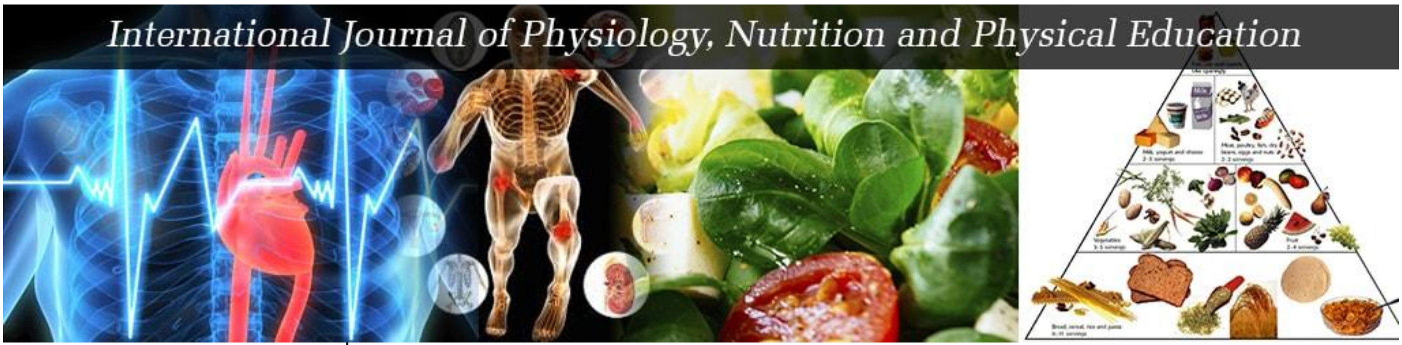

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Does socioeconomic status of women play an important role in controlling iron deficiency anaemia

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Abstract
Anaemia among which iron deficiency anaemia (IDA) is most prevalent in women especially of the reproductive age (WRA). Though supplementation with iron helps to some extent in reducing anaemia but if the root causes are not uprooted then there are always chances of recurring on anaemia cases and this is evidence from the prevalence of anaemic from NFHS-3study. Our aims in this study was to study how anaemia can be control by nutritional counselling and the role of socioeconomic status of the women in anaemia eradication. The rural women were first screened for IDA and then randomly allocated into two groups designated as experimental and control group. The control group was devoid of any counselling from the authors. Our results at the end of the study shows that the women of experimental group were less anaemic compared to the women in the control group and the poor economic group had more percentage of anaemic women then that of the high economic group. Hence we may conclude that nutritional counselling proves beneficial in controlling anaemia and anaemic condition is more prevalent in women in poor economic status.

Keywords: Iron deficiency anaemia, Women of reproductive age group, socioeconomic status

1. Introduction

Almost 800 million women are affected by anemia worldwide. In India, it is classified as a major public health problem as it is estimated that 52% of non-pregnant women of reproductive age are anemic [1]. Anaemia is defined as a reduction in the red cell mass in blood resulting in a drop in the amount of oxygen supply to meet the metabolic needs of the body [2].

According to World Health Organization (WHO) the global burden of deaths that is attributable to anaemia in women of reproductive age ranges from 16 800 to 28 000 annually with a greater risk of anaemia-related death in younger women [3].

Anaemia is also an important factor that negatively impacts the health of the women and their ability to work, particularly in their reproductive years, and leads to increased infant and maternal mortality [4, 5, 6]. Iron-deficiency also has important consequences for the future generations, as iron-deficiency anemia increases the risk for preterm labor, low birth weight, infant mortality and predicts iron-deficiency in infants after 4 months of age [7, 8]. Anemia, of which iron-deficiency is the major contributor, accounts for 3.7% and 12.8% of maternal deaths during pregnancy and childbirth in Africa and Asia, respectively [9]. It also leads to cognitive deficits and reduced intellectual performance among school children [10].

Iron-deficiency anemia is observed when dietary intakes of iron declines, when iron is not sufficiently absorbed, when bodily requirements increases, or in cases of excessive blood loss [11, 12]. Economic analysis shows that iron-deficiency anaemia can be easily cured with low-cost measure, such as through the provision of dietary education at diagnosis.

The National Family Health Survey (NFHS –2), India reported that anaemia is a major health problem with over half of every married woman in the age group of 15-45 years having the condition. It was reported that 53.9 percent among women in the age group of 15-49 years living in rural area and 45.7 percent of urban women any form of anaemia. In the report of data in NFHS-3 it revealed that among married women between the ages of 15-49 years, the prevalence of anaemia has risen from 51.8 percent in 1998-99 (NFHS-2) to 56.1 percent in 2005-06 (NFHS-3). In Chhattisgarh state as per NFHS-3data the percentage of rural women having any form of anaemia is 59.8%.

An important factor that is closely related to the cause of IDA and which is common in the developing countries like India, but is often overlooked is socio-economic deprivation. This has also been linked with the development, severity and outcome of many other medical conditions [13, 14]. Poverty and low standards of living are still major problems facing most developing countries. Where women occupy a low status in society their health needs are often neglected, and existing health facilities may not be accessed by women in need.

It has been suggested, more than once, that dietary factors may help explain some of the observed social inequities in health [15, 16]. The more affluent population subgroups are not only healthier and thinner, but they also consume higher-quality diets than do the poor [17]. Diet quality is affected not only by age and sex, but also by occupation, education, and income levels [18, 19, 20].

This study was hence undertaken to find out how WRA suffering from anemia be benefited from nutritional counselling, to find out if socioeconomic condition of the women play any role in intervention process of prevention of anemia and is there any association between economic condition of the women and their mean intake of their nutrients.

2. Materials and methods

This is a longitudinal interventional study done on rural women of reproductive age group of 14–49 years.

2.1. Place of field study: District Mungeli of state Chhattisgarh.

2.2. Period of the study: January 2014 to September 2016.

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

2.3. Exclusion criteria

Women who have complained of suffering from any diseases, which was suspected to be of inflammatory type of disease or of any type of hemoglobinopathies , after questioning them were excluded from the study .Also women informing having recent major surgery or hemorrhagic incident were also excluded.

2.4 Inclusion criteria

Apparently health women of age between 14 -49 years and non-pregnant and non-lactating women were taken for the study.

A total of 2105 women of age group were screened for hemoglobin out of which 76% that is 1600 were found to be anemic. Women who were found to be anemic were then tested for ferritin test out of which 73% that is 1168 women were found to be suffering from IDA.

IDA was considered when hemoglobin values falls below 12.0 gm/dl of blood and ferritin value less than 15.0 ng/ml of blood [21].

Prior necessary ethical approval was taken for this study. The details of the study were thoroughly explained to all the women enrolled for the study. Informed written consent of the participants or their guardian in cases the participants were below eighteen years was obtained before involving them in the study.

At the baseline 584 IDA women from 305 household were randomly taken in the experimental group and 584 women from 310 household were taken in control group.

In this study, anemia was defined according to the World Health Organization (WHO) definition as a baseline hemoglobin concentration less than 12.0 mg/dl [22].

Base line study include estimation of hemoglobin, ferritin, along with food intake survey by continues seven days 24 hours dietary recall method [23].

Hemoglobin was estimated by cynamethhemoglobin method and ferritin by radioimmuassay (RIA) [24].

Socioeconomic data was taken by O.P. Aggarwal method and accordingly the population was classified into poor, lower middle, middle and high income group [25].

After baseline study the hematological and food survey was again carried out after six months for both groups and those women still found to be anemic in experimental group was re-counselled. The procedure was repeated again at twelve months and finally at the 18 months data of both experimental and control group were statistically analyzed to evaluate the aims of the study.

Data on 24 hour recalls were converted to nutrient intakes by a computerized dietary analysis system Intake assessment and calculations were done using the software “Dietcal” (version 7.0; Department of Dietetics; AIIMS New Delhi and Profound Tech solutions, India) which is based on the values in the Nutritive Value of Indian foods database [26].

24 hour recalls were administered on consecutive seven days to each participant at 6 month intervals. Recalls for each subject included all days of the week: The interviewer requested participants to recall all food and drink consumed over the previous 24 hours. Portions were carefully estimated by use of food models, household measures and utensils in conjunction with a detailed description of the food and method of preparation. The average intake was then calculated for one day for every participant in the study.

2.5 Statistical analyses

The Kolmogorov-Smirnov test was used to assess normality of the data. Since our Kolmogorov-Smirnov test results showed that our data was not normally distributed we opted for non-parametric tests [27].

All statistical tests were 2-tailed and differences were considered significant at $p<0.05$. Statistical analysis was done by SSPS version 22 [28].

3. Results & Discussion

Mean age of women in experimental group is 25 years ±7.6 and ranging from 14 yrs to 45 yrs and for control group the mean age is 24 yrs±7.8 yrs and ranging from 14 yrs to 45 yrs.

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

In experimental group 70,319,170 and 15 subjects were in poor, lower middle, middle, and high income group respectively, while in control group 87, 311, 161 and 15 subjects were in poor, lower middle, middle, and high income group respectively.

At the end of the study that is after 18th months 10 women opted out of the study in experimental group and 8 women opted out from the control group. To keep the sample size equal we kept sample size of both group at 574.

At the end of the study we may observe from table 1 that 306 (53.3%) of the women in the experimental group were non anaemic whereas in the control group it was only 78 (13.6%) women found to be non anaemic.

There is a statistical significance in the result between the experimental and control group

$X^2(1) = 203.41$, $p<0.005$.

A Chi-square test of homogeneity was conducted to test the statistical significance of anemic status among different economic groups after the end of the study in experimental group with an adequate sample size established according to Cochran (1954) [29].

The observed frequencies/count and percentages of anemic status are presented in the table 2 along with the p value and chi- square test value for 18 months. A statistically significant result was obtained. $X^2(3)=27.80$, $p<0.005$. From the table it is observed that after the end of the study in poor group 16.4% women were still anemic while only 8.5% women were non anemic. In the lower middle income group 61.4% women were still anemic while only 50.3% women were non anemic. In the middle income group only 20.9% women still have anemia while 37.3% women were non anemic. In the high income group only 1.1% women still have anemia while 3.9% women were non anemic.

Post-hoc analysis involving pair wise comparison using multiple Z- tests of two proportions with a Bonferroni correction was conducted to assess the significance among different anemic status. Statistical significant was accepted at $p<0.0125$. All pairwise comparisons were statistically significant.

Table 3 shows the mean and median intake of nutrition – protein, iron, Vitamin C and food groups (other vegetable and Green leafy vegetables, pulses, fishes, meat, and fruits) among different economic classes at the end of the study for experimental group. It was observed from the table 3 that the women belonging to poor section of the society have the least mean/median intake per day of nutrients like iron, Vitamin C and iron rich food group like green leafy vegetables, other vegetables, fishes, meat and fruits, while the women in high income section enjoys the highest mean/median intake per day of nutrients like iron, Vitamin C and iron rich food group like green leafy vegetables, other vegetables, fishes, meat and fruits.

Kuskar Wallis test was used to compare the dietary intake of iron between different socioeconomic groups the poor (n=70), lower middle (n=319) middle (n=170) and high income group (n=15). Median Iron scores were statistically significantly different between the different levels of the economic groups. $X^2(3) = 10.617$ p=0.014, $p<0.05$

Our results indicate that consumption of green leafy vegetable, other vegetables, meats, fish, and other fruits were associated with higher socioeconomic stratum which is also indicated in a large number of studies [30-34].

In other studies, deficiencies in dietary iron, Vitamin C were more common among women in lower socioeconomic households [35-36].

Our study also indicate that the prevalence of anaemia at the end of the study in the experimental group was more in the poor social classes, followed by the lower middle class, followed by middle income class and then high income class where it was lowest. This is not surprising considering the fact that women in low socio-economic classes are likely to have financial constraints, which ultimately causes poor intake of iron rich nutrition necessary to overcome anemia.

The high prevalence of anemia among women of reproductive age group in India is a burden for them, for their families, and for the economic development and productivity of the country. Iron supplementation programs, for a variety of reasons, have not been effective in reducing anemia prevalence [37, 38] and operational research on how best to improve existing iron supplementation programs is needed [39]. According to the works of Hass and Brownlie [40] Iron-deficiency anemia has been hypothesized to contribute to the cycle of poverty among females. It may not be incorrect to state that there occurs a viscous cycle among iron deficiency, diminished work capacity, work output and productivity, low income, and subsequent risk of iron deficiency as demonstrated in figure 1.

4. Conclusion

It is not only needed to prevent anaemia at hospital levels but also to address the prevailing socio-economic factors associated with it. The socio-economic status of women should be enhanced in line with the Millennium Development Goals that all the 193 United Nations have agreed to achieve. The female empowerment in the form of financial contribution is very important as it helps prevent the family from falling into poverty by breaking the viscous cycle.

We authors hence believe that improving women's overall nutrition status and their access to resources (income) will have the greatest impact on reducing anaemia especially in developing country like India.

Table 1: Shows the frequency and percentage of anemic and non anemic women in experimental and control groups along with X^2 and p value at the end of the study.

Anemic and non-Anemic women	Experimental group (N=574)	Control Group (N=574)	X^2 Value	P Value
Anemic women			203.41	P<0.005
Frequency	268	496		
Percentages	46.7	86.4		
Non Anemic Women				
Frequency	306	78		
Percentages	53.3	13.6		

N= no of women

Table 2: Shows the frequency and percentage of anemic and non anemic women among experimental group in different economic groups along with X^2 and p value at the end of the study.

Economic strata	Anemic Women (Total=268)	Non Anemic Women (Total=306)	X^2 value	P value
Poor (N=70)			27.80	P<0.005
Frequency	44	26		
Percentage	16.4	8.5		
Lower Middle (N=319)				
Frequency	165	154		
Percentage	61.4	50.3		
Middle (N=170)				
Frequency	56	114		
Percentage	20.9	37.3		
High (N=15)				
Frequency	3	12		
percentage	1.1	3.9		

N= no of women

Table 3: Represents the mean, median intake of nutrients and food groups per day among experimental group women of different socioeconomic groups at the end of the study.

	Poor (n=70)			Lower Middle (n=319)			Middle income (n=170)			High income (n=15)		
Nutrients	**Mean**	**Median**	**SD±**	**Mean**	**Median**	**SD±**	**Mean**	**Median**	**SD±**	**Mean**	**Median**	**SD±**
Protein g/day	39.68	37.02	6.0	41.46	42.95	6.12	42.9	45.2	5.8	45.1	45.27	4.18
Iron mg/day	15.57	12.2	7.7	16.4	14.0	7.1	18.75	22.13	6.7	20.7	22.13	6.09
Vit C mg/day	115.1	121.0	59.9	129.8	154.8	69.9	146.7	162.5	51.1	141.9	169.28	46.4
Food Groups												
OV g/day	72.0	60.0	31.3	70.5	60.0	23.3	79.31	70.0	25.4	84.6	93.57	27.9
GLV g/day	40.3	32.85	16.2	45.8	52.8	17.6	51.65	52.87	18.4	50.44	52.87	16.4
Pulses g/day	30.4	30.48	16.7	31.18	29.9	14.85	35.33	37.14	18.0	44.08	41.42	18.5
Fishes g/day	3.3	3.32	3.52	4.32	4.28	3.95	5.15	5.71	3.55	6.09	5.71	4.0
Meat g/day	3.1	3.14	6.0	4.50	0.00	7.25	7.18	0.00	8.44	9.0	8.57	8.6
Fruits g/day	73.5	73.54	19.2	77.4	86.42	18.89	74.3	86.42	18.1	75.13	80.0	11.5

OV-Other vegetables, GLV –green leafy vegetables

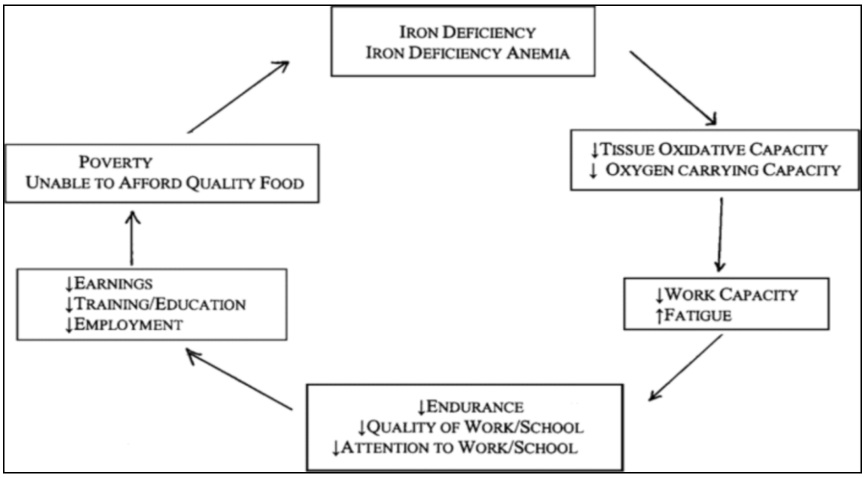

Fig 1: Iron deficiency, iron-deficiency anemia, and the cycle of poverty. ↓, Descreased; ↑, increased.
Source: From: Iron-Deficiency Anemia and the Cycle of Poverty among Human Immunodeficiency Virus-Infected Women in the Inner City Clin Infect Dis. 2003; 37(Supplement_2):S105-S111. Doi: 10.1086/375892

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