



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2020; 8(1): 926-931

© 2020 IJCS

Received: 19-11-2019

Accepted: 23-12-2019

**Bobby Rai**

Department of Food Science and Nutrition, Faculty of Community Science, AAU, Jorhat, Assam, India

**Mamoni Das**

Professor, Department of Food Science and Nutrition, Faculty of Community Science, AAU, Jorhat, Assam, India

## Effect of anemia on productivity and physical work capacity of tribal women engaged in agriculture activities in Assam, India

**Bobby Rai and Mamoni Das**

DOI: <https://doi.org/10.22271/chemi.2020.v8.i11.8368>

**Abstract**

The present study was undertaken to assess the effect of anemia on productivity and physical work capacity of tribal farm women of Assam, India. To fulfill the objective of the study 400 tribal women belonging to the age group of 18-45 years were selected for the collection of data on different parameters such as morbidity profile, height, weight, haemoglobin, stool analysis, anaemia and physical work capacity. From the study, the results showed 56.75% of the respondents suffered from various morbidities of which 34.25% of respondents suffered from respiratory tract infection, 4.75% suffered from gastrointestinal tract infection and 17.75% suffered from different febrile condition. The chronic energy deficiency (BMI<18.5) was about 57.9% among the respondents. The prevalence of anaemia was universal evident which affected 80% of the women as per Indian reference value (12 g/dl) with mean haemoglobin level of 8.40±0.91 g/dl and mean total iron binding capacity (TIBC) of 410.60±22.38 µg/dl. It was also observed that 82.5% of the respondents were infected by intestinal parasites. The pre-activity pulse rate of anaemic respondents was 72.16±2.25 per min and non anaemic respondent was 62.76±2.61 per min. After transplanting, the post activity pulse rate of anaemic and non anaemic respondent was 105.20±2.3 and 82.36±2.5 per min respectively. The pulse rate before and after activity among the anaemic respondent was significantly (p<0.01) higher than the non anaemic respondent.

**Keywords:** Health status, tribal farm women, physical work capacity

**Introduction**

In India, the tribal people constitute about 8.2 per cent of the total population and more than 700 tribal groups are heavily concentrated in the north-eastern states each with its distinct cultures, religions, social practices, dialects and occupations (2015 Census). The nutritional status of tribal's in India presents a varied and complex picture because the health and nutritional problem of the tribal population of India are as varied as tribal groups themselves who presents bewildering diversity in the socio-economic, socio-cultural and ecological settings thus making them vulnerable to under nutrition due to household food insecurity (Joshi and Vijayalaxmi, 2009) [6]. The tribal women are not healthy and there are greater incidence of malnutrition among them due to poor educational status, poor sanitary and housing facilities, deficient food intake and low per capita income (Kapoor *et al.*, 2009) [7]. Tribal farm women are considered as the backbone of hill economy because agriculture depends mostly on women folks in hills. About 43.19 per cent of the tribal women of north east region are engaged in farm related activities like agriculture, cattle care and poultry. Tribal farm women face challenges in getting a sustainable livelihood and a decent life due to environment degradation. The tribal farm women work for about 12 to 15 hours per day involving in agriculture and allied activities are drudgery prone (Gite and Singh, 1997) [2].

Women with poor health and nutrition are more vulnerable to malnutrition and other micronutrient deficiency. There is increased risk of anaemia among the tribal farm women due to inadequate dietary intake of iron rich food (Rao *et al.*, 2010) [11]. The consequences of anaemia in tribal women include increased risk of maternal morbidity and mortality and lowered physical activity, lower mental concentration and productivity. Women with anaemia may experience fatigue and have reduced work capacity (Johnson *et al.*, 1982) [5]. Many studies have reported that hill farm women were in the grip of severe to moderate malnutrition due to traditional food practices, poor sanitation, poverty and non utilization of available food

**Corresponding Author:****Mamoni Das**

Professor, Department of Food Science and Nutrition, Faculty of Community Science, AAU, Jorhat, Assam, India

resources (Pant, 2002) [9]. Considering the multiple roles of agricultural women, the present study is an attempt to assess the nutritional status of tribal farm women of Karbi Anglong.

## Materials and Method

### 1. Study region and Study population

The study was conducted in Karbi Anglong district of Assam and blocks Lumbajong was selected purposively for the study as it has a sizeable target population. 400 participants within the age range of 18-45 years were selected from four village's viz. Doljhora, Sutarpara, Rongkhelan and Barsangaon. The respondents were divided into three groups in the age group of 18-25 years, 26-35 years and 36-45 years.

### 2. Morbidity profile

Data on morbidity profile of each respondent was collected by specially designed questionnaire. Records of individual diseases like respiratory tract infection (cough, cold, asthma, tuberculosis), Gastro-intestinal diseases (dysentery, diarrhea, jaundice) and febrile condition (fever, malaria, typhoid etc.) were recorded in terms of number of days the respondents were morbid. The morbidity data prior to 1 month from the date of the interview was recorded.

### 3. Nutritional anthropometry measurement Weight:

Portable scale "Krupps platform balance" with 0.01 kg sensitivity was used. Individuals removed shoes, socks and belt prior to weighing. The pointer of the balance was adjusted at '0' to avoid error.

**Height:** Height was measured with anthropometer rod. Subjects stood erect on the levelled surface without shoes with heels together, toes apart and head held straight. The anthropometer rod was placed behind the subject in the center of the heels perpendicular to the ground. The moving head piece of the anthropometer was placed in the sagittal plane over the head of the subject applying a slight pressure to reduce the thickness of the hair.

**Body Mass Index (BMI):** The body mass index (BMI) of the respondents was calculated by taking the weight (Kg) and height (m<sup>2</sup>) measurements.

## Biochemical assessment

### Estimation of haemoglobin by acid Hematin method

About 5 drops of N/10 HCl was placed in a clean graduated tube which occupies the lower most mark of the tube. Then the top of the middle or the ring finger was pricked and blood was drawn by drawing pipette upto 20 c.u mm. The blood was then immediately transferred to a graduated tube which was already partly filled with N/HCl. Thus the tube was kept undisturbed for 5-6 minutes so that formation of acid hematin can take place. The water was sucked by the pipette and washings were transferred to the graduated tube. The colour of acid hematin is dark brown wait for 2-4 minutes so that all parts of blood are converted to acid hematin. The distilled water was added drop by drop with constant stirring until the colour of the solution matches with that of the standard colour. The scale of the graduated tube was used to measure the result and the reading on the scale was taken after 5 minutes.

## Determination of total iron binding capacity

This method involves the addition to the serum an amount of iron more than sufficient to saturate the iron binding proteins. Then absorbing, the excess iron onto MgCO<sub>3</sub> and finally determining the total bound iron by the depyridyl method.

4 ml of FeCl<sub>2</sub> solutions were added to 2 ml serum. After standing for 5 minutes, 400 mg MgCO<sub>3</sub> (100 mg for each ml FeCl<sub>2</sub>) were added. It was shake frequently and vigourously for 30-60 minutes. Then 4 ml of supernatant fluid, 1 ml each of the 0.2 ml sulphite and 0.2 per cent dipridyl was added and the same procedure as for serum iron determination was followed. Since the volume of Serum in 4 ml supernatant was 1.33 ml and same standard i.e. 3µg/ml was used (2ml standard solution, 2 ml H<sub>2</sub>O and 1 ml each of dipridyl and sulphites solution) then,

$$\text{TIBC in meg/100 ml serum} = \frac{\text{Reading of unknown}}{\text{Reading of standard}} \times \frac{100}{1.33} \times 6 \text{ (i.e. 450)}$$

## Stool examination

About two gram (2g) of early morning stool was collected into plastic containers. The stool was used for the determination of intestinal parasites and helminthic parasites, which localize in the biliary tract and discharge their eggs into the intestine. The simple test tube flotation method was used for the detection of nematode and cestode eggs and coccidia oocysts in the faeces. It is based on the separating of eggs from faecal material and concentrating them by means of a flotation fluid with an appropriate specific gravity.

## 4. Measurement of physical work capacity

### Work performance

The work performance was measured by simple agricultural activities like transplanting and seedling uprooting of physical capacity i.e. the work output of the respondents in terms of mean work output area covered in 30 minutes. Pre-activity and post- activity pulse rate was recorded for 60 second.

### Measurement of pulse rate

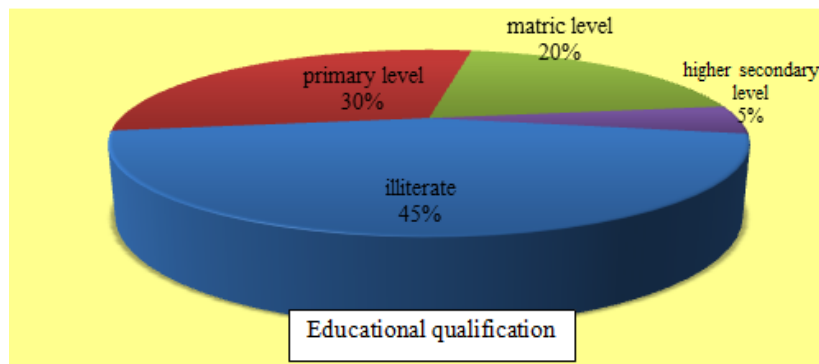
Pulse rate is used as a parameter to assess the physical work capacity status of an individual. For the measurement of pulse rate, sphygmomanometer was used by an experienced medical professional. The pre-activity and post-activity pulse rate was taken thrice in three different days. Mean of the three readings was taken to avoid any instrumental error and to ensure correct reading.

## 5. Statistical analysis

Data obtained were statistically analysed and results obtained were tabulated. The different statistical methods viz. percentage, mean, standard deviation and sample 't' test were applied for the analysis of the recorded data.

## Results and Discussion

Socio-economic details in terms of education revealed that 45 per cent of the respondents were illiterate, 30 per cent of the respondents studied up to primary level, 20 per cent up to matric and only 5 per cent upto higher secondary level indicating very low level of educational status.



**Fig 1:** Percentage distribution of educational qualification of the respondents

The Health status of the tribal farm women revealed that 56.75% of the respondents suffered from various morbidities out of which 34.25 per cent of respondents (Table 1) suffered from respiratory tract infection. Among the respiratory tract infection 30.75 per cent of the respondents suffered from cough and cold, 2 per cent from tuberculosis, 1.5 per cent from asthma and 4.75 per cent suffered from gastro intestinal tract infection. Among different gastro intestinal tract

infection 1.25 per cent of the respondents suffered from jaundice, 2 per cent of the respondents reported to be suffered from dysentery and 1.5 per cent from diarrhoea. Similarly, 17.75 per cent respondents suffered from different febrile condition like fever (12.75%) mostly due to cold and cough. About 3 per cent of the respondent suffered from malaria and 2 per cent of the respondents reported to suffer from typhoid over a period of one month.

**Table 1:** Percentage prevalence of episodes of morbidity of respondents

Episodes	Morbidity present	
	Sample size	Percentage (%)
Respiratory tract infection	137	34.25
Cough and cold	123	30.75
Asthama	6	1.50
Bronchitis	0	0
Tuberculosis	8	2.00
Gastro intestinal tract infection	19	4.75
Dysentery	8	2.00
Diarrhoea	6	1.50
Jaundice	5	1.25
Ulcers	0	0
Gall bladder stone	0	0
Febrile condition	71	17.75
Fever	51	12.75
Malaria	12	3.00
Typhoid	8	2.00

#### Anthropometric measurements

The mean height and weight of subjects were  $149.2 \pm 5.23$  cm and  $44.36 \pm 3.24$  kg (Table 2). Lower body weights decreases

the productivity and work capacity of the female workers which is negatively and significantly correlated with the body weight (Vijaylakshmi *et al.*, 1987) <sup>[15]</sup>.

**Table 2:** Mean Anthropometric measurement of the respondents

Number of Samples	Mean height (cm) $\pm$ SD	Mean weight (kg) $\pm$ SD
400	$149.20 \pm 5.23$	$44.36 \pm 3.24$

From Fig. 2 revealed the mean body mass index (BMI) that 42.5 per cent respondents were normal, 37.5 per cent suffering from mild (CED grade I), 14.1 per cent were moderate (CED grade II) and 6.3 per cent were severe (CED grade III). The tribal farm women of Karbi Anglong were suffering from mild to severe form of chronic energy deficiency. The contributing factor may be due to poor

purchasing power, faulty food practices prevailing in the society, lack of proper health care facilities, and inadequate access to food supply system. Chronic Energy Deficiency (CED) impairs the work performance and working potential of the agricultural workers hampering their work output and productivity (Varadarajan and Prasad, 2009) <sup>[14]</sup>.

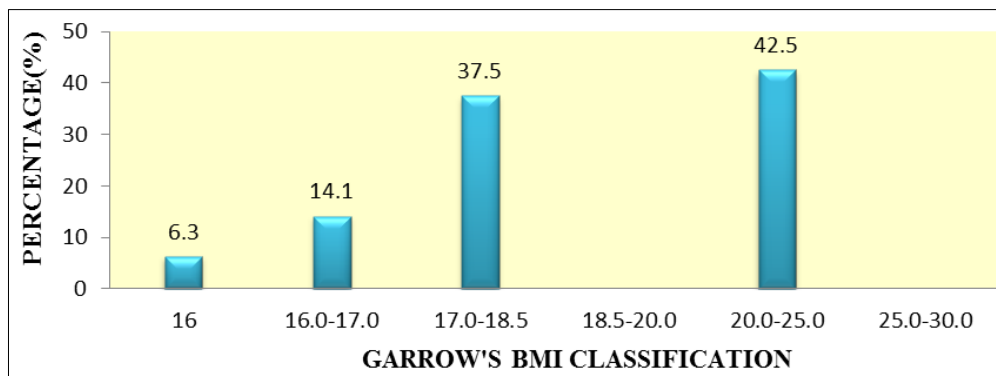


Fig 2: Mean body mass index (BMI) of tribal farm women according to Garrows classification

### Biochemical Assessment

The Biochemical assessment of tribal farm women revealed that 20 per cent were non anaemic with mean haemoglobin

level of  $12.00 \pm 0.21$  g/dl where 80 per cent were anaemic with mean haemoglobin level of  $8.40 \pm 0.91$  g/dl.

Table 3: Mean haemoglobin level and Percentage prevalence of anaemia of the respondents in different age groups

Age group (years)	Sample size (N=320)	Percentage of prevalence	Mean haemoglobin g/dl
			Indian cut off point 12 g/dl
18-25	172	53.75%	$8.26 \pm 0.70$
26-35	104	32.50%	$8.73 \pm 0.95$
36-45	44	13.75%	$8.86 \pm 1.10$

The mean haemoglobin level of the respondents in the age group 18-25 years, 26-35 years and 36-45 years were  $8.26 \pm 0.70$  g/dl,  $8.73 \pm 0.95$  g/dl and  $8.86 \pm 1.10$  g/dl respectively (Table 3). The farm women of all the age group had lower blood haemoglobin level in comparison with WHO cut off (2011) point of 12 g/dl indicating the presence of anaemia within the population.

The total iron binding protein (TIBC) level of the tribal farm

women (fig 3) between the age group 18-25 was  $380.6 \pm 23.8 \mu\text{g/dl}$  and between age group 26-35 and 36-45 was  $425.6 \pm 45.17 \mu\text{g/dl}$ . The prevalence of iron deficiency anaemia was high among the age group of 26-45 years, indicating poor intake of iron rich food in their diet, low intake of dietary iron, unhealthy sanitary practices, worm infestation and disease condition resulting in low level of total iron binding capacity (Sreelakshmi *et al.* 2012) [13].

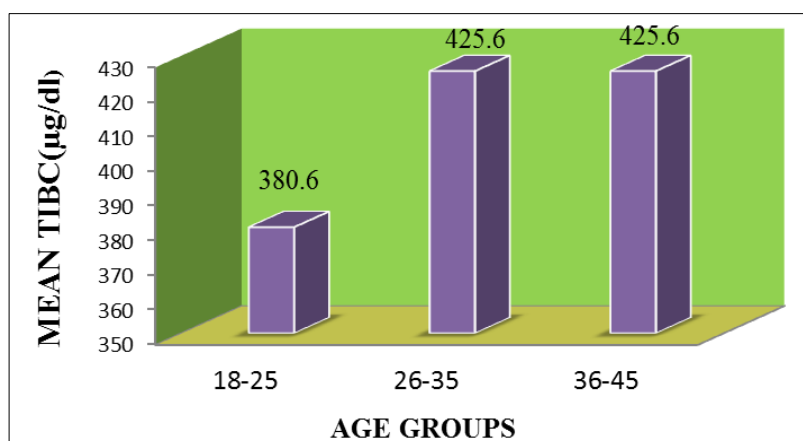


Fig. 3: Mean TIBC level of the respondents in different age groups

From Table 4, 82.50 per cent of the respondents infected with parasites had mean haemoglobin level of  $8.40 \pm 0.91$  g/dl and 17.50 per cent tribal farm women not infected by parasites had haemoglobin level of  $12.00 \pm 0.21$  g/dl. The parasitic

infections aggravate the existing states of iron deficiency and may push the affected individual into overt anaemia. In adults it may result in weight loss, decreased activity and lower work productivity (Pawalowski *et al.*, 1991) [10].

Table 4: Impact of parasitic infection on the haemoglobin level of the respondents

Parasitic infection	Percentage infected	Mean Hb g/dl $\pm$ SD
Absent	70 (17.50%)	$12.00 \pm 0.034$
Present	330 (82.50%)	$8.40 \pm 0.068$
<i>Ascaris lumbricoides</i> (round worm)	99 (30.00%)	$9.12 \pm 0.036$
<i>Ancylostoma duodenale</i> (hook worm)	180 (54.54%)	$8.20 \pm 0.061$
<i>Trichuris trichiuria</i> (whip worm)	21 (6.36%)	$9.20 \pm 0.081$

The impact of parasitic infection on the haemoglobin level of the farm women depicts that 54.54 per cent (Table 4) infected with *Ancylostoma duodenale* (hook worm) had mean haemoglobin level of 8.20 g/dl, 30.00 per cent with *Ascaris lumbricoides* (round worm) had a mean haemoglobin level of 9.12 g/dl and 6.36 per cent of the respondents infected with *Trichuris trichiuria* (whip worm) had a mean haemoglobin level of 9.20 g/dl. In a population where iron status is already compromised by low dietary iron intake and poor bioavailability, a small load of parasites can precipitate anaemia (Atukorala *et al.*, 1994) [1].

### Impact of anaemia on physical work capacity

Work capacity under maximal workload has been shown to be related to haemoglobin concentration and to decrease even in mild anaemic subjects. Although most jobs do not involve near maximal workloads, there is increasing evidence that

mild degrees of anaemia may also affect work output in everyday tasks (INACG, 1977) [4]. In the present study the pre-activity pulse rate of anaemic respondents (Table 5) was  $72.16 \pm 2.25$  per min and non anaemic respondent was  $62.76 \pm 2.61$  per min. After transplanting an area of 11.16 sq.mt the post activity pulse rate of anaemic respondent was  $105.20 \pm 2.3$  per min and non anaemic was  $82.36 \pm 2.5$  per min. Both the pulse rate before and after activity among the anaemic respondent was significantly ( $p < 0.01$ ) higher than the non anaemic respondent. Li *et al.*, (1994) [8] stated that compared to non-anaemic workers, anaemic workers in China were 15 per cent less efficient in performing their work. Similarly, in a study in Kenya showed that better nourished non anaemic women were able to spend more time in work related activities including home production activities like winnowing, pounding of grains etc, compared to anaemic women (Sahn and Alderman, 1988) [12].

**Table 5:** Mean pulse rate of the respondents before and after the activity and Mean work output of the respondents

Group/ Activities	N	Pre activity mean pulse rate		Post activity mean pulse rate		Mean work output in terms of area covered in sq.mt per 30	't' value		
		Before activity	't' value	After activity	't' value				
<b>Transplanting (sq.mt)</b>									
Anaemic	30	$72.16 \pm 2.25$	3.23**	$105.20 \pm 2.30$	8.23**	$11.16 \pm 4.86$	5.75**		
Non Anaemic	30	$62.76 \pm 1.24$		$82.36 \pm 2.50$		$24.11 \pm 3.4$			
<b>Seedling uprooting (sq.mt)</b>									
Anaemic	30	$72.23 \pm 2.61$		$115.20 \pm 2.30$		$10.9 \pm 5.08$	6.01**		
Non Anaemic	30	$62.50 \pm 1.49$	$82.36 \pm 2.50$	$22.47 \pm 5.9$					

\*\*Significant at the 0.01 level

The mean work outputs of the anaemic respondent were less when compared with non-anaemic respondent (Table 5). In case of transplanting, the anaemic respondents covered an area of 11.16 sq.mt/30 min for transplanting of paddy where as the non anaemic respondent covered an area of 24.11 sq. mt per 30 min. The area covered by non anaemic respondent was significantly ( $P < 0.01$ ) higher than anaemic respondents. Similarly, for seedling uprooting the area covered by non-anaemic respondent was significantly ( $P < 0.01$ ) higher than anaemic respondent.

### Conclusion

It can be concluded from the present study that prevalence of anaemia among the tribal farm women was responsible for decreasing work performance and productivity thereby decreasing money earning capacity which ultimately affected their food and nutrient intake thus reflecting their poor nutritional status. This is a major state of concern because almost all the farm women work at their home as well as in their agricultural fields or as daily wage earner in other allied agricultural activities. Thus, this poor state of health hampers their productivity and along with anaemia aggravates the condition of malnutrition.

### References

- Atukorala TM, Silva LDR, Dechering WHJ, Dassenaik TS, Perera RS. Evaluation of effectiveness of iron folate supplementation and anthelmintic therapy against anaemia in pregnancy-a study in the plantation sector of Sri Lanka. *Amer. J. Clin. Nutr.* 1994; 60:286-292.
- Gite LP, Singh G. Ergonomics in agricultural and allied activities in India. Central Institute of Agricultural Engineering, Bhopal India, No. CIAE/97/70, 1997.
- ICMR. Nutrient requirements and recommended dietary allowances for Indians. A report of the expert group of the ICMR, 2010, 1, 203p.

- International Nutritional Anaemia consultative Group. Guidelines for the eradication of iron deficiency anaemia. A report by the INACG. The Nutrition foundation New York and Washington DC, 1977, 23-39p.
- Johnson AA, Lantham MC, Roe DA. The prevalence and etiology of anemia in Guyana. *Amer. J. Clin. Nutr.* 1982; 35:309-318.
- Joshi N, Vijayalaxmi KG. Nutritional education tool to improve overall dietary attitude and Knowledge among young women. *J. Hum. Ecol.* 2009; 25(3):187-197.
- Kapoor S, Tyagi R, Saluja K, Chaturvedi A, Kapoor AK. Nutritional profile and socio-economic status of Saharia, a primitive Tribe of India. *Open Anthropol. J.* 2009; 2:58-63.
- Li R, Chen X, Yan H, Deurenberg P, Garby L, Hautvast J. Functional consequences of iron supplementation in iron deficient female cotton mill workers in Beijing. *Amer. J. Clin. Nutr.* 1994; 59:908-913.
- Pant BR. Drudgery and nutrition status of the rural women in the Central Himalaya (Uttarakhand Himalaya). *The Indonesian J. Geogr.* 2002; 34(1):1-16.
- Pawalowski FS, Schad GA, Scott GJ. Hookworm infection and anaemia approaches to prevention and control. World Health Organisation, Geneva, 1991.
- Rao KM, Balakrishna N, Arlappa N, Laxmaiah A, Brahmam GNV. Diet and nutritional status of women in India. *J. Hum. Ecol.* 2010; 29(3):165-170.
- Sahn D, Alderman H. The effects of human capital on wages and the determinants of labour supply in a developing country. *J. Dev. Econ.* 1988; 29:157-183.
- Sreelakshmi PR, Vijayakumar K, Anish TS, Shrinivasa BM, Sheela S. Abraham A *et al.* Anaemia and body mass index of non pregnant tribal women of reproductive age group in Palakkad District of Kerala, India. *Ind. J. Prev. Soc. Med.*, 2012, 43(1).

14. Varadarajan A, Prasad S. Regional variations in nutritional status among tribals of Andhra Pradesh. *Stud. Tribes Tribal.* 2009; 7(2):137-141.
15. Vijayalakshmi P, Kupputhail U, Maheswari VU. Anaemia and work output of farm women. *Ind. J. Nutr. Dietet.* 1987; 24:253-259.
16. WHO. Control of nutritional anaemia with special reference to iron deficiency. Report of an IAEA/USAID/WHO Joint Meeting. World Health Org. *Tech. Rep. Ser.* 2011; 580:5-71.