

Evaluation of effectiveness of iron-folate supplementation and anthelmintic therapy against morbidity and money earning capacity of coal mine workers of Assam

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■ **ABSTRACT** : To test the effectiveness of iron-folate supplementation and anthelmintic therapy against morbidity and productivity (in terms of money earned) 300 samples in the age group of 25-45 yrs. were randomly selected and pair matched for weight and haemoglobin and formed three groups namely, group I receiving 60 mg of elemental iron and group II receiving 120 mg of elemental iron and a Placebo. Supplementation was assigned for 180 days at a stretch. It was found that in both the treated groups, there was decrease in the incidence of morbidity, absenteeism and increase in the haemoglobin level and money earning capacity. Increment in haemoglobin level from baseline to final was 2.94 g/dl in group I and 3.14 g/dl in group II. Decrease in the incidence of morbidity in group I from baseline to final intervention was 53 per cent and in group II was 62 per cent. Correlation studies revealed that morbidity has a negative correlation with money earning capacity and haemoglobin level had positive effect on the productivity in terms of money earned and absenteeism. The treated groups were found to become more alert, responsive and demonstrated a feeling of fitness and willingness to turn out more work.

■ **KEY WORDS** : Iron-folate, Supplementation, Anthelmintic, Morbidity, Anaemia

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Nutritional anemia is an important health problem in many developing countries and leads to decrease capacity for physical work. In India, coal industry is the second largest industry in terms of employment. The coalmine workers play a vital role in the production of coal right from extracting, coal cutting, loading, tramming, dispatching and other ancillary and auxiliary jobs (Coal Report, 1998). As these jobs are against the nature, hazardous and due to hot and humid conditions of mines, the workers are always in a nature of fatigue even working for less hours. The physical performance of the workers plays a vital role both at the household and national level because in developing countries, most industries are labour intensive. The workers whose survival depends on their job performance, the daily work productivity is often a crucial factor. A reduction in work output and economic productivity is an inevitable

consequence of severe nutritional deprivation in humans (Edgerton *et al.*, 1981, Flores *et al.*, 1984). Iron deficiency anemia is found throughout the world among the working population particularly in developing countries where productivity of the workers is a key to the developmental process (Li *et al.*, 1994). The present study was carried to find out the effectiveness of iron-folate supplementation on anemia, morbidity and money earning capacity.

■ RESEARCH METHODS

Sample selection:

Initially six hundred workers were randomly enrolled using Random Number Tables. From the enrolled samples, 300 samples were screened keeping age group as criteria from 25-45 yrs. The entire samples were dewormed using single dose of Albendazole Tablets (Zeetal forte). Data on

weight, haemoglobin, morbidity, absenteeism, productivity in terms of money earned were collected at baseline (0 days), 90 days (mid intervention), 180 days (final intervention). The samples were pair matched for weight and haemoglobin and formed three groups namely, Placebo, group I (receiving 60 mg of ferrous sulphate and group II (receiving 120 mg of ferrous sulphate) at a stretch for 180 days.

Morbidity profile :

Data on morbidity profile of each worker was collected by asking individual worker in each phases of intervention. Records of individual disease like respiratory tract infection (cough, cold, asthma, bronchitis's, tuberculosis), gastro – intestinal disease (dysentery, diarrhoea, jaundice, gastritis, ulcers, gall stones, appendicitis), Metabolic disorders like diabetes, CVD and febrile condition (fever, malaria, typhoid etc.) were recorded in terms of numbers of the days the workers were morbid. The morbidity data prior to 1 month from the date of the interview was recorded. A specially designed questionnaire with the list of disease was used and checked with the available medical records.

Absenteeism :

The absenteeism record was ascertained from the attendance register maintained by the time keeper's office which keeps records of the working days, sick leave availed, casual leave granted and privileged leave entitled.

Productivity measurements (In terms of money earned):

Data on money earned were obtained from individual pay register for the whole study period maintained by the time – keeper's office.

Biochemical assessment :

Haemoglobin was analyzed using the cyanmet haemoglobin method (Oser, 1971). Stool analysis was done by microscopic examination of stained and unstained smear

and by concentration method.

■ RESEARCH FINDINGS AND DISCUSSION

It is documented that moderate to heavy infection with intestinal parasites impairs the nutritional status of the host by mechanism such as impairment of enzymatic digestion, malabsorption of nutrients and competing for the host's nutrients causing gastrointestinal loss of nutrients. A significant association was observed between the prevalence of parasitic infection and haemoglobin level among the workers. Table 1 revealed that about 69 per cent of the workers were infected with parasites with a mean haemoglobin level of 8.96 ± 0.89 g/dl. Non – infected workers had a better mean haemoglobin level (10.44 ± 0.46). The parasitic infections aggravate the existing states of iron deficiency and may push the affected individual into overt anemia resulting in weight loss, decreased activity and lower work productivity .

Table 1 : Per cent prevalence of parasitic infection among coalmine workers

Parasitic infection	% Prevalence	Mean Hb g/dl	t value
Parasitic infected	69 (207)	$8.96 (\pm 0.87)$	10.41 *
Parasitic non-infected	31 (93)	10.44 ± 0.46	

Figures in parenthesis indicate the number of workers

* Indicate significance of value at P=0.05

The high rate of parasitic infection (Table 2) among coal mine workers might be due to poor hygiene, polluted

Table 2 : Impact of parasitic infection on the haemoglobin level of the male coalmine workers of Assam

Parasitic infection	Percentage infected	Mean Hb g/dl \pm SE
<i>Ascaris lumbricoides</i>	37%	9.26 ± 0.064
<i>Ancylostoma duodenale</i>	25%	8.30 ± 0.102
<i>Trichuris trichiuria</i>	7%	9.27 ± 0.157

Table 3 : Effect of iron-folate supplementation on morbidity, number of working days and money earned by coalmine workers of Assam

Stages of evaluation	Treatments	Number of morbid (%)	Mean haemoglobin (G/DL)	Mean working days	Mean money earned (Rs.)
Baseline	Placebo	86	9.24 ± 0.21	17 ± 4.63	2968 ± 12.19
	Group I	72	9.12 ± 0.28	18 ± 0.45	3293 ± 131.12
	Group II	74	9.09 ± 0.26	20 ± 0.36	3749.80 ± 115.17
Mid intervention	Placebo	60	9.47 ± 0.24	20 ± 0.36	3526 ± 106
	Group I	45	11.63 ± 0.23	22 ± 0.32	3913 ± 111.9
	Group II	21	11.37 ± 0.30	23 ± 0.25	4433 ± 100
Final intervention	Placebo	51	9.50 ± 0.20	22 ± 0.34	3748 ± 105
	Group I	19	12.06 ± 0.25	24 ± 0.26	4291 ± 102
	Group II	12	12.23 ± 0.26	25 ± 0.17	4828 ± 87.5
Post- final intervention	Placebo	53	9.67 ± 0.34	21 ± 0.35	3769 ± 83.49
	Group I	46	10.75 ± 0.15	23 ± 0.23	4153 ± 101.27
	Group II	43	11 ± 0.10	24 ± 0.15	4659 ± 83.49

environment and lack of sanitation. Parasitic infection appears to be one of the alarming problems among the working population of developing countries (Olsson, 1978, Unnikrishan, 1989). In a population where iron status is compromised by low intake and poor bioavailability, a small load of parasites can precipitate anemia and can impart a deleterious effect on adult working population.

In case of coalmine workers, in spite of the management providing sanitary toilets most defecate outside and become more prone to hookworm infection and pollute environment.

Impact of supplementation on morbidity profile :

Morbidity has a direct bearing on the productivity of the workers. Among the morbidities, 53 per cent of the respondents suffered from general morbidity like back pain, weakness, giddiness and lack of appetite. 13.3 per cent suffered from gastro-intestinal infection, 4 per cent with respiratory tract infection and 7 per cent from febrile conditions like malaria, typhoid and fever. The haemoglobin level was worst affected in case of gastro-intestinal tract infections (8.92 ± 0.16 g/dl) followed by general morbidity (9.05 ± 0.073 g/dl).

Impact of supplementation was observed with a decreasing trend in the incidence of morbidity in the supplemented groups (Fig. 1) as well as the placebo group, which might be due to the deworming prior to supplementation.

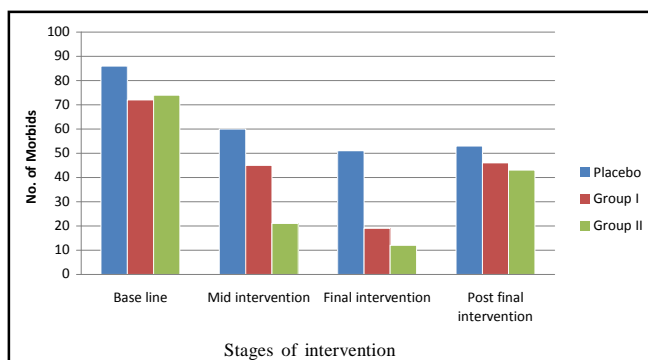


Fig. 1: Effect of iron folate supplementation on morbidity

In group I, the decrease in the incidence of morbidity from baseline to mid intervention was 27 per cent and to final intervention was 53 per cent. In the same group, the mean increment in haemoglobin from baseline to mid and final intervention was 1.56 g/dl and 1.86 g/dl, respectively. Similarly the decrease in the incidence of morbidity in Group II from baseline to mid intervention was 53 per cent and to final intervention was 62 per cent. The mean increment in haemoglobin level from baseline to mid and to final was 2.57 g/dl and 2.94 g/dl in group I and 2.25 g/dl and 3.14 g/dl in group II, respectively. However, after withdrawal of supplementation, increase in morbidity was observed at the

end of 270 days. Similar results were observed by Rahamatullah (1983) who stated that iron supplementation improved morbidity status of the workers and created a sense of well being with decreased tiredness and palpitation.

Impact of supplementation of money earning capacity:

Absenteeism is one of the important factors affecting productivity among the labour intensive organized industrial sectors and anemia being a major contributing factor. Improvement in the number of days worked was observed during different stages of intervention in the supplemented groups. In group I and group II highest increase in number of days worked was observed between baseline of final intervention.

Different studies have suggested that haemoglobin concentration affects the productivity of the workers in terms of number of days worked. Correlation studies (Table 4) revealed a highly significant correlation between haemoglobin and number of days worked ($r=0.698$; $p<0.01$). Similarly, a high significant positive linear relationship ($r=0.845$; $p<0.01$) was found between working days and money earning capacity and a significant negative correlation ($r=-0.272$; $p<0.01$) with morbidity confirming that as morbidity increases it has a direct affect on the absenteeism of the workers.

Table 4 : Correlation between different variables with number of working days and money earning capacity

Variables	Correlation with working days	Correlation with money earned
Hemoglobin	0.698**	0.745*
Weight	0.100 ms	0.126 *
Morbidity	-0.272 **	-0.288**
Money earned	0.845**	--
No of days worked	--	0.845**

* and ** Indicate significance of value at $P=0.05$ and 0.01 , respectively

Differences in productivity in terms of money earned was observed in all the groups (Table 3). The highest amount of money earned was observed in group II, followed by group I. There was a gradual improvement in the amount of money earned in all the three groups over a period of one month. However, at post-final intervention there was drop in the amount of money earned over a period of one month but the earning capacity was much better than the amount at baseline and at mid intervention.

The amount of money earned by the workers depends on other factors like absenteeism, haemoglobin and morbidity. In the present study, the money earning capacity was significantly ($r=0.845$, $p<0.01$) correlated with the numbers of working days of the workers. Moreover, morbidity has a negative correlation ($r=-0.288$, $p<0.01$) with money earning capacity and haemoglobin had positive effect

($r=0.742$; $p<0.01$) on the workers productivity.

Similar correlation was found between haemoglobin concentration and productivity among tea plantation workers of Sri Lanka (Gardner *et al.*, 1977). Wolegmuth *et al.* (1982) also supported a similar relationship between work output and iron status among road construction workers of Kenya.

The study demonstrates that treatment of anemia with iron supplementation produces a quantifiable improvement in terms of the nutritional profile of the coalmine workers. Supplementation of elemental iron at 60 mg and 120 mg dose level had a positive impact on weight gain and haemoglobin level. Previous studies also stated that iron supplementation infused a feeling of improvement in their general health condition, creates a psychological feeling of fitness and willingness to turn out more work (Flores *et al.*, 1984; Diaz *et al.*, 1991).

The findings indicate that in long term supplementation, haemoglobin levels are altered by iron therapy in anemic workers. The results are in conformity with studies made by Rahamatullah (1983), Vijayalakshmi and Jayanti (1986) and Dodd *et al.* (1992) who suggested that for a good haemoglobin response to iron supplementation, higher dose of elemental iron (100 mg) are required not only to improve the haemoglobin level but also to build up iron stores.

There is the need to adopt measures to prevent hook worms infection such as more effective health education and improvement in sanitary practices. In the present study, the compliance was low with 120 mg elemental iron supplementation probably due to other associated problems like constipation and irregular bowel syndrome. Further studies are required to determine the effectiveness of the dose level of folate supplementation among the workers. The study indicated that iron supplementation increases work output, which suggests that anemia decreases productivity and iron supplementation is beneficial to working population to improve the work out put, decreasing the incidence of morbidity and infusing a feeling of well being among the workers.

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