POLICY BRIEF 3

Agricultural Interventions to Address Nutritional Challenges in India

Anil Kumar, Ananta Sarkar, Praveen Jakhar and A. K. Panda

The farmers and agricultural scientists together with enabling government policies have made India self sufficient in food production and the granaries are now brimming with food grains. However, malnutrition continues to an area of concern and presents a formidable challenge towards holistic development of the country. The recent National Family Health Survey (NFHS-5, 2019-21) highlights the continuing problem of malnutrition among women and children in the country. In India, 35.5% of children, below the age of five are stunted, 19.3% are wasted, 32.1% are underweight and 67.1% are anaemic. In case of adolescent girls, 40% are anaemic and in case of boys, 18% are anaemic (World Bank, 2019). In case of women, 15.2% of women (reproductive age) were overweight, 17.6% were underweight and 65.9% women were anaemic (UNICEF, 2019). Despite village level implementation of a number of Govt. schemes, malnutrition and micronutrient deficiencies are increasing day by day. To address this, nutritional supplementation is done through different modes like commercial fortification, medical supplementation, dietary diversification and bio-fortification.

Analysis of data from NFHS-5 indicate that although the percent of children (6-23 months) receiving adequate diet has increased and percentage of stunted, wasted and underweight children (under 5 years) have reduced a little bit but the percentage of anaemic children (6-59 months) has increased on a much higher side during 2015-21. The percentage of both underweight men and women are gradually decreasing over years and reached to about 19% of adult (age 15-49 years) women who were underweight (BMI < 18.5 kg/m^2) as compared to 16 percent adult men in India during 2019-21 but the percentages of anaemic adults (both men and women) have increased during the period. In spite of several programmes in the country a large section of population specially children and women are still suffering from undernutrition. Traditionally agricultural interventions have focused on increasing food production and rising incomes to reduce malnutrition, hunger and poverty. Although this remains part of the long term strategy, it is now recognized that higher levels of production and income alone have limited impact on improving nutrition. A comprehensive approach is necessary to optimize contribution of agriculture to good nutrition though nutri-sensitive interventions.

Further, agriculture and nutrition are intricately linked and, the outcome of one directly influences the outcomes of the other. Child undernutrition can be addressed through nutrition specific interventions which takes care of the immediate determinants of fetal and child nutrition. Women farmers are important stakeholders in agriculture who can address the challenges of both the agricultural development as well as reducing malnutrition. Therefore, strategic and farm women inclusive interventions must figure in the large-scale nutrition programme.

Endeavours of ICAR-CIWA

To combat malnutrition, a number of research studies have been undertaken by ICAR-CIWA and AICRP on Women in Agriculture for establishing the agri-nutrition linkage and changing the food habit in rural areas through balanced diet utilising locally grown crops. During Xth plan period a project on "*Sustainable Approaches for Nutritional Security*" was carried out in which Nutri-gardens were promoted and assessed for the nutrition status of farm families.

During XIth plan period, project on "*Nutritional Security and Health Promotion of Farm Families*" was effected to address the micronutrient deficiencies in operational villages. The institute has also accomplished an exploratory Inter-Institutional study on nutritional status in Nabarangpur district of Odisha during 2016-19 and it was observed that need based interventions are necessary for improving nutritional status of rural families.

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- The Institute and its AICRP Centres have developed large number of nutri-products for addressing the problem of farm women. For anemia, 24 *lehyams*/ formulations were developed using 65 underutilized region specific green leafy vegetables. Eighteen nos. of dietary products with low Glycemic Index were also developed by AICRP (WIA) centres.
- A total of 362 foods from different food groups having low Glycemic Index (GI) for addressing non-communicable diseases such as diabetes has been documented and a database on low glycemic index foods for the management of diabetes was prepared by ICAR-CIWA.
- The Institute along with its AICRP (WIA) Centre UAS, Bangalore commercialized two technologies for management malnutrition among farm women. The High Fibre Multigrain Mix was developed for management of over nutrition/obesity. This product was effective in significant reduction in total serum cholesterol, triglyceride, LDL and HDL. Another product, Nutri-dense *Laddu* (*Poustik Laddu*) was developed with a focus on management of risk of under nutrition and very helpful in significant increase in haemoglobin level.

Table 1. Nutritional status of children in States & India (percent)

		(6-23 months)		(Under 5 years)								(6-59 months)	
		Receiving adequate diet		Stunted		Wasted		Severely Wasted		Underweight		Anaemic	
	State	NFHS4	NFHS5	NFHS4	NFHS5	NFHS4	NFHS5	NFHS4	NFHS5	NFHS4	NFHS5	NFHS4	NFHS5
1	Jammu & Kashmir	23.5	13.6	27.4	26.9	12.2	19.0	5.6	9.7	16.6	21.0	53.8	72.7
2	Himachal Pradesh	10.9	19.0	26.3	30.8	13.7	17.4	3.9	6.9	21.2	25.5	53.7	55.4
3	Punjab	5.9	11.9	25.7	24.5	15.6	10.6	5.6	3.7	21.6	16.9	56.6	71.1
4	Chandigarh	0.0	19.0	28.7	25.3	10.9	8.4	3.9	2.3	24.5	20.6	73.1	54.6
5	Uttarakhand	8.5	12.5	33.5	27.0	19.5	13.2	9.0	4.7	26.6	21.0	59.8	58.8
6	Haryana	7.5	11.8	34.0	27.5	21.2	11.5	9.0	4.4	29.4	21.5	71.7	70.4
7	NCT Delhi	5.2	16.8	31.9	30.9	15.9	11.2	4.6	4.9	27.0	21.8	59.7	69.2
8	Rajasthan	3.4	8.3	39.1	31.8	23.0	16.8	8.6	7.6	36.7	27.6	60.3	71.5
9	Uttar Pradesh	5.3	6.1	46.3	39.7	17.9	17.3	6.0	7.3	39.5	32.1	63.2	66.4
10	Bihar	7.5	10.9	48.3	42.9	20.8	22.9	7.0	8.8	43.9	41.0	63.5	69.4
11	Sikkim	23.1	24.7	29.6	22.3	14.2	13.7	5.9	6.6	14.2	13.1	55.1	56.4
12	Arunachal Pradesh	14.0	22.0	29.4	28.0	17.3	13.1	8.0	6.5	19.4	15.4	54.2	56.6
13	Nagaland	18.8	14.5	28.6	32.7	11.3	19.1	4.2	7.9	16.7	26.9	26.4	42.7
14	Manipur	18.8	19.6	28.9	23.4	6.8	9.9	2.2	3.4	13.8	13.3	23.9	42.8
15	Mizoram	14.5	13.4	28.1	28.9	6.1	9.8	2.3	4.9	12.0	12.7	19.3	46.4
16	Tripura	5.9	13.5	24.3	32.3	16.8	18.2	6.3	7.3	24.1	25.6	48.3	64.3
17	Meghalaya	23.5	29.8	43.8	46.5	15.3	12.1	6.5	4.7	28.9	26.6	48.0	45.1
18	Assam	8.9	8.0	36.4	35.3	17.0	21.7	6.2	9.1	29.8	32.8	35.7	68.4
19	West Bengal	19.6	23.4	32.5	33.8	20.3	20.3	6.5	7.1	31.6	32.2	54.2	69.0
20	Jharkhand	7.2	10.5	45.3	39.6	29.0	22.4	11.4	9.1	47.8	39.4	69.9	67.5
21	Odisha	8.5	20.4	34.1	31.0	20.4	18.1	6.4	6.1	34.4	29.7	44.6	64.2
22	Chhattisgarh	10.9	9.3	37.6	34.6	23.1	18.9	8.4	7.5	37.7	31.3	41.6	67.2
23	Madhya Pradesh	6.6	9.2	42.0	35.7	25.8	19.0	9.2	6.5	42.8	33.0	68.9	72.7
24	Gujarat	5.2	5.9	38.5	39.0	26.4	25.1	9.5	10.6	39.3	39.7	62.6	79.7
26	Dadra NHDD	2.1	10.2	37.2	39.4	26.7	21.6	11.5	4.3	35.8	38.7	82.0	75.8
27	Maharashtra	6.5	9.0	34.4	35.2	25.6	25.6	9.4	10.9	36.0	36.1	53.8	68.9
28	Andhra Pradesh	7.6	9.3	31.4	31.2	17.2	16.1	4.5	6.0	31.9	29.6	58.6	63.2
29	Karnataka	8.2	12.8	36.2	35.4	26.1	19.5	10.5	8.4	35.2	32.9	60.9	65.5
30	Goa	10.4	21.5	20.1	25.8	21.9	19.1	9.5	7.5	23.8	24.0	48.3	53.2
31	Lakshadweep	15.9	19.0	26.8	32.0	13.7	17.4	2.9	8.7	23.6	25.8	53.6	43.1
32	Kerala	21.4	23.5	19.7	23.4	15.7	15.8	6.5	5.8	16.1	19.7	35.7	39.4
33	Tamil nadu	30.7	16.3	27.1	25.0	19.7	14.6	7.9	5.5	23.8	22.0	50.7	57.4
34	Puducherry	31.1	22.9	23.7	20.0	23.6	12.4	7.8	3.7	22.0	15.3	44.9	64.0
35	A&N Islands	14.2	19.5	23.3	22.5	18.9	16.0	7.5	4.8	21.6	23.7	49.0	40.0
36	Telangana	10.1	9.2	28.0	33.1	18.1	21.7	4.8	8.5	28.4	31.8	60.7	70.0
37	Ladakh	23.9	24.0	30.9	30.5	9.3	17.5	5.1	9.1	18.7	20.4	91.4	92.5
	India	9.6	11.3	38.4	35.5	21.0	19.3	7.5	7.7	35.8	32.1	58.6	67.1

NFHS-4: 2015-16; NFHS-5: 2019-21

Table 2. Status of nutrition among adults in States & India (percent)

		BMI below normal				Anaemic			
		Women		Men		Women		Men	
	State	NFHS4	NFHS5	NFHS4	NFHS5	NFHS4	NFHS5	NFHS4	NFHS5
1	Jammu & Kashmir	12.2	5.2	11.5	4.3	48.9	65.9	20.4	36.7
2	Himachal Pradesh	16.2	13.9	18.0	11.8	53.5	53.0	20.1	18.6
3	Punjab	11.7	12.7	10.9	12.5	53.5	58.7	25.9	22.6
4	Chandigarh	13.3	13.0	21.7	15.1	75.9	60.3	19.3	8.1
5	Uttarakhand	18.4	13.9	16.1	16.2	45.2	42.6	15.6	15.1
6	Haryana	15.8	15.1	11.3	14.5	62.7	60.4	20.9	18.9
7	NCT Delhi	14.9	10.0	17.7	9.1	54.3	49.9	21.7	12.6
8	Rajasthan	27.0	19.6	22.7	14.0	46.8	54.4	17.2	23.2
9	Uttar Pradesh	25.3	19.0	25.9	17.9	52.4	50.4	23.7	21.5
10	Bihar	30.4	25.6	25.4	21.5	60.3	63.5	32.3	29.5
11	Sikkim	6.4	5.8	2.4	4.9	34.9	42.1	15.8	18.7
12	Arunachal Pradesh	8.5	5.7	8.3	4.9	43.2	40.3	18.7	21.4
13	Nagaland	12.3	11.1	11.5	7.5	27.9	28.9	11.7	10.0
14	Manipur	8.8	7.2	11.1	8.0	26.4	29.4	9.5	6.0
15	Mizoram	8.4	5.3	7.3	5.1	24.8	34.8	12.1	15.6
16	Tripura	18.9	16.2	15.7	12.4	54.5	67.2	24.7	36.9
17	Meghalaya	12.1	10.8	11.6	9.0	56.2	53.8	32.4	25.5
18	Assam	25.7	17.6	20.7	13.4	46.0	65.9	25.4	36.0
19	West Bengal	21.3	14.8	19.9	15.1	62.5	71.4	30.3	38.9
20	Jharkhand	31.5	26.2	23.8	17.1	65.2	65.3	29.8	29.6
21	Odisha	26.5	20.8	19.5	15.3	51.0	64.3	28.3	28.5
22	Chhattisgarh	26.7	23.1	24.1	17.4	47.0	60.8	22.1	27.0
23	Madhya Pradesh	28.4	23.0	28.4	20.8	52.5	54.7	25.5	22.4
24	Gujarat	27.2	25.2	24.7	20.9	54.9	65.0	21.6	26.6
26	Dadra NHDD	23.4	25.1	16.3	18.3	72.9	62.5	27.6	24.6
27	Maharashtra	23.5	20.8	19.1	16.2	48.0	54.2	17.7	21.9
28	Andhra Pradesh	17.6	14.8	14.8	16.5	60.0	58.8	27.0	16.2
29	Karnataka	20.7	17.2	16.5	14.3	44.8	47.8	18.3	19.6
30	Goa	14.7	13.8	10.8	12.5	31.3	39.0	11.0	12.0
31	Lakshadweep	13.5	8.0	8.2	5.5	46.0	25.8	11.4	5.6
32	Kerala	9.7	10.1	8.5	10.0	34.3	36.3	11.8	17.8
33	Tamil nadu	14.6	12.6	12.4	12.1	55.0	53.4	20.4	15.2
34	Puducherry	11.3	9.0	10.2	11.1	52.4	55.1	15.9	19.5
35	A&N Islands	13.1	9.4	8.7	4.0	65.7	57.5	30.8	16.1
36	Telangana	22.9	18.8	21.5	16.2	56.6	57.6	15.3	15.3
37	Ladakh	10.5	4.4	11.2	2.1	78.4	92.8	41.2	75.6
	India	**22.9**	**18.7**	**20.2**	**16.2**	**53.1**	**57.0**	**22.7**	**25.0**

NFHS-4: 2015-16; NFHS-5: 2019-21

Agricultural interventions to augment household nutrition

I. Homestead Nutrition Garden and Assorted Seeds Packet

Homestead nutrition garden has proved to be an important source for providing income by the sale of surplus produce which lands in the hands of women who spends it judiciously in purchase of other food products or to meet the other urgent family needs. A periodic supply of packet of assorted seeds of seasonal vegetables at least thrice a year can ensure constant supply of nutrient rich seasonal vegetables to the household throughout the year. It will address the dilemma of *problem of plenty but not a drop to drink* wherein the seeds required by women may be available in abundant quantity in the market but not in the small quantities of 5 to 7 varieties of the vegetables she requires to plant in her backyard garden. Herein, the services of the huge network of frontline workers of *anganwadi* workers, *ASHA Didis*, *Mahila Shakti Kendra*, Community Food and Nutrition Extension Units (CFNEUs) of Food and Nutrition Board may be utilized who are already imparting nutrition education to rural women, to also distribute the packet of assorted seeds of seasonal vegetables just required to meet the family needs through backyard kitechen garden. The quality seeds of seasonal vegetables can be procured from the vast network of Krishi Vigyan Kendra located in every district of the country besides the specialized agricultural research institutes of the government of India and the state agricultural universities.

II. Vertical Garden

Vertical gardening is a method of growing plants in an upright form by making use of stakes, cages, bamboo, plastic pots and other vertical supports. The purpose of such intensively grown garden is to harvest the maximum produce possible from a given space. Roof-top gardening and vertical gardens have until now been looked as urban intervention to supply fresh green vegetables to the households. Vertical farming systems can also be applied to multilevel buildings, public housing etc. With this method we can utilize the roof top species optimally and more efficiently. This technology has made rapid strides in the last few years and found acceptability in urban environment. A low cost set-up of vertical gardens can also be provided to the households who do not own land in rural areas together with regular supply of seeds of assorted seasonal vegetables to ensure steady supply of vegetables to such households to address the challenges of nutritional deficiency.

III. Backyard Poultry

Providing eggs in Mid-Day meal scheme has been taken up in many states, while in some of them it has been mired in the controversy of vegetarian and non-vegetarian issue. The importance of eggs in providing quality protein is beyond doubt, those who have no issue in taking it must be provided by the state. At present, 12 states serve eggs in mid-day meal in schools varying from 1 to 5 eggs per week A large number of dual purpose backyard poultry birds have been developed like, *Giriraja*, *Vanaraja*, *Gramapriya*, CARI *Nirbhik*, CARI *Sonali*, etc. which can be reared for both eggs and meat purpose. Such birds perform well under zero-input backyard poultry production system and have wide acceptability by rural women. Wherever such birds have been introduced, they have increased the household egg consumption besides supplementing income through sale of birds. However, the regular supply of chicks to women willing to rear these birds is the biggest bottleneck in growing this sector. Herein, the government must come in and make available the improved breed of chicks within the sphere of mobility of rural women. Each district should have a hatchery and rearing unit of these birds to make them available on demand.

IV. Mushroom

Mushrooms are of excellent food value as they provide a full protein food containing all the twenty one amino acids besides containing useful amount of fats, vitamins and minerals. Mushroom protein being easily digestible (70-90%) is considered superior to vegetable proteins. Two essential amino acids lysine and tryptophan are rich in mushrooms which are not found in cereals. Being low in caloric value (300 – 390 Kcal/100 g dry wt), low fat and high protein, they are considered as 'delight of diabetic patients'. Folic acid and Vitamin B_{12} which are normally absent in vegetarian foods are present in mushrooms (3g fresh mushroom can supply 1ug vitamin B_{12}, recommended for daily uptake). Paddy straw mushroom cultivation as an income generating activity is most preferred by farm women.

V. Bio Fortification with Micronutrients

Micronutrient malnutrition or hidden hunger is very common among women and pre-school children caused mainly by low dietary intake of micronutrients, especially Zn and Fe. Bio fortification is the process of increasing the bio available concentrations of essential elements in edible portions of crop plants or animal tissues through genetic selection or supplementation may be the solution to malnutrition or hidden hunger mitigation. A high proportion of marginal and landless farm families suffer from malnutrition because of too little income and affordability to purchase quality foods. For example, the pulses supplying dietary protein are too expensive for the poor. Here comes the role of bio fortified food crops which are enriched in vital micronutrients. These foods essentially provide the critical nutrients such as iron and zinc besides supplementing protein and essential vitamins.

VI. Awareness & Capacity Building

Strengthening nutrition awareness with integration of health, nutrition, sanitation concerns are must to fight malnutrition at household level. Awareness on various aspects need to be covered which include conservation of nutrients, better cooking and dietary habits, inclusion of super foods, nutri sensitive gardening, complementary foods, *nutri* -

thali concept, de-worming, management of nutritional anaemia, importance of breast feeding, sanitation and hygiene, locally available health foods, eat right movement etc. are some governmental schemes launched for the upliftment of vulnerable groups etc. Capacity building programmes for farm women on following domain can help households to combat malnutrition:

- Preparation of health foods using locally available nutri-dense foods.
- Post harvest management and value addition.
- Preparation of low cost nutritious supplements for pregnant and lactating ladies
- Revival and popularization of traditional healthy food preparations and concepts

Initiatives undertaken by ICAR-CIWA: Nutrition Smart Villages

PMs overarching scheme for holistic nourishment of women was launched by the Government of India in December 2017 with objectives to reduce stunting and underweight in children each by 6% @2% per annum besides others in a time frame of 3 years by 2022. To fight malnutrition and to strengthen the Poshan Abhiyan, a new programme entitled "*Nutrition Smart Villages: An Innovative Model for Strengthening Poshan Abhiyan*" was launched during November 2021 which aims to develop 75 Nutrition Smart villages across India through the network of AICRP-WIA at 13 centres in 12 states of India, besides the coordinating institute (ICAR-CIWA) located at Bhubaneswar. The programme is being implemented with the following objectives *i.e.,* promoting nutritional awareness, behavioral changes in adopted villages, harnessing local recipes for combating malnutrition and implementing nutri-sensitive agriculture through homestead agriculture and nutri-garden.

Methodology:

Intensive awareness campaign and field activities should be undertaken for focusing on the concept of nutri-village/ nutri-food/ nutri-diet/ *nutri-thali* etc. for strengthening the *Poshan Abhiyan.* Awareness among the women farmers should also be created about their legal rights in all walks of life. The products/ tools/ technologies developed by AICRP centres should be evaluated through multi-location trials.

a. Assessment of NUTRITIONAL status of farm families in selected villages

Baseline survey and nutritional status of farm families will be assessed in each of the five villages at 13 centres in 12 states of India using standardized tools and techniques.

b. Establishing nutri-gardens in villages and schools

Nutri-gardens will be initiated in villages and schools by involving farm women, SHGs, School children and teachers, through standard nutri-garden models (eg: Dr. Swaminathan model) to achieve food and nutritional security at household and community level.

c. Promoting mixed cropping systems/ crop diversification/ IFS incorporating minor millets

In selected villages mixed cropping system or IFS models will be encouraged through family farming approach to achieve food and nutritional security and to address nutritional problems, especially micronutrient deficiency.

d. Nutritional awareness and education through ICT

Based on nutritional survey in selected villages, nutritional literacy programmes will be organized through capacity building / skill based training / ICTs and the impact will be assessed on nutritional literacy of farm families.

Way Forward

Agriculture is the major source of livelihood for the small and marginal farmers of rural pockets of India. Therefore, agriculture is the right tool to overcome the curse of malnutrition in India. To obliterate and combat malnutrition issues, agriculture is the key sector to maximize its impact on nutrition. Agricultural initiatives should primarily aim to work in harmony with other allied sectors to produce enough quality food to sustainably feed the ever-growing human population. This needs a holistic approach which can be achieved through enhancing crop and animal productivity, reducing food losses and waste, improving storage facilities, dietary diversification, and promoting foods that include vitamins and micronutrients by encouraging women's participation in intra-household food security. Meeting the future food demand will not only require shifts in behaviour as well as shift towards more sophisticated technologies, information and knowledge management systems for farming systems and whole value chains, but also policy intervention. Agriculture must change to meet the rising demand, to contribute more effectively to the reduction of poverty and malnutrition, and to become ecologically more sustainable. Integrating agriculture and nutrition programs can be a better means to combat malnutrition in India.

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ICAR - CENTRAL INSTITUTE FOR WOMEN IN AGRICULTURE

(भारतीय कृषि अनुसंधान परिषद) (Indian Council of Agricultural Research)

Bhubaneswar- 751 003, Odisha