International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Bio-Fortified Wheat and Soybean Varieties: A Sustainable Approach of Food and Nutritional Security at District Dewas in Madhya Pradesh

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Abstract

Food security of the country has been ensured due to green revolution through adopting of high yielding varieties and newly introduced agricultural technologies at ground realities, hence achieved the rational production (305.44 million tones) of cereal crops during 2020-21 (Ministry of Agriculture and farmers welfare third advance estimates). Now days country is facing with great problems of malnutrition (38.4%) of women, adolescent girls & children resulted high rate of anemia (58.6%), underweight (35.7%) & mortality (41%), whilein Madhya Pradesh malnutrition (42%), Anemia (68.9%), underweight (42.8%), mortality of children (51%) were higher comparatively to the country, may be due to imbalance, inappropriate nutrition, health & hygiene, poor awareness of livelihood peoples etc.(National Family Health Survey 2015-16). A stealthier form of deficiency is known as hidden hunger which is caused due to the intake of inadequate nutritious cheap food and thosehaving the characteristic of fulfillness the stomach but actually lacked in essential vitamins and minerals nutrition ingredients. Keeping in mind to cope up the malnutrition problems the Indian council of Agriculture research has taken lead for the biofortification of cereal crops based on earlier national breeding research efforts including biotechnology transgenic techniques and agronomic practices promotion of encourage the utilization of micronutrient fertilizers, targeting the enhancement of nutrients like zinc, iron, protein, folic acid, riboflavin, KTI free, Lipoxygenase-2 etc. in staple major & minor food and oilseed crops. The current study has planned to review the role and importance of bio-fortified cereal crops like wheat and oilseed associated with high rich protein i.e.soybean incorporated for balance and appropriate nutrition to overcome and reducing the risk of malnutrition i.e. anemia, underweight as well as to ensure the nutritional security on respondence of children less than 5 years. To achieve the goal the experiment has designed by incorporating the Porridge of biofortified durum wheat variety HI-8777 containing protein >14%, iron 48.7 ppm, zinc 43.6 ppm and soybean variety NRC-127 KTI free simultaneously on ten children at village Agera district Dewas (M.P.). The study comprises three treatments i.e.**T1**-*Panjeeri*, **T2**-*HI-8777*, **T3**-*HI-8777 + NRC-127* (09:01) provided each treatment for 2 months respectively and total upto 6 months. The observations were recorded on various parameters like haemoglobin, total protein, iron, zinc, height and weight after two months intervals completing the each treatment. The base line data was recorded by adopting the standard analytical procedure for collecting the blood samples of respondents and their testing. The result data reveals that all studied parameters were found in increasing trend on treatment no.03 as compare to control. The maximum hemoglobin (13), total protein (7.9), iron (69), zinc (735) were recorded in treatment No. 03 in against of baseline data i.e. 09, 6.4, 13, 20 respectively after 6 months. Height and weightparameters were also higher in treatment no.03 as

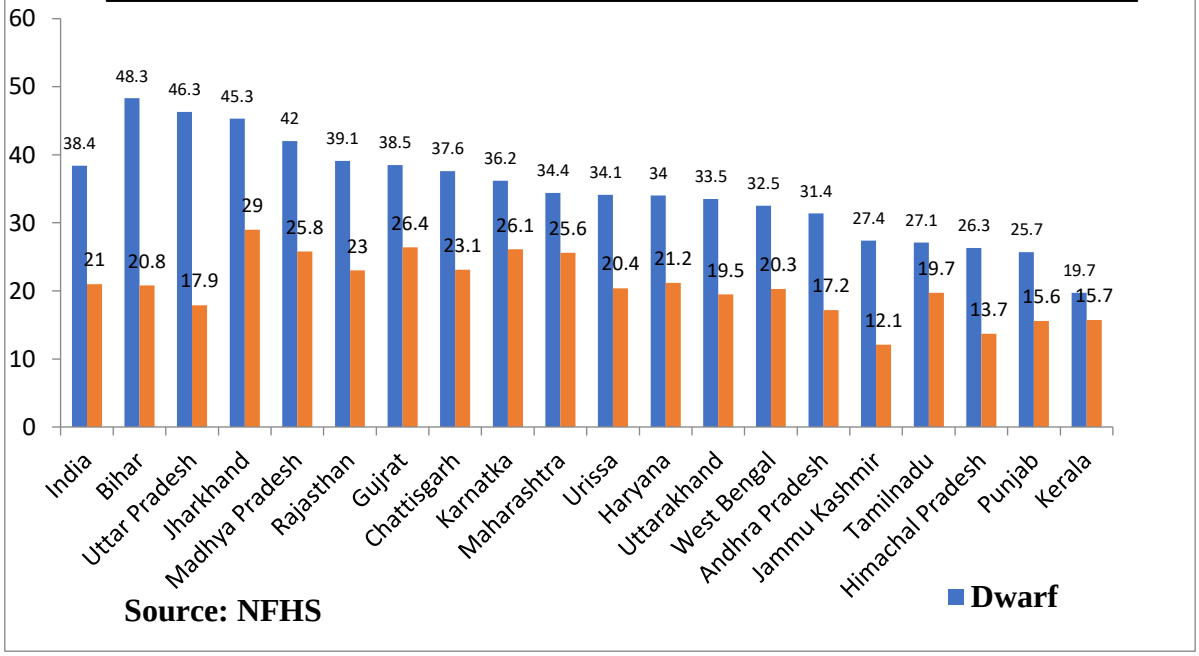
compare to treatment no.01. On the basis of data it concluded that recent bio-fortified wheat and soybean varieties were played vital role in contributing to the food and nutritional livelihood securities specially for the poor population of the rural areas in village Agera Distt Dewas to cope up the malnutrition problems in the state as well as the country. The result also confirmed by PriyaSingla and Kiran Grover during 2001

Keywords: Malnutrition, Biofortification, Micronutrients, Iron and Zinc.

INTRODUCTION

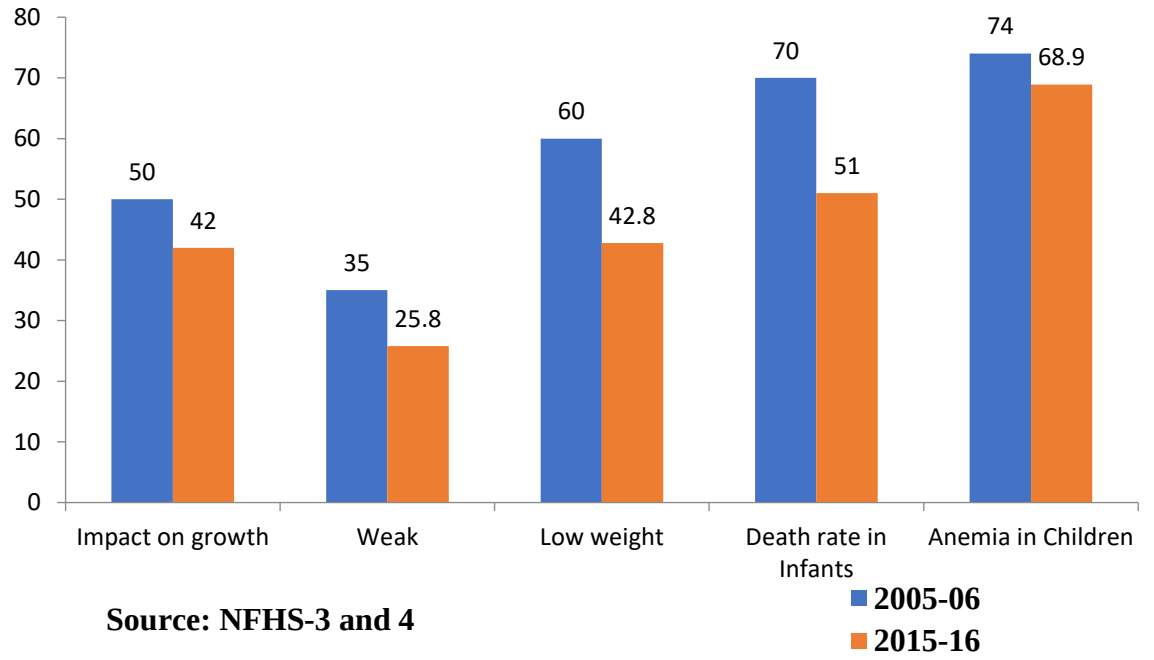
- No doubt the India has been achieved the food security through the rational production (305.44 million tones) of cereal crops during 2020-21 (Ministry of Agriculture and farmers welfare third advance estimates)
- The rural farmers left away from the major and minor millets crops i.e. jowar, bajra, ragi, kodo etc. which has the good potential to meet out the nutritional requirement.
- Madhya Pradesh was highly malnourished state which falls in category of fourth level in the country.
- The malnutrition problems in children emphasized that the short height 3.8% & 4.2%, weakness 2.1% & 2.6%, under weight 3.6% & 4.3%, anaemia 5.9% & 6.9% in India as well as M.P. respectively.
- It was also observed that 74 % newly born children of Madhya Pradesh suffered with anaemia either due to low iron & haemoglobin content.

Fig. 01 State wise weakness and dwarfness in malnurished children (2015-16)



Source: NFHS

Fig. 02: Children index of malnutrition , infant death rate per 1000 birth in M.P.



Source: NFHS-3 and 4

1. Role and importance of bio-fortified varieties of wheat on malnourished children.
2. Also find out the role of bio-fortified soybean to eradicate malnutrition of children.
3. To aware & encourage for the inclusion of bio-fortified varietiesin daily intake of rural peoples.

METHODOLOGY

- To attain and meet out the goal of objective, the study was carried out by KVK, Dewas during January to June 2020-21.
- To conduct OFT, Nutri smart village Agera was selected from sonkutch block of Dewas district.
- A total of 10 preschool children were selected &assessed for nutritional status and identified asmalnourished based on new WHO child growth standards 2006, weight for age and hemoglobin content.
- The baseline data was recorded by collecting the blood samples&analyzed from Pathology laboratory of Vinayak hospital.
- Among 10 children respondents, 09 were highly anaemic or low hemoglobin content except of one namely Anshul.
- The iron content was varied between very low to low range of namely Pari, Devraj, Ravindra, Kritika, Hansraj while the five falls in almost normal range.
- The zinc content were varied between very low (Ritesh & Ravindra) to medium range (Hansraj, Divya & Shailendra) excluding two respondents.
- The three children namely Hansraj, Shailendra & Neha were found that moderate acute malnourished due to very low weight in ratio of height.
- The study comprises of three treatments as per details given below for the study purpose :

➢ **T1**-*Panjeeri*

- **T2**-Wheat-*HI-8777*: Protein-**14%**, Iron-**48.7 ppm**, Zinc-**43.6 ppm**
- **T3**-Wheat-*HI-8777+Soybean- NRC-127****KTI free, Protein 40%*****(09:01)**

- The first treatment namely *Panjeeri* was selected for feeding @120 gm/day from January to February 2021 through Anganwadi workers.
- Second treatment @ 120 gm/day from March to April 2021.
- Third treatment comprises biofortified wheat + soybean porridge @ 120 gm./day from May to June 2021.
- The observations were recorded on various parameters like height, weight, haemoglobin, total protein, iron, zinc after two months of intervals completing the each treatment.

RESULTS AND DISCUSSION

Impact of different treatments on height and weight:

- The effect of bio-fortified wheat + soybean porridge (T3) was showed that the heightgained minimum (73 cm) and maximum (106.5 cm) in against of baseline data 70.5, 103.0 of Kumari Kritika and Master Shailendra respectively after 2 months (May to June) completion of the study.
- In spite this, the maximum & minimum % increase weight among the included respondents were found 18.3 and 6.1 of Ku. Neha & Master Shailendra respectively. The maximum (14.9 kg) & minimum weigh (8.5 kg.) were also observed in treatment no.03 as compare to treatment no. 2 after completion of the experiment.
- After taking the porridge of wheat HI 8777 in treatment 02 improvement were seen in the children all were becomes normal except one child while the positive effect of treatment 03 combination porridge of wheat HI 8777 + soybean NRC 127 were attend all respondents gains normal weight.

Impact of different treatments on Haemoglobin, Zinc & Iron::

- The data revealed that the whole respondents were anaemic or either having poor haemoglobin content below regulated normal range (11.5 to 22.8 g/dl).
- The data showed that there was no appreciable changes in T1 while the T2 and T3 had the remarkable improvement in haemoglobin content.
- The four respondents namely Master Ritesh, Master Anshul, Ku. Divya & Master Shailendra except others was recovered after feeding of T2 from March to April.
- The all respondents becomes anaemic free or having standard haemoglobin content in T3 after feeding of 02 consecutive months from May to June.
- Maximum range of Haemoglobin % were recorded in master Devraj 51.3 g/dl while minimum range of haemoglobin % change was recorded 8.6 g/dl in master Anshul.
- The data revealed that zinc content of five children were falls under low to very low in range after feeding of the Panjeeri (T1), there was no any drastic change.
- The T2 and T3 showed that all respondents were achieved almost normal range after time period of two months respectively.
- The maximum percent change 90% was attained by Master Ravindra and minimum 1.4% by Master Devraj.
- According to baseline data, the iron content of five respondents were very low to low range while others in normal range.

- After the studied period, it was noticed that almost respondents were get the satisfactory response and become anaemic free by feeding of T3 @ 120 gm/day per children
- The T2 showed that 07 children were recovered except 03 children those were anaemic.
- The maximum (195.4 %) percent increase were found in Ku. Kritika followed by Ku. Pari (158.6%) while the minimum (3.4%) percent increase was found in Master Ravindra.

Table 5. Impact of bio fortified wheat and soybean porridge on height and weight of malnourished children

S. No.	Children	Age (Year)	Height (cm)					Weight (Kg)				
			Base Data	Control (Jan-Feb)	HI 8777 (March-April)	HI 8777 + NRC 127 (May-June)	% Increase	Base Data	Control (Jan-Feb)	HI 8777 (March-April)	HI 8777 + NRC 127 (May-June)	% Increase
1	Hansraj	2	76.0	76.1	77.0	78.5	3.3	8.0	8.0 MAM	8.4 (N)	8.7 (N)	8.7
2	Pari	1.5	76.0	76.3	77.3	79.0	3.9	8.0	8.0 (N)	8.2 (N)	8.5 (N)	6.3
3	Ritik	5	99.2	99.2	102.0	103.0	3.8	13.5	13.5 (N)	13.6 (N)	14.0 (N)	3.7
4	Ansul	4	90.1	90.1	92.0	93.0	3.2	11.3	11.3 (N)	11.4 (N)	11.7 (N)	3.5
5	Devraj	1.5	72.0	72.1	74.0	75.0	4.2	8.3	8.3 (N)	8.5 (N)	8.8 (N)	6.0
6	Ravindra	1	72.0	72.0	73.2	74.0	2.8	8.0	8.0 (N)	8.2 (N)	8.5 (N)	6.3
7	Divya	3	78.0	78.1	79.0	81.0	3.8	8.7	8.7 (N)	9.0 (N)	9.3 (N)	6.9
8	kritika	4	70.5	70.6	72.0	73.0	3.5	8.2	8.2 (N)	8.2 (N)	8.7 (N)	6.1
9	Shailendra	5	103.0	103.3	105.0	106.5	3.4	13.3	13.3 MAM	14.5 (N)	14.9 (N)	12.0
10	Neha	5	103.0	103.0	104.5	106.0	2.9	12.6	12.6 MAM	13 MAM	14.9 (N)	18.3

MAM - Moderate acute Malnutrition; N- Normal

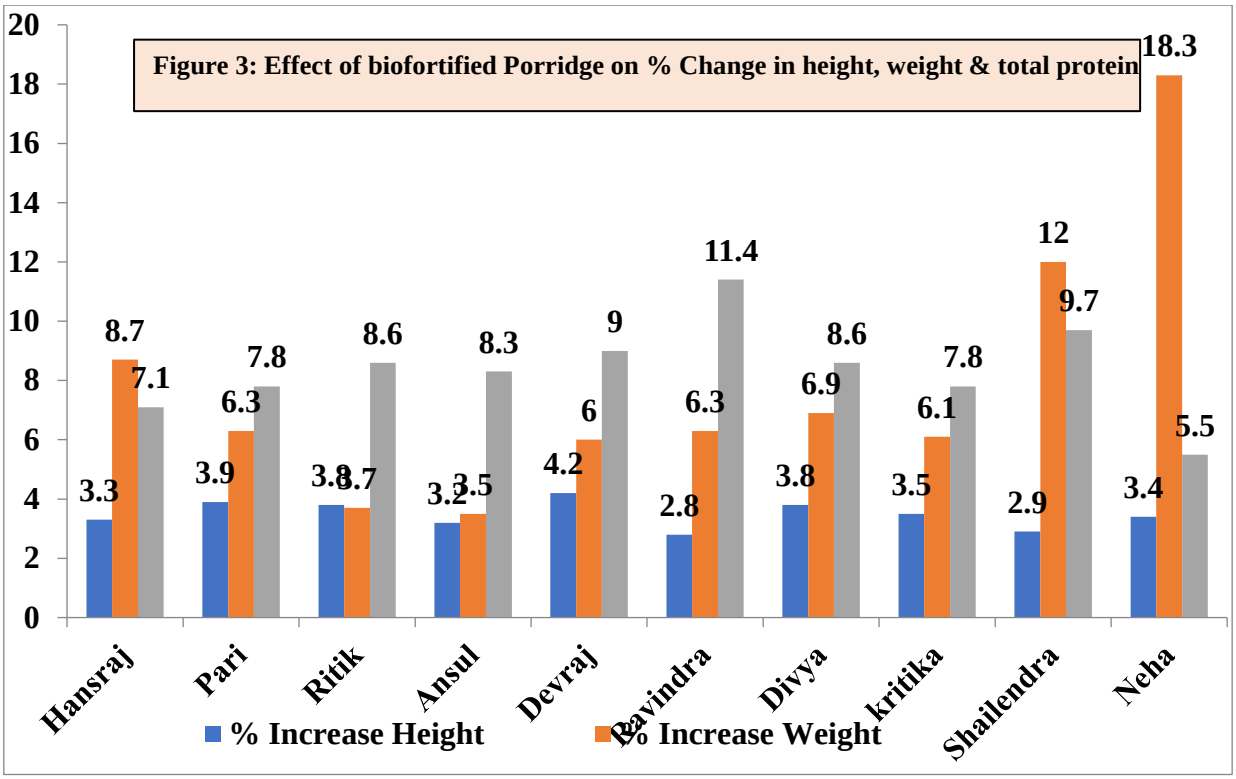


Table 6. Impact of bio fortified wheat and soybean porridge on haemoglobin and protein of malnourished children

S. No.	Children	Age (Year)	Haemoglobin					Total protein				
			Base Data	Control (Jan-Feb)	HI 8777 (March-April)	HI 8777 + NRC 127 (May-June)	% Increase	Base Data	Control (Jan-Feb)	HI 8777 (March-April)	HI 8777 + NRC 127 (May-June)	% Increase
1	Hansraj	2	9.0 (A)	9.2 (A)	11.0 (A)	12.5 (N)	38.9	7.0 (M)	7.1	7.4	7.5	7.1
2	Pari	1.5	8.8 (A)	9.0 (A)	11.3 (A)	11.8 (N)	34.1	6.4 (M)	6.5	6.7	6.9	7.8
3	Ritesh	5	11.3 (A)	11.7 (N)	12.7 (N)	13.0 (N)	15.0	7.0 (M)	7.0	7.5	7.6	8.6
4	Ansul	4	11.6	11.0 (A)	12.0 (N)	12.6 (N)	8.6	7.2 (M)	7.3	7.6	7.8	8.3
5	Devraj	1.5	7.8 (A)	8.0 (SA)	10.0 (A)	11.8 (N)	51.3	6.7 (M)	6.8	7.2	7.3	9.0
6	Ravindra	1	8.7 (A)	9.0 (SA)	10.8 (A)	12.0 (N)	37.9	7.0 (M)	7.2	7.7	7.8	11.4
7	Divya	3	10.0	10.2	11.5	11.8	18.0	7.0	7.0	7.5	7.6	8.6

			(A)	(SA)	(N)	(N)		(M)				
8	kritika	4	9.7 (A)	9.9 (SA)	11.0 (A)	11.5 (N)	18.6	6.4 (M)	6.6	6.8	6.9	7.8
9	Shailendra	5	11.3 (A)	11.3 (A)	12.2 (N)	12.9 (N)	14.2	7.2 (M)	7.3	7.7	7.9	9.7
10	Neha	5	9.5 (A)	9.8 (SA)	10.9 (A)	11.5 (N)	21.1	7.3 (M)	7.4	7.6	7.7	5.5

A - Anemic; SA - Severe Anemic; L - Low; VL - Very Low; N- Normal

1. Range of hemoglobin in children 11.5 to 22.8 g/dl
2. Range of total protein in children 6.4 to 8.2 g/dl

Note: protein is normal in all children

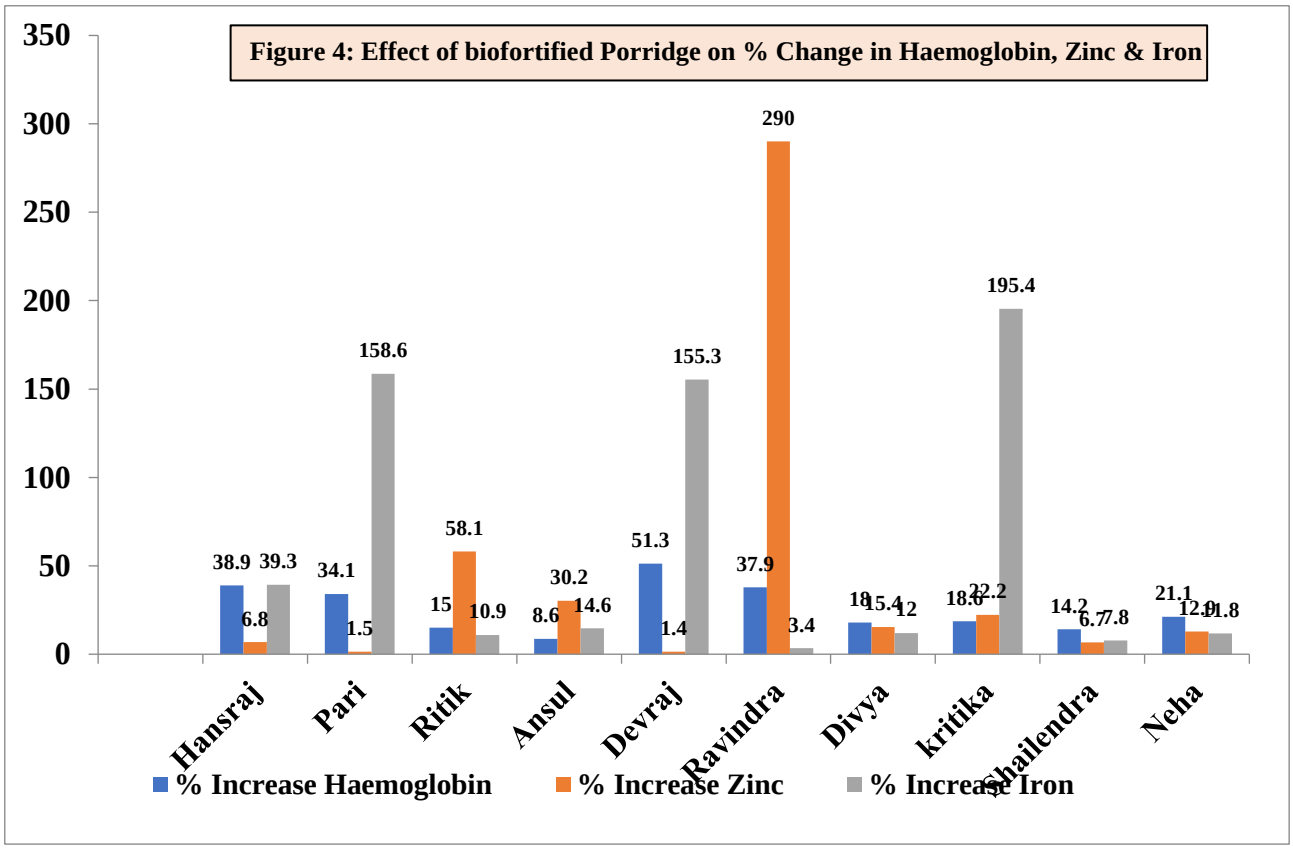


Table 7. Impact of bio fortified wheat and soybean porridge on zinc and iron of malnourished children

S. No	Children	Age (Year)	Zinc					Iron				
			Base Data	Control (Jan-Feb)	HI 8777 (March-April)	HI 8777 + NRC 127 (May-June)	% Increase	Base Data	Control (Jan-Feb)	HI 8777 (March-April)	HI 8777 + NRC 127 (May-June)	% Increase
1	Hansraj	2	88 (M)	89 (N)	93 (N)	94 (N)	6.8	27 (L)	27.3 (N)	32.6 (N)	37.6 (N)	39.3
2	Pari	1.5	72.4 (H)	73.0 (N)	73.2 (N)	73.5 (N)	1.5	14 (VL)	14.2 (VL)	30.0 (L)	36.2 (N)	158.6
3	Ritesh	5	43 (VL)	44 (L)	66 (N)	68 (N)	58.1	46 (N)	46.5 (N)	49.7 (N)	51 (N)	10.9
4	Ansul	4	53 (L)	54 (L)	67 (N)	69 (N)	30.2	41 (N)	42 (N)	45.8 (N)	47 (N)	14.6
5	Devraj	1.5	70.5 (H)	70.7 (N)	70.9 (N)	71.5 (N)	1.4	15 (VL)	15.3 (VL)	21.0 (L)	38.3 (N)	155.3
6	Ravindra	1	20 (VL)	21 (L)	30 (L)	38 (N)	90.0	29 (VL)	29.2 (L)	36.3 (N)	30 (N)	3.4
7	Divya	3	78 (M)	79 (N)	86 (N)	90 (N)	15.4	35 (N)	35.7 (N)	38.0 (N)	39.2 (N)	12.0
8	kritika	4	54 (L)	56 (L)	68 (N)	66 (N)	22.2	13 (VL)	13.5 (VL)	20.5 (L)	38.4 (N)	195.4
9	Shailendra	5	105 (M)	106 (N)	109 (N)	112 (N)	6.7	64 (N)	64.3 (N)	67.8 (N)	69 (N)	7.8
10	Neha	5	62 (L)	63 (L)	67 (N)	70 (N)	12.9	34 (N)	34.4 (N)	37.0 (N)	38 (N)	11.8

L - Low; M - Medium; VL - Very Low; N- Normal

1. Range of Zinc in children 65 to 118 µ/dl
2. Range of Iron in children 1 year children is 35 to 155 and 2 to 12 year children 22 to 135

CONCLUSION

- It concluded that, the bio-fortified varieties may be prove as a miracle for the malnourished women, children & adolescent girls to the eradication of malnutrition of rural peoples.
- The bio fortified of wheat varieties HI 8777 and Soybean varieties NRC 127 may became a good source of nutrition to fulfill the human requirement of protein, iron, zinc, minerals, vitamins, energy etc.
- The all respondents were almost became anaemic free and gains appreciable height & weight.
- If the country will go to focus on bio fortified varieties of various crops in daily intake of the rural livelihood peoples then malnutrition can be easily removed from the society and help to build up healthy India.

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