mazumder S, Samanta A. Does effective counseling play an important role in controlling iron deficiency anemia among pregnant women. Natl J Physiol Pharm Pharmacol 2018;8(6):840-847.

Source of Support: Nil, **Conflict of Interest:** None declared.