NUTRITION SENSITIVE AGRICULTURE AND NUTRITION LITERACY

भाकृअनुप
ICAR

भाकृअनुप–कृषि प्रोद्यौगिकी अनुप्रयोग अनुसंधान संस्थान
ICAR-Agricultural Technology Application Research Institute
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ICAR-Agricultural Technology Application Research Institute
(Division of Agricultural Extension)
Jabalpur, Madhya Pradesh

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FOREWORD

Food and nutrition are human's fundamental needs and access is even more imperative for a common person for overall growth and development. In India poverty, hunger and malnutrition are the main problems in some section of population. Green revolution reduced poverty and hunger and food production is increased to five fold. But still 250 million people live in poverty and about 47 million children below five year are malnourished. Food security and improved nutrition would be the major issues to the growing population. In this context food systems must deliver more nutritious food to populations. This can be possible by strengthening of value chains for micronutrient-rich foods and food availability at affordable price to consumers. Nutrition Sensitive Agriculture (NSA) places nutritionally rich food, dietary diversity and food fortification at household level in the centre for holistic nutritional security of the communities. NSA ensures food production in adequate quantity and quality to meet the dietary requirements of populations in a sustainable manner. The approach also stresses the importance and social significance of the food and agricultural sector for supporting rural livelihood.

For making agriculture pro-nutrition, a food-based approach is required to promote nutrition literacy and fine tuning of the production plan in fields, farms as well as in backyards through nutritional gardens for overcoming malnutrition and micronutrient deficiencies at household level. Multiple benefits derived from enjoying a variety of foods, recognizing the nutritional value of food for supporting rural livelihoods to make the global food system better equipped to produce good nutritional outcomes.

The initiative taken by ATARI, Jabalpur in organizing International Workshop on **"Nutrition Sensitive Agriculture and Nutrition Literacy"** is very timely and appreciable. This workshop provided a professional forum for multi-stakeholder deliberations on the role and readiness of agricultural systems in promoting nutrition sensitive agriculture. I commend the efforts of associated scientists from ATARI for preparing this useful document for students and scientists.

(T. MOHAPATRA)

Dated the 23rd August, 2019
New Delhi

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PREFACE

Nutritional security is a prime concern of our country today, as the number of people suffering from lifestyle related diseases and specific nutrient deficiencies are on the steep rise. Forty four percent of children under the age of five are underweight, while 72 percent of infants have anaemia. India needs a lot more to be done to tackle the menace of malnutrition and agriculture could be more nutri-sensitive for plugging the gaps in the nutrition-led government schemes.

The debates aimed solely at increasing production, raising income and increasing energy intake hardly help in ensuring household nutritional security as effectively as programmes that also recognize the importance of diet quality and diversity. Achieving success in nutritional security as well as food security also needs narrowing the "nutrition gap" which requires increasing availability and access to the food necessary for a healthy diet and ensuring the intake of those food at recommended quantity. The structure and policies of institutions that contribute and influence agricultural development needs to be reshaped with the values, behaviors, gender relations, and social norms of the societies in which they are situated.

To tackle the nutritional sensitivity problem, a new initiative has been taken by the ICAR-ATARI, Jabalpur in collaboration with Women and Children Development Department, (WCD), Govt. of Madhya Pradesh to establish "Nutri-SMART Villages" (NSV) at block level to showcase the technology & methodology suited for nutritional security at the grass-root level and increasing availability of healthy foods and wide scale nutritional literacy to overcome challenges of nutritional imbalances.

The International Workshop was focused mainly on Innovative practices to promote nutrition-sensitive agriculture and food security; capacity development of women institutions, enabling suitable governance and policy, nutrition literacy, improving maternal and child nutrition. The event set a new milestone of convergence for sustaining nutritional efforts by the ICAR and WCD, GoMP. This publication **'Nutrition Sensitive Agriculture and Nutritional Literacy'** will prove to be a ready reckoner for the planners, policy makers, researcher and field functionaries in accelerating the nutritional security efforts.

Dated : 23.08.2019

(A. K. SINGH)

CONTENTS

Introduction

Nutrition is alike other human's fundamental needs, and access is even more imperative for a child. Regular access to food drives progress. A nation-wide Rapid Survey on Children (RSOC), in association with UNICEF showed a marked improvement in nutritional inadequacy. Also, it is imperative, that along with government's initiatives, support from civil society can add increased access to nutrition, as well as counseling of nutrition choices to these category of children. A combination of aforementioned civil society activities, the public sector and sponsorship through those who donate online, investors, corporate, and volunteers can successfully eradicate the hunger problem, and permanently end the scourge of nutritional sensitivity-based infant deaths.

Nutrition Sensitive Agriculture (NSA) places nutritionally rich food, dietary diversity and food fortification at household level in the centre for holistic nutritional security of the communities. NSA ensures food production in adequate quantity and quality to meet the dietary requirements of populations in a sustainable manner. The approach also stresses the importance and social significance of the food and agricultural sector for supporting rural livelihoods. The overall objective of NSA is to make the food system better equipped to produce good nutritional outcomes. The International workshop intends to provide a common platform for professionals from various countries involved in different sub sectors of nutrition – from production, processing, packaging, marketing to consumption to understand the linkages with nutrition.

India's nutritional sensitivity problem is said to be even worse than Burkina Faso, Haiti, Bangladesh or North Korea. It is not just related to calorie intake, but on India's dependence on a carbohydrate-based diet with low protein and fat content. Besides inadequate sanitation, this triggers increase in infection-borne deficiencies in nutrients. There is indeed a lot of work to be done in this domain, through sincere efforts in nutrition security, as well as creating infrastructure for better nutrition for children.

The theme of Workshop was divided in six thematic areas to cover the topic of nutrition sensitive agriculture and nutrition literacy. Following themes were identified for intensive exchange of knowledge, good practices and governance related issues to evolve a systematic policy framework for eradication of the nutritional sensitivity.

- Innovative practices to promote nutrition-sensitive agriculture and food security
- Capacity development of women institutions/ SHGs/FIGs/FPOs
- Value chain and village trade related issues
- Enabling suitable governance and policy
- Nutrition literacy
- Improving maternal and child nutrition

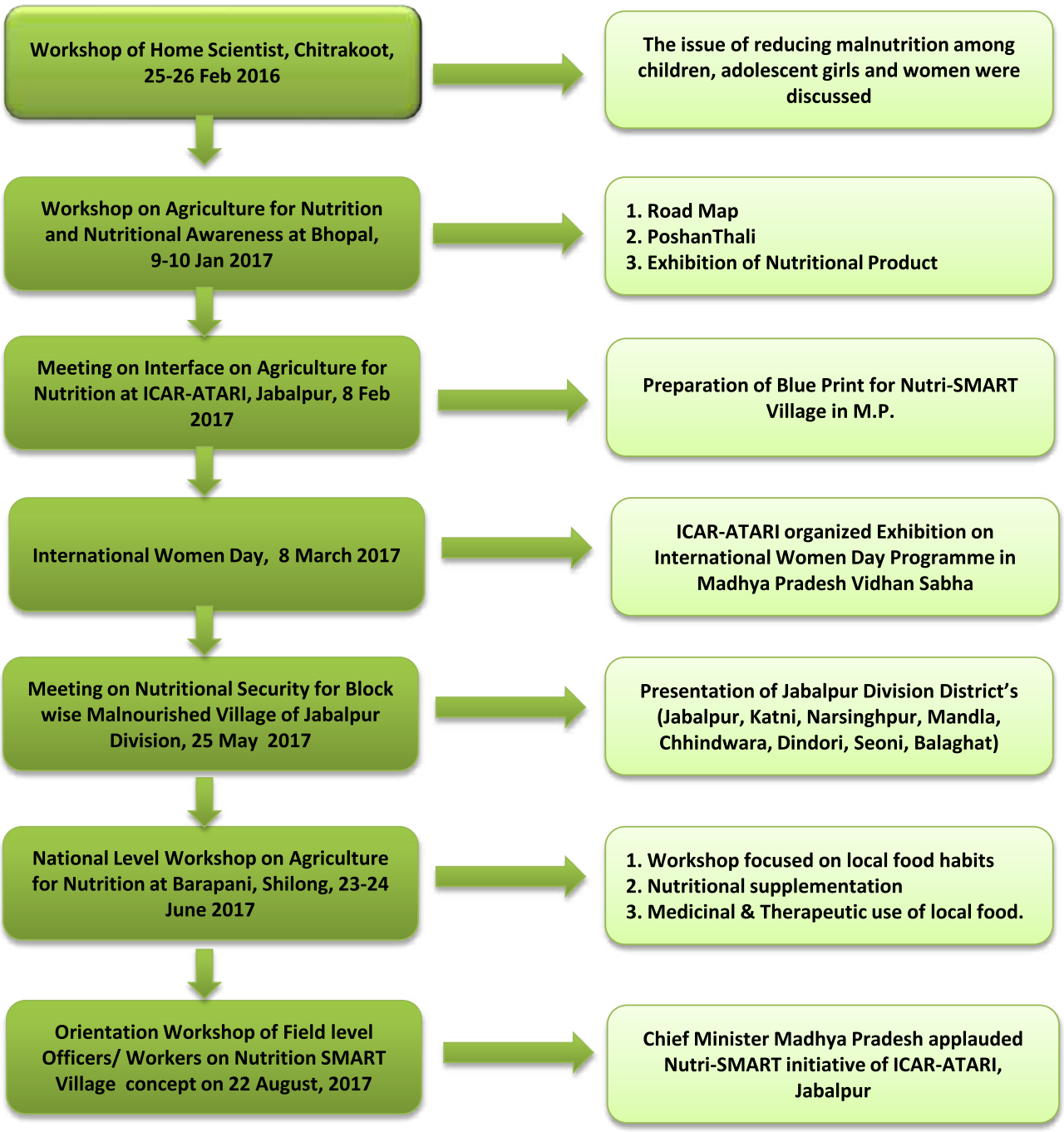
In the workshop, a total of 512 delegates participated from 23 organizations including 12 international organizations.

Genesis of Nutri-SMART Village

To make the initiated efforts sustainable, there is a need to have working framework with following features -

- Knowledge enhancement and maximizing the impact of food and agricultural systems by creating and promoting relevant databases and critical reports, as well as identifying and addressing knowledge gaps.
- Efficient food and agricultural systems governance for nutrition and improved nutrition literacy.
- Capacity strengthening for formulation and implementation of policies and programmes towards improving nutritional status.

- Developing roadmap/action plan to strengthen nutrition sensitive agriculture
- The workshop planned to provide a workable academic and policy model of convergence among academia, executives, NGOs/ practitioners, policy makers and political leadership.
- The well knit and action oriented workshop facilitated to provide a professional platform for knowledge sharing, knowledge accumulation, knowledge conceptualization and ultimately knowledge operationalization on nutritional aspects vis-à-vis nutrition sensitive agriculture.
- The ensuing International Workshop, **"Nutrition Sensitive Agriculture and Nutrition Literacy"** has provided a professional forum for multi-stakeholder deliberations on the role and readiness of agricultural systems in promoting nutrition-sensitive women-led agriculture.



SECTION-I

INNOVATIVE PRACTICES TO PROMOTE NUTRITION SENSITIVE AGRICULTURE AND FOOD SECURITY

IRRI Innovations in Rice-Based Agri-Food Systems for Addressing Food and Nutritional Security

Nafees Meah
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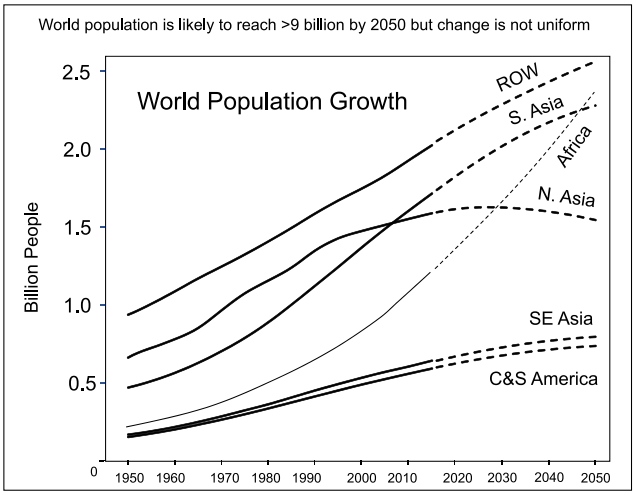
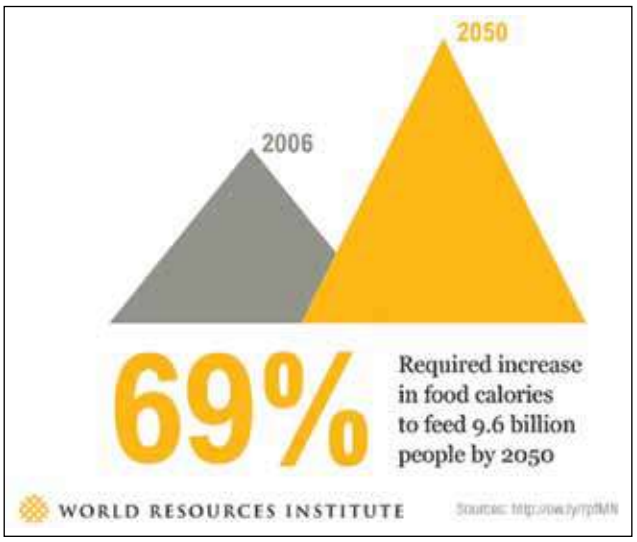
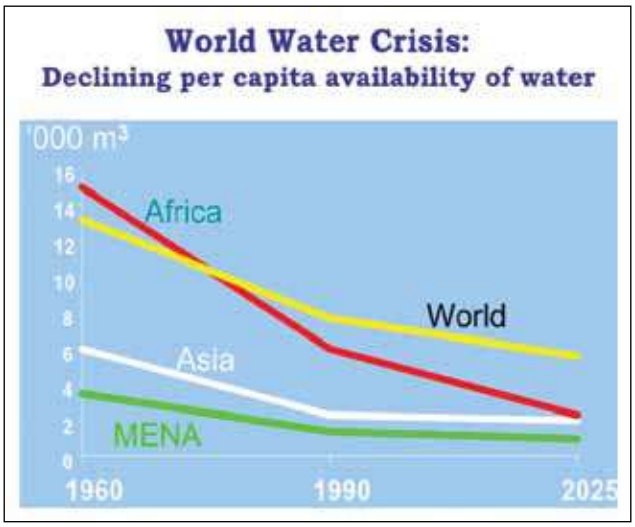
The world faces multiple complex challenges viz., continued population growth; scarcity of land, water and labour for feeding around 9 billion people; rapid urbanization; and climate change, etc. Despite technological advances and continued evolution of the roles of the public and private sectors, such complex challenges will rarely be solved by simple solutions.

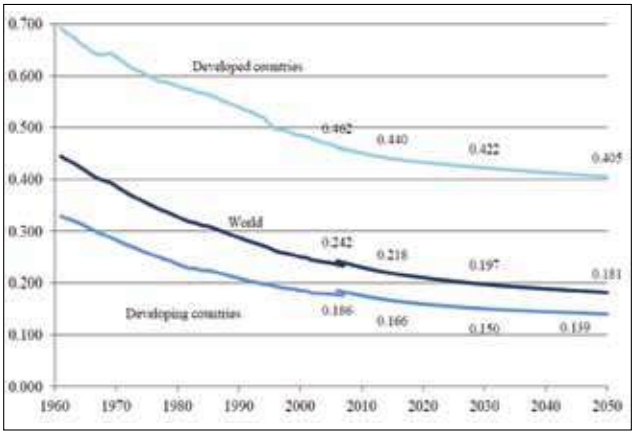


World population is likely to reach >9 billion by 2050 but change is not uniform



Source: FAO World Agriculture towards 2030 – 2050 2012 revision





Agricultural land per capita is rapidly diminishing

In South Asia, rice is the main staple food for hundreds of millions of people and IRRI is working with partners to develop innovations in rice-based agri-food systems (e.g. high Zinc and high Iron rice varieties; low Glycaemic Index (GI) rice and high Vitamin A rice varieties; mixed farming systems e.g. rice-fish systems) to improve the nutritional quality of the diet of smallholder farmers and their families. IRRI founded in 1960 by the Ford & Rockefeller Foundations & the Philippine Government Member of the Consortium of International Agricultural Research Centers (CGIAR) Autonomous, Non-government, research and development, international status by Treaty.

IRRI's Mission

- Improve livelihoods
- Abolish poverty, hunger and malnutrition
- Protect the health of rice farmers and consumers,
- Protect the environmental sustainability of rice farming
- Promote the empowerment of women
- Support opportunities for youth

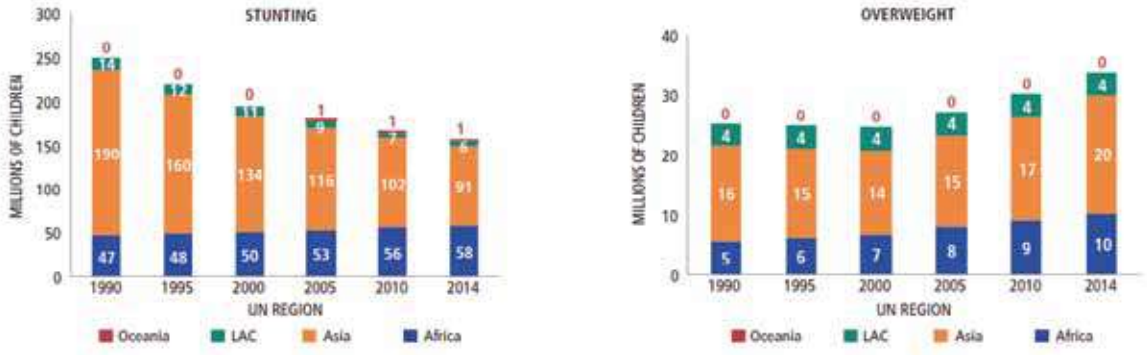
Goals

- Innovation leadership for the global rice sector
- Catalyze impact at scale for people and planet
- Transform rice-based agri-food systems

The rate of improvement in nutritional status has not kept pace with India's significant gains in economic prosperity and agricultural productivity during recent decades. Stunting rates are likely to decline with economic progress, but economic growth cannot, by itself, reduce undernutrition and may contribute to overweight and obesity.

Global Nutrition Report 2016

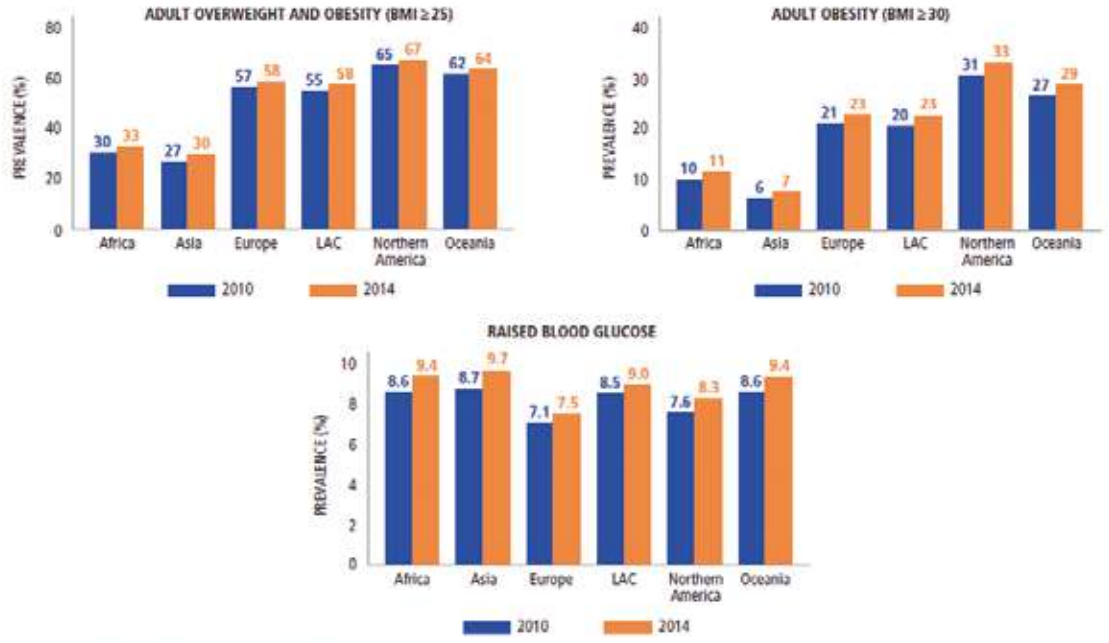
FIGURE 2.1 Number of children under 5 affected by stunting and overweight by region, 1990–2014



Source: Authors, based on data from UNICEF, WHO, and World Bank (2015).

Note: LAC = Latin America and the Caribbean. Europe and Northern America were not included in the overweight figure because of lack of data. Estimates for Asia exclude Japan. Estimates for Oceania exclude Australia and New Zealand.

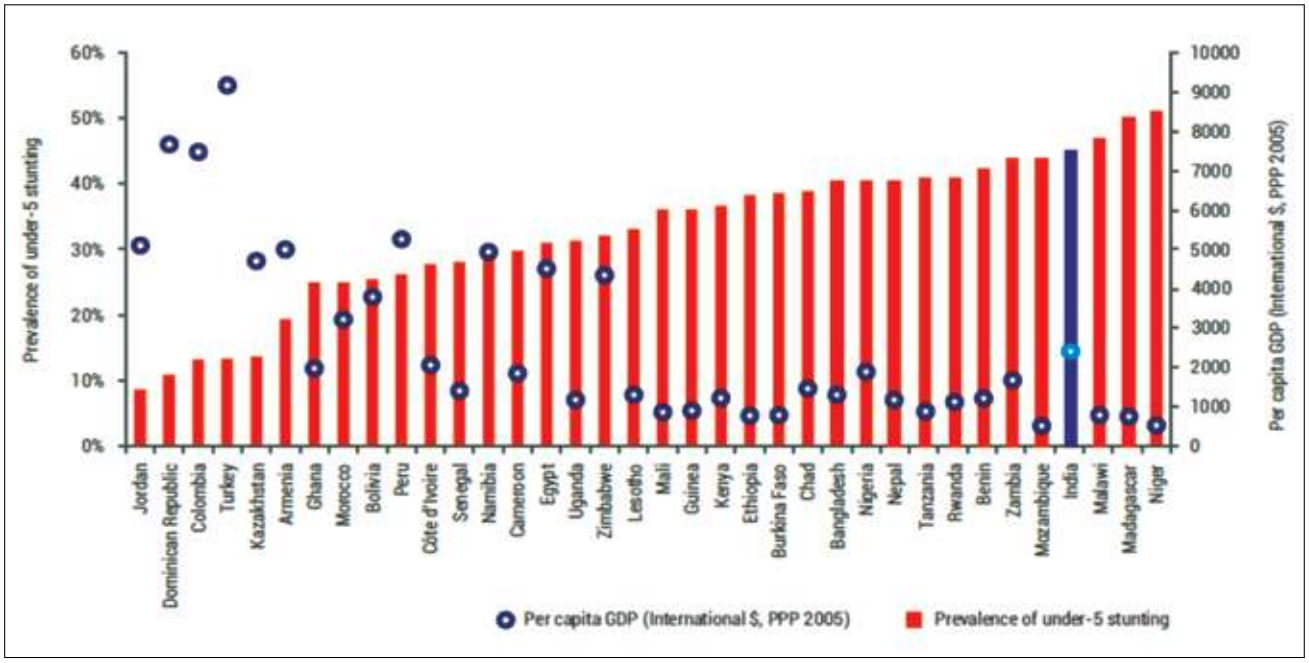
FIGURE 2.2 Adult overweight and obesity, adult obesity, and adult diabetes, by UN region, 2010 and 2014

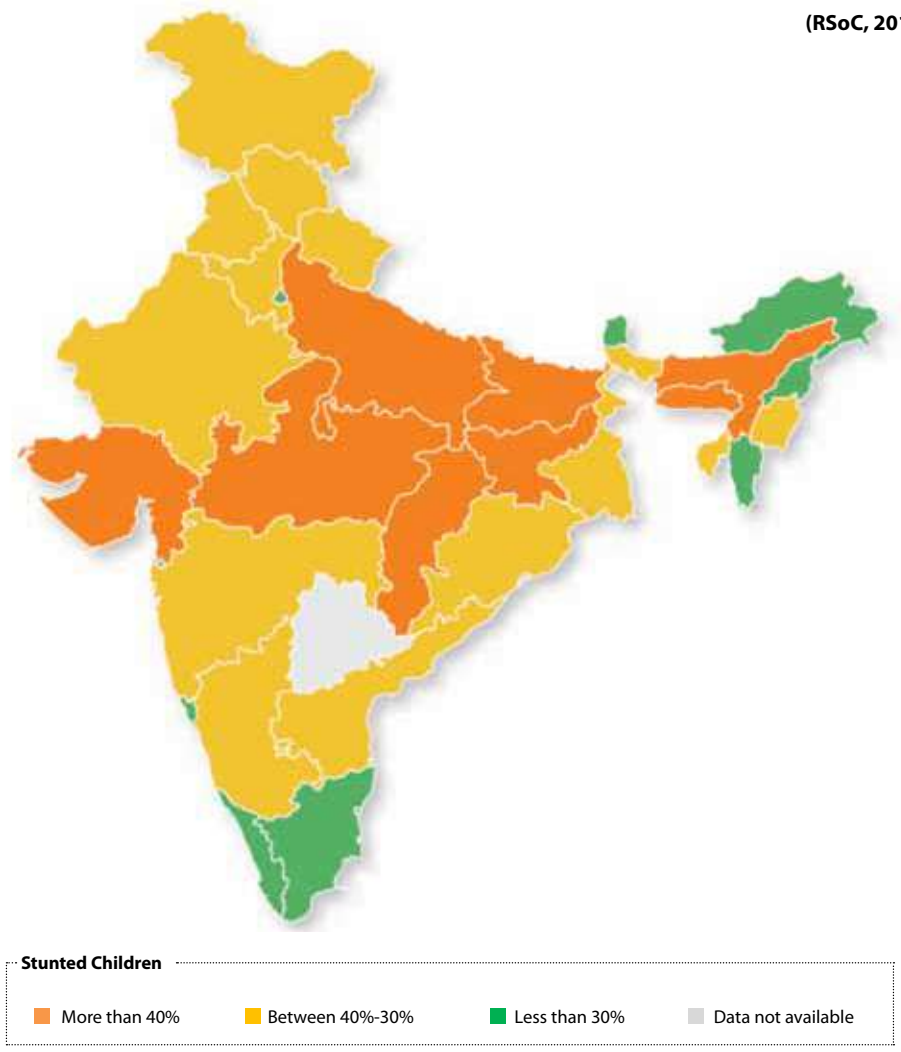


Source: Authors, based on data from WHO (2015a).

Note: Raised blood glucose = fasting glucose ≥7.0 mmol/l (126 mg/dl) or on medication for raised blood glucose or with a history of diagnosis of diabetes. BMI = body mass index; LAC = Latin America and the Caribbean. Number of countries = 190. Prevalence data are age-standardized adjusted estimates (population age 18+ years). Regional estimates are population-weighted means.

Prevalence of under-5 stunting and economic development





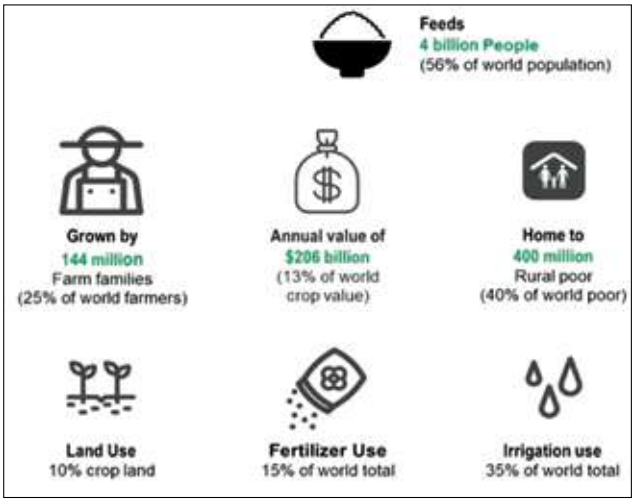
(RSoC, 2014)

States	Numbers in Percentage
Uttar Pradesh	504
Bihar	49.4
Jharkhand	47.4
Chhattisgarh	43.0
Meghalaya	42.9
Gujarat	41.6
Madhya Pradesh	41.5
Assam	40.6
India	38.7
Odisha	38.2
Haryana	36.5
Rajasthan	36.4
Maharashtra	35.4
Andhra Pradesh	35.4
West Bengal	34.7
Karnataka	34.2
Himachal Pradesh	34.2
Uttarakhand	34.0
Manipur	33.2
Jammu & Kashmir	31.7
Tripura	31.0
Punjab	30.5
Delhi	29.1
Nagaland	29.1
Arunachal Pradesh	28.4
Sikkim	28.0
Mizoram	26.9
Tamil Nadu	23.3
Goa	21.3
Kerala	19.4

Nutritional status and progress on reducing stunting vary markedly across India's states indicating that state-specific approaches are necessary to achieve further gains in reducing stunting.

Role of Rice in South Asia

- South Asia is home to 1.7 billion people
- Rice is a strategic commodity as overall economic growth and political stability of the region depend on an adequate, affordable and stable supply of this staple food crop (FAO, 2014)
- Rising populations, increasing economic inequality, land degradation, climate change impacts and water stress means that delivering the SDGs will be a challenge



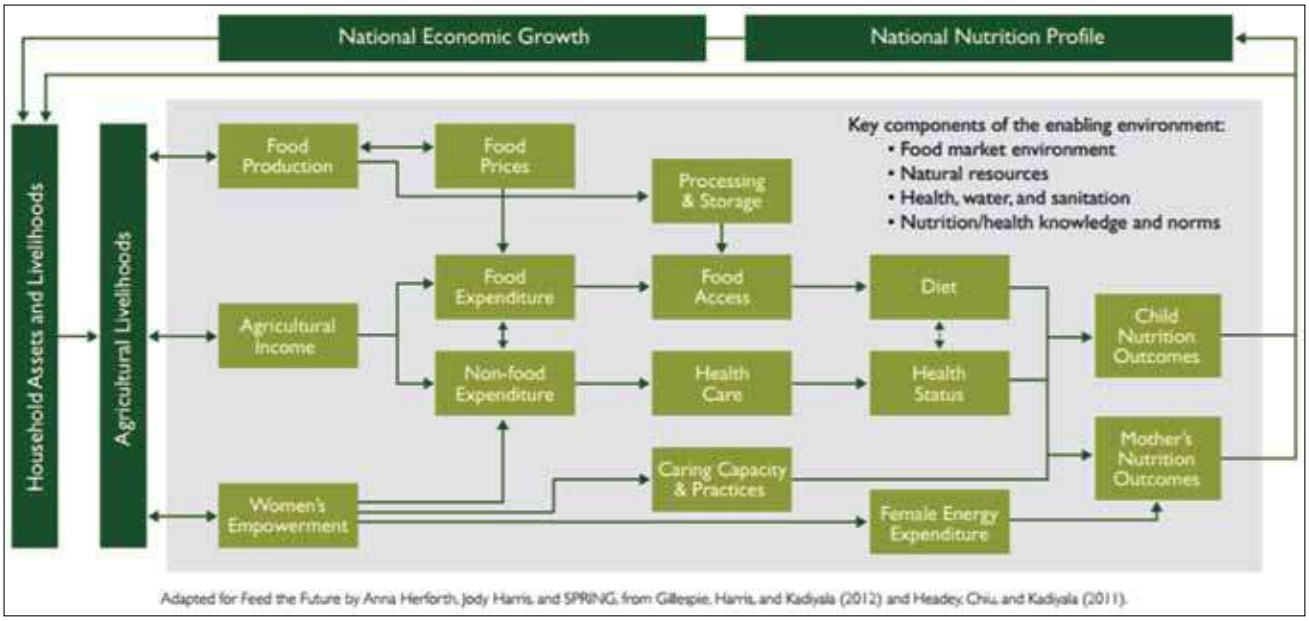
Rice

South Asia has among the highest rice consumption per capita

Country	Population (millions)	GNI per capita, Atlas method (current US$)	Milled rice consumption kg per person per year	Paddy production (million tons)	Paddy Yield (tons/ha)
Afghanistan	32.53[a]	610[a]	17[g]	0.62[b]	2.70[b]
Bangladesh	160.9[a]	1,190[a]	152[d]	51.9[d]	4.60[d]
Bhutan	0.774[a]	2,380[a]	172[g]	0.07[c]	3.37[c]
India	1,311[a]	1,600[a]	66[e]	159[b]	3.59[b]
Nepal	28.51[a]	730[a]	122[f]	4.66[f]	3.20[f]
Pakistan	188.9[a]	1,440[a]	17[g]	9.96[b]	3.75[b]
Sri Lanka	20.96[a]	3,800[a]	103.8[g]	3.45[b]	3.46[b]

Sources: a) http://data.worldbank.org; b) psd online 2016 data, USDA; c) Bhutan RNR Statistics, 2015; d) Bangladesh Bureau of Statistics; e) NSSO, 2014; f) Nepal, MoAD, 2015; g) Rice Almanac, 2013

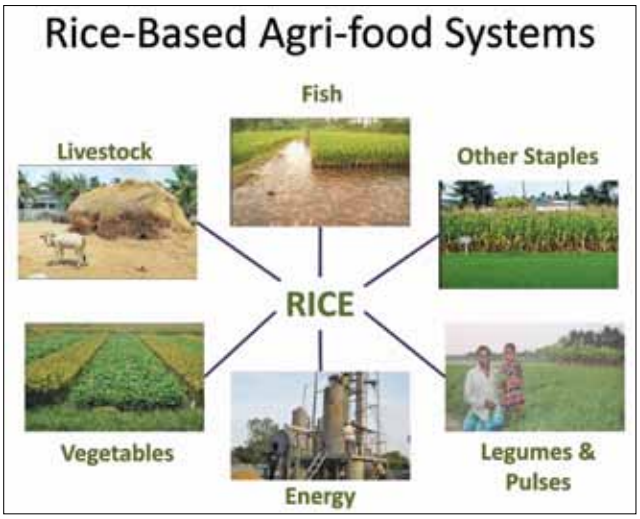
Conceptual Pathways between Agriculture and Nutrition



Adapted for Feed the Future by Anna Herforth, Jody Harris, and SPRING, from Gillespie, Harris, and Kadiyala (2012) and Headey, Chiu, and Kadiyala (2011).

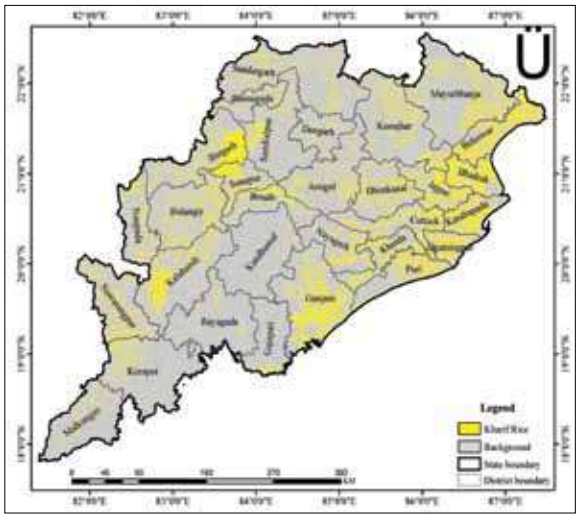
Research & innovation at IRRI to address the global nutrition challenge

- Rice-based agri-food systems to increase dietary diversity
- Increase agricultural productivity
- Increase incomes of small holder farmers
- Empower women farmers
- Healthier rice - biofortification, Low GI

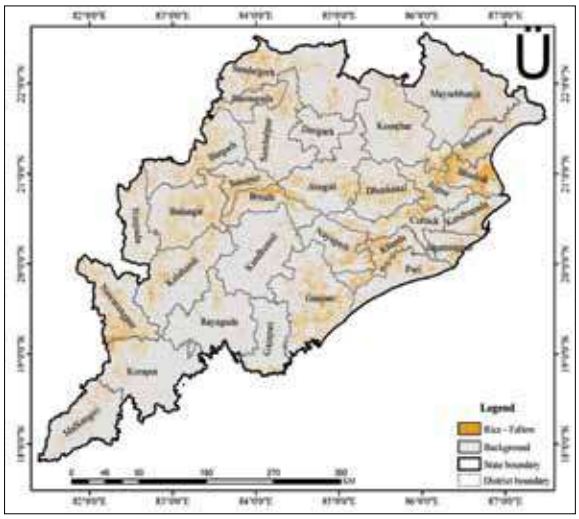


Identification of rice fallow areas using satellite remote sensing & GIS techniques Map A depicts the distribution and extent of rice in Odisha during Kharif season of 2016. Map B illustrates the areas which remains fallow in rabi season of 2016-17 after having rice crop in year 2016

Mapping rice fallows in Odisha



Kharif Rice 2016 Map (A)



Rice-Fallow 2016-17 Map (B)

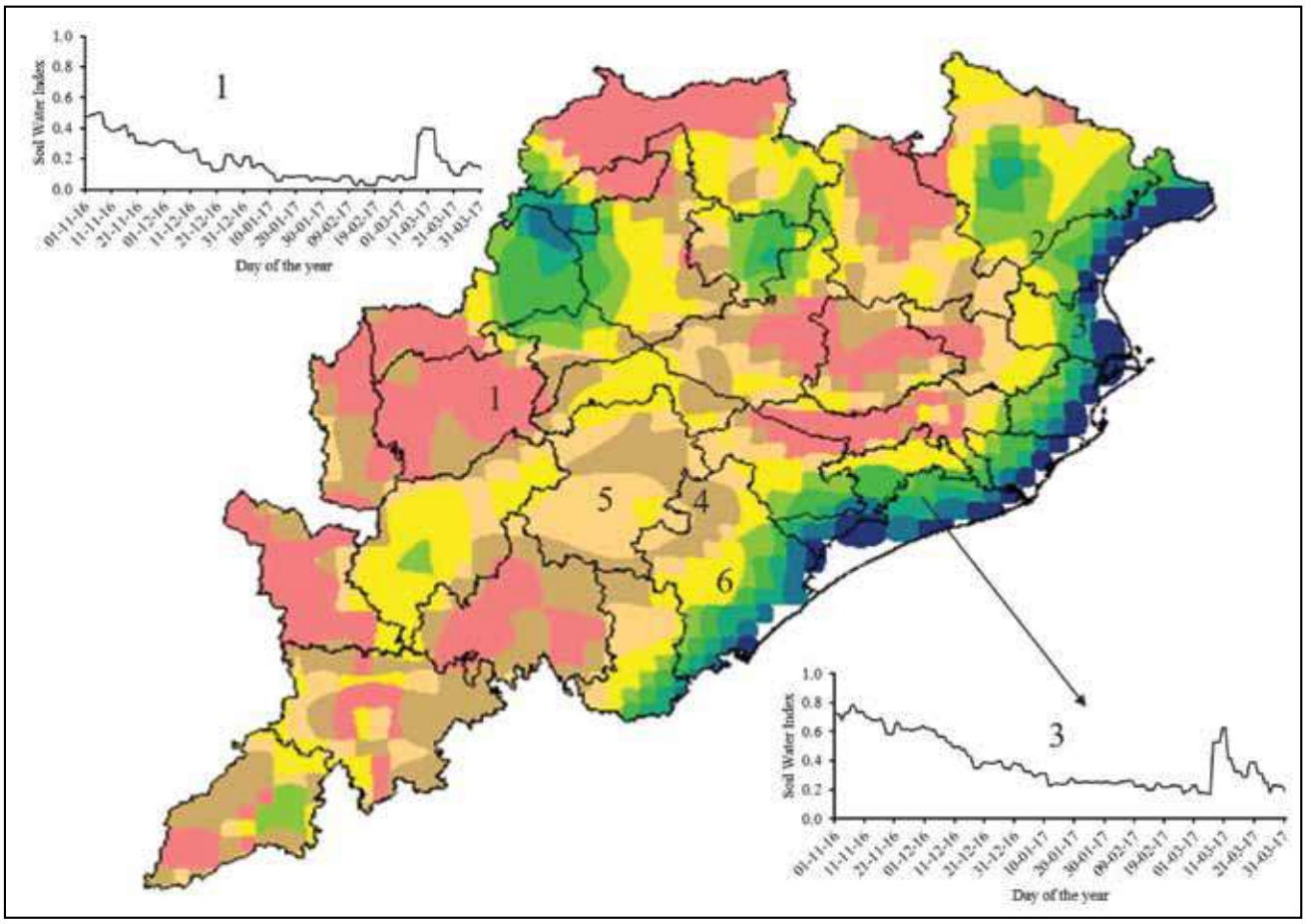
Recommendation domains of improved cropping systems, Stress Tolerant Cultivars and Direct Seeded Rice in Eastern India

- Extrapolation domain analysis (EDA) used for identification of geographical areas that are suitable for the adoption of improved cropping systems.
- During 2016-17, secondary data and remote sensing data were collected to characterize the rice fallows and stress prone areas of ten districts in Odisha.

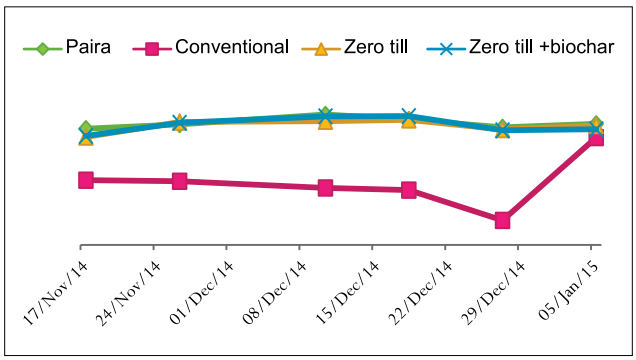
Sustainable diversification and intensification of rice fallows in rainfed drought prone-areas

Planting of medium to short duration rice varieties such as *Sahbhagi dhan* makes it possible to use residual soil moisture for establishment of the following dry season crop.

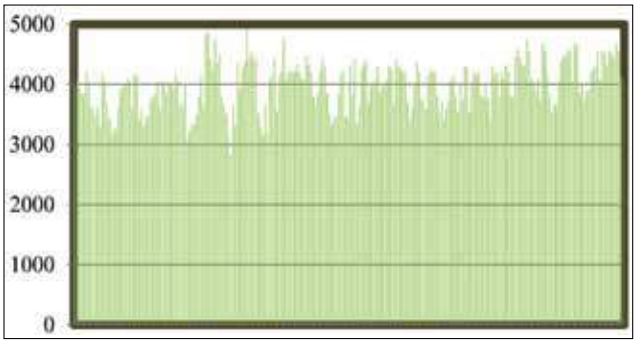
Rainfed rice grain yields kg/ha (cv. *Sahbhagi Dhan)* during the wet season in the fields in Bhagalpur, Banka & Munger districts of Bihar under recommended management.



Spatial variation in soil moisture profiles for period Oct 2016 –Mar 2017



Volumetric soil moisture content in the dry season lathyrus crops under different crop establishment practices



Shahbhagi dhan yield

Minimum = 2824 kg ha^{-1} Maximum = 4934 kg ha^{-1}

Mean = 3992 kg ha^{-1} Std Error = 25.57

Simplified pathway toward better nutrition, livelihoods and women's empowerment in rural households

Nutritional awareness of women

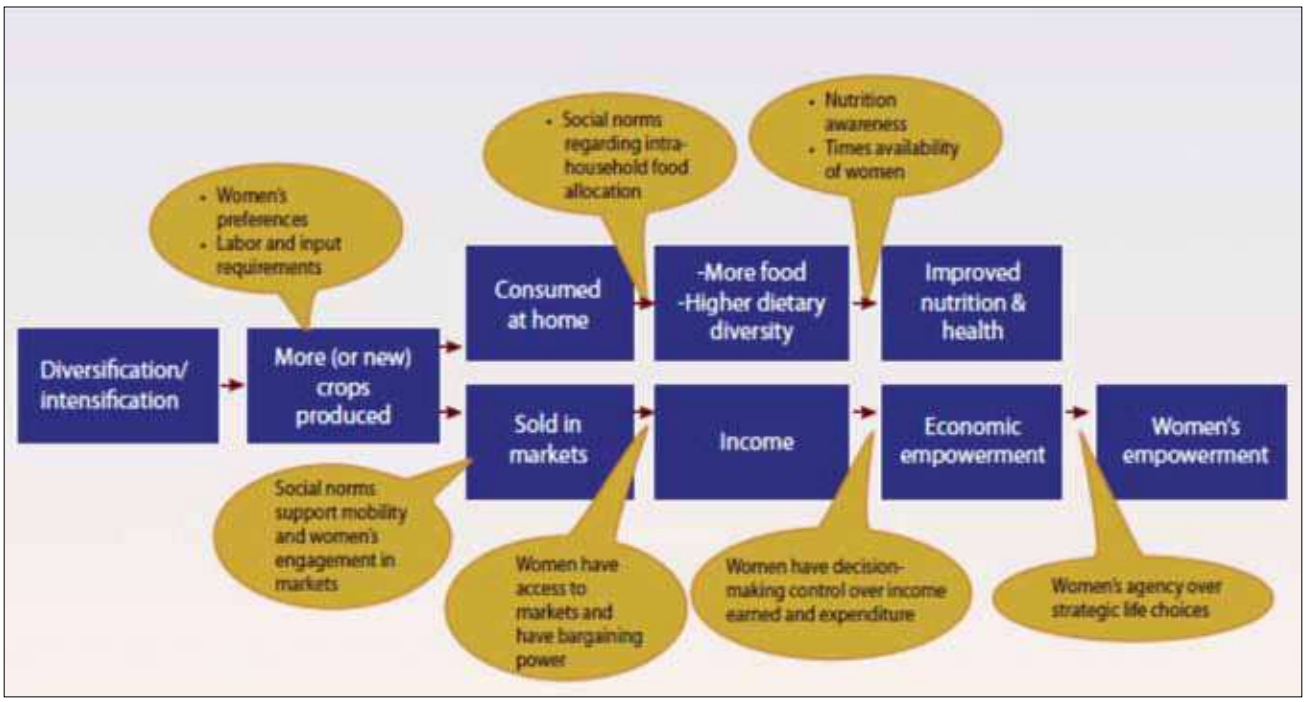
Women have a special role in healthy nutrition of the population. Women's awareness on nutrition not only affects their own health status but also family health status. The public health depends upon women's understanding of healthy nutrition issues. Women, therefore, play a key role in implementing a healthy nutrition policy, both in the family and in society as a whole. Nutritional awareness of women can be increased by

- Knowledge hub on nutrition
- Engaged mothers of primary school children
- Creating awareness of the importance of micronutrients and high-nutrition rice and the benefits of zinc-biofortified rice to the health of children

Biofortification

Biofortification is the idea of breeding crops to increase their nutritional value. This can be done either through conventional selective breeding, or through genetic engineering. Biofortification makes plant foods nutritious as they are growing. It will helpful in :

- Linking agriculture to nutrition
- Bridging nutrition and micronutrient gaps
- Stewardship of new rice varieties to meet international standards and national needs
- Improving health in vulnerable populations



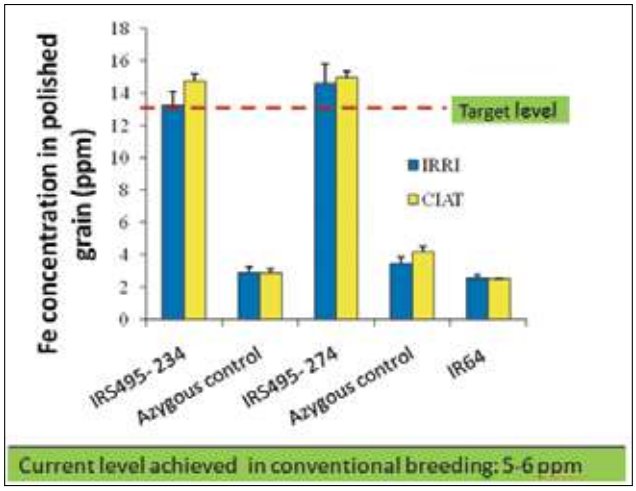
Source: Polder Tidings, Volume 2, Number 1, May 2017

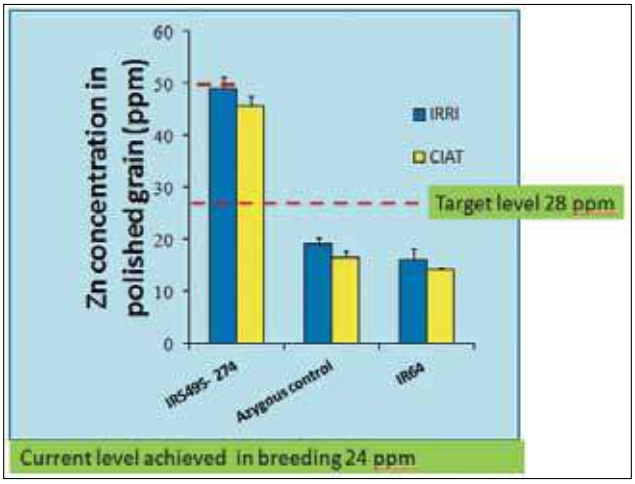
High Iron, High Zinc

Soybean/legume genes to increase iron storage (sink) and rice genes to improve iron loading (source).

Increasing the health potential in rice by lowering glycaemic index response in high yield lines

- Through a Genome Wide Association Study (GWAS) the genetic basis of GI has been fine mapped on chromosome 6 and 7.
- Defined haplotypes distinguishes high to intermediate GI response in the diversity pool

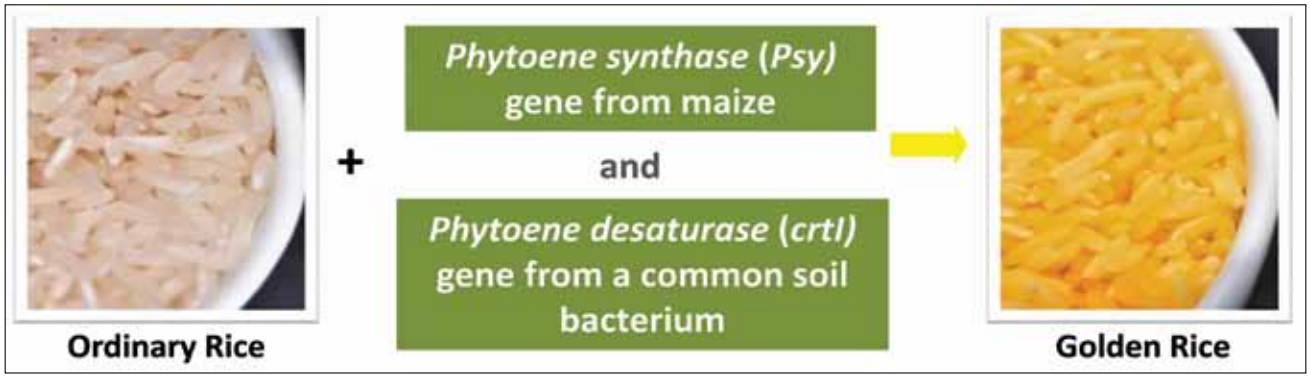


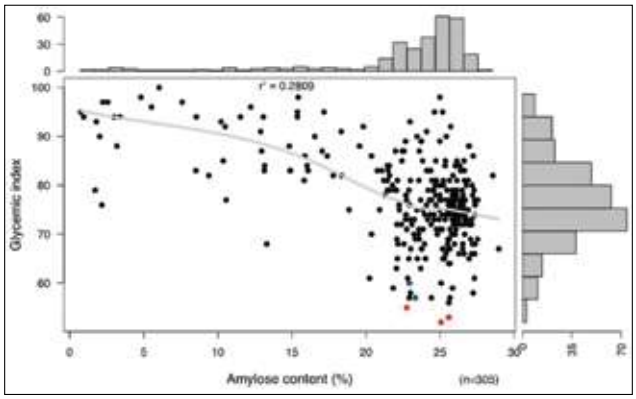


Confined Field Trials in 2011, 2012 and 2013

Golden Rice

A genetically modified rice that produces high amount of beta-carotene in its grains

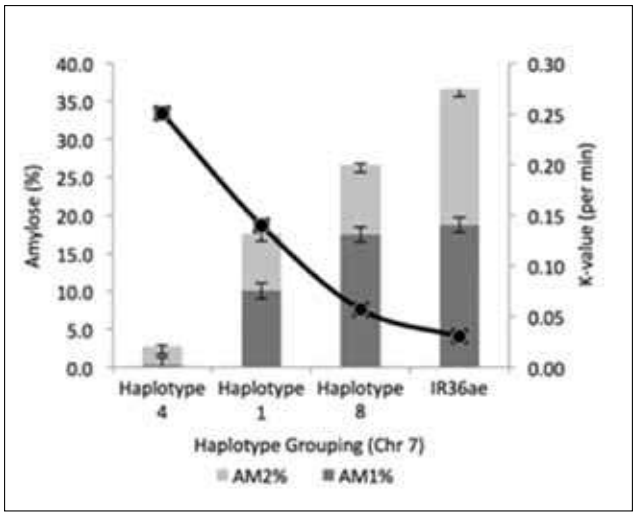


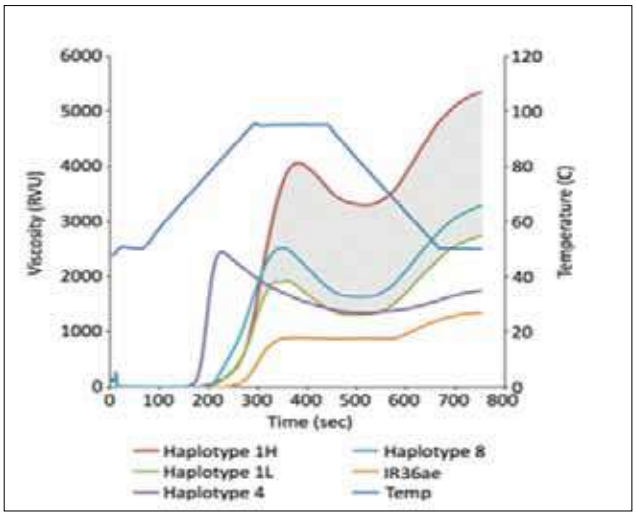


305 diverse samples , $r^2 = 0.28$

Modifying Glycaemic potential of Rice

- Background information and tools to modify glycaemic index and resistant starch content in rice
- Established alternative phenotyping tools to estimate starch structure predictive glycemic index, % amylolysis, rapid digestable carbohydrates and resistant starch in rice core collection.
- Genetic basis of starch structure is established and major haplotypes identified on chromosome 6 and 7.
- Identified rare accessions with lower glycemic index and higher resistant starch in rice pools.





IRRI South Asia Regional Centre, Varanasi

- Grain Quality and Nutrition
- Biofortification
- Heavy metals
- Glycaemic index
- Heirloom rice varieties
- Supporting the modernization of breeding programs and focus on increasing the value of rice
- Value chains and market preferences – research, training and policy issues
- Training and education

References

Ali M A. 2017. Gender - equitable diversification in rice-based systems: Some Observations. The Beginning of Change-with a diverse cropping system in the Coastel Zone of Banladesh. Polder Tidings.Vol 2, Number 1. P11. (https:// cgspace. cgiar.org/ bitstream/ handle/ 10568/ 87981/ Polder% 20Tidings_Volume%203%20 -Newsletter.pdf?sequence=1&isAllowed=y)

http://www.fao.org

https://www.worldbank.org

https://www.unicef.org/

https://www.who.int/

A Smart Food Strategy Towards Nutrition Sensitive Agriculture

Joanna Kane-Potaka
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International Crops Research Institute for the Semi-Arid Trpics (ICRISAT)
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Vision

Our food is 'Smart' - healthy, sustainable on the environment and good for those who produce it.

Problem

The biggest hurdle for smart food being in our diets is the food system is divided. Rice, wheat and maize deliver > 50% of calories and protein consumed globally. About 45% of private sector agriculture research investment only on one crop. There is diversity in diets and healthier diets available but lack of education about them. Diversity on-farm environmentally sustainable production/foods and change in relative contribution of crops to our diet (by calorie intake).

Smart Food

Food Security

↓

+ Nutrition Security

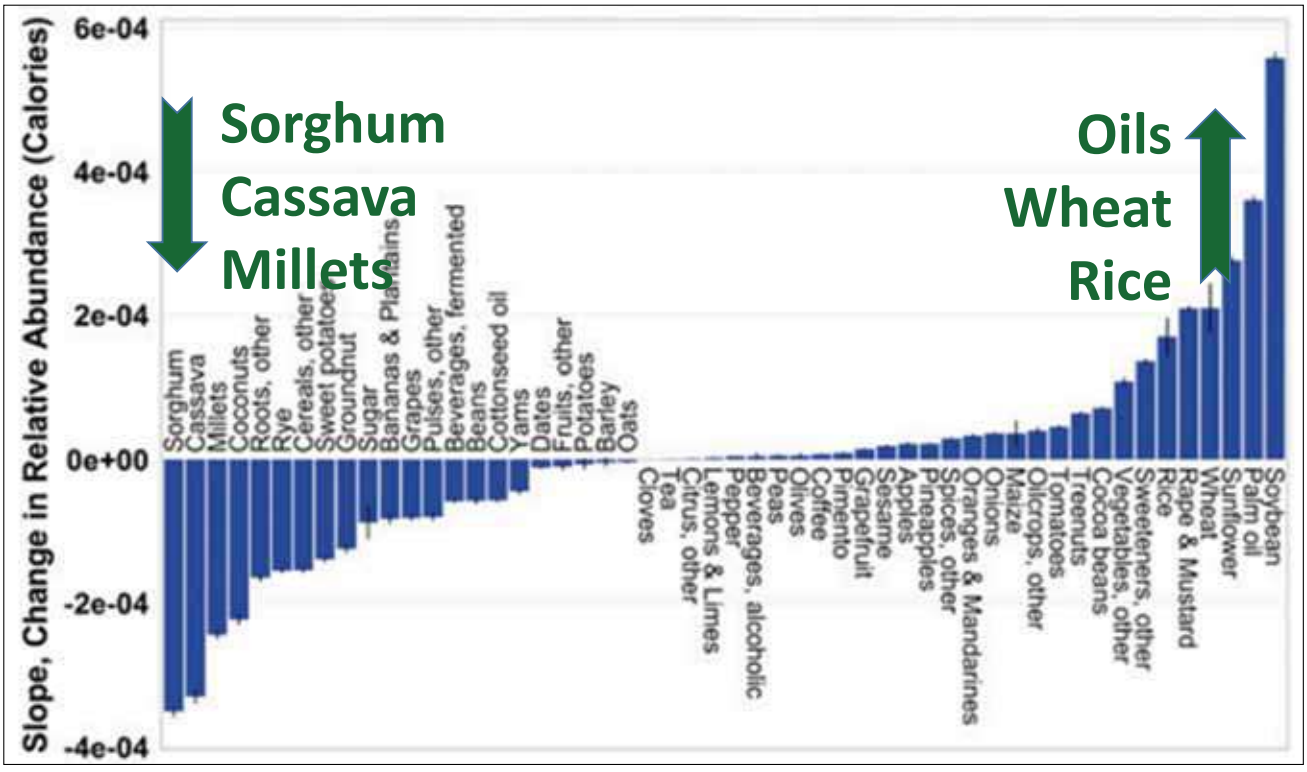
↓

Sustainable Diets

↓

Good for You, the planet, the farmer

Change in relative contribution of crops to our Diet (by calories intake)



(Khoury et al, Proceedings of the National Academy of Sciences of the USA)…

Solution

The Food System Divide

Objective: Mainstreaming some Smart Food as a staple.

This is **Nutrition** sensitive, **Environment** sensitive and **Farmer** sensitive Agriculture

Tackle some of the biggest challenges in unison and with major impact:

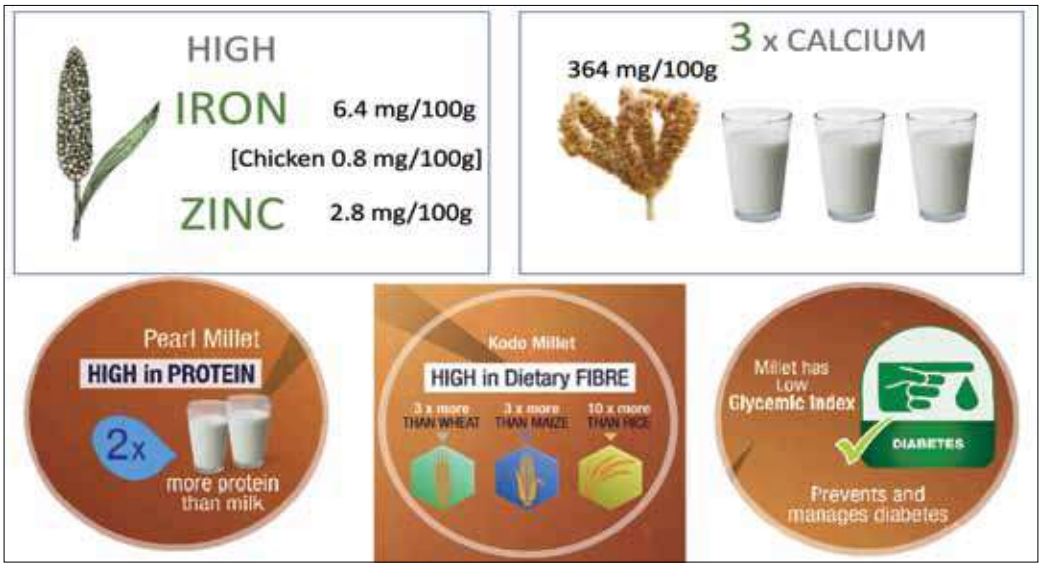
- Malnutrition
- Rural poverty
- Environmental issues

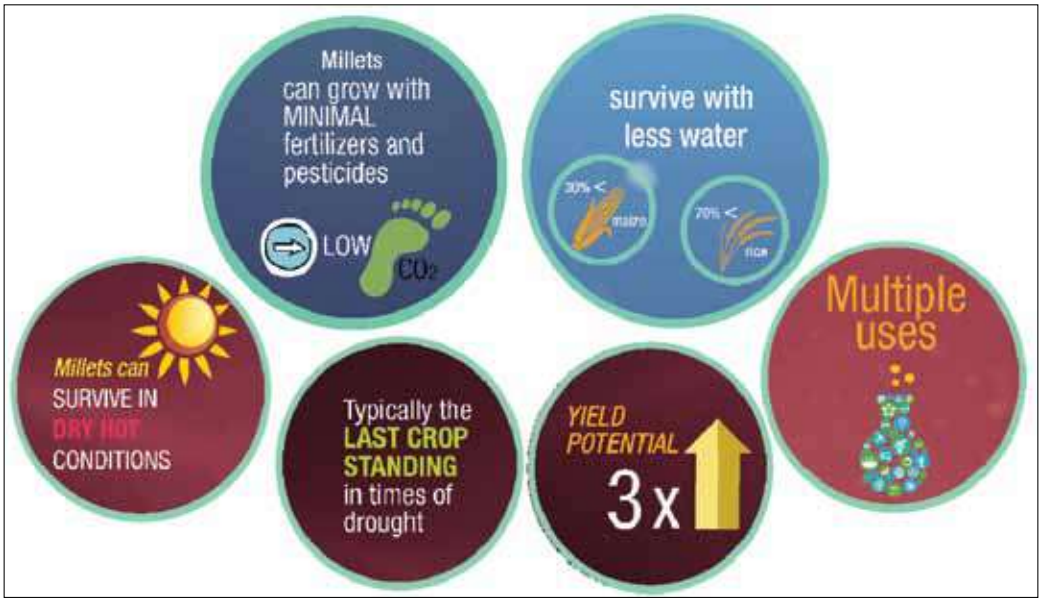
New Approach

- Consumer driven
- Work with the whole value chain and linking back to the farmer
- Rural, Urban and Global

What first?

Millets & Sorghum

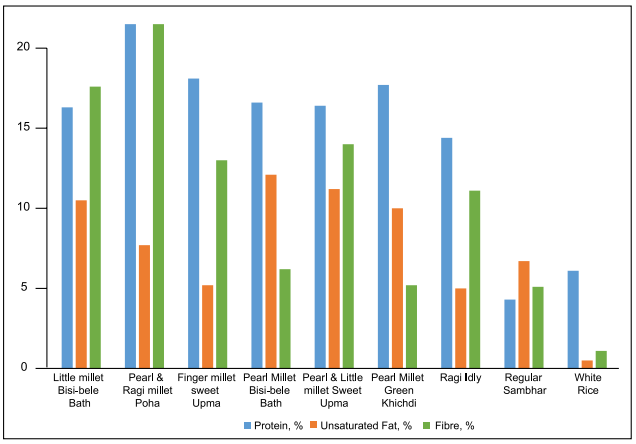


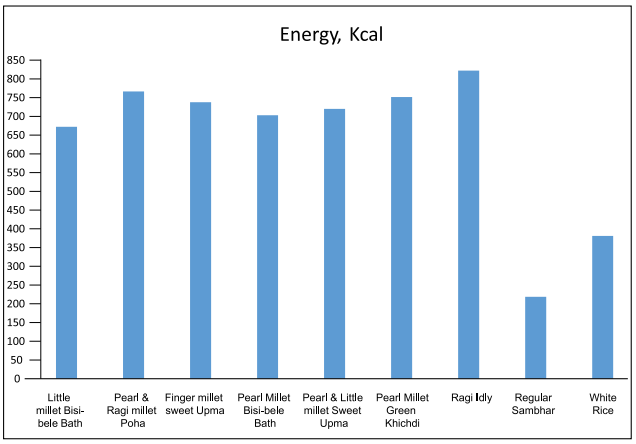


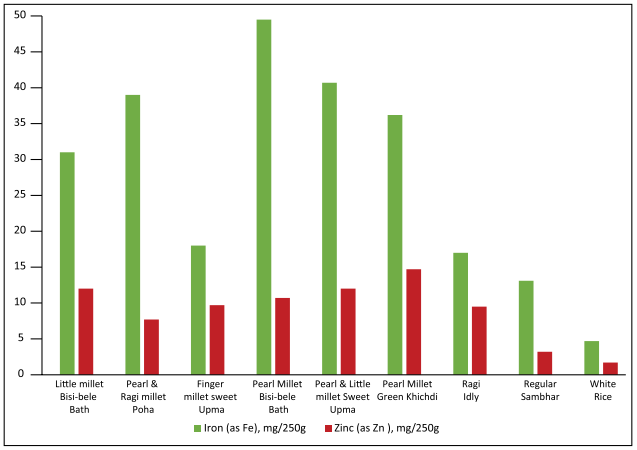
How

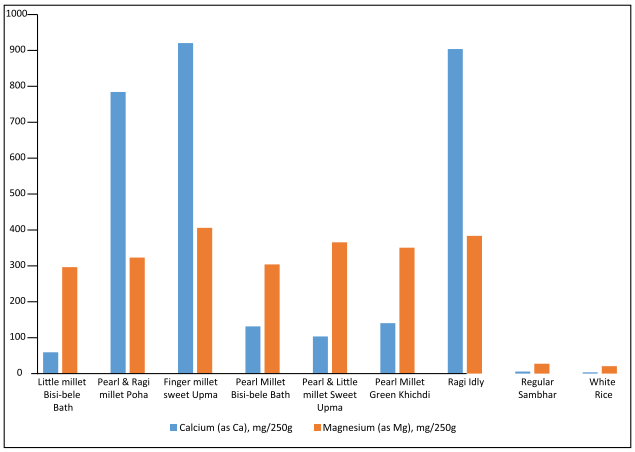
Implementation Examples

- Nutrition & bioavailability
- Taste
- Cost
- Suitability
- Availability & scalability









Success Factors

- Involve Agriculture, Education and Health => Message repetition
- Fun, demonstrations
- Branded – ownership
- Mothers were the researchers
- Diet diversity Hygiene Food safety (aflatoxin)
- Building the whole value chain

In Summary

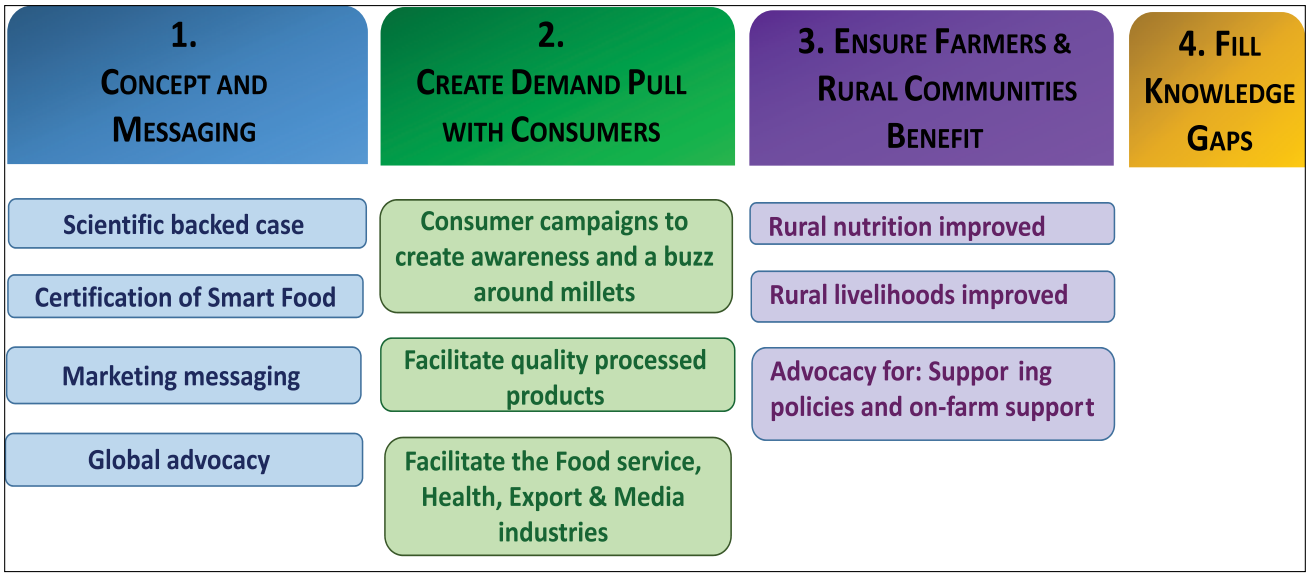
- Diversify (diets & farms)
- Staples
- Smart Food
- Millets & Sorghum
- Consumer driven
- Value chain

1. Concept and Messaging

- Scientific backed case
- Certification of Smart Food
- Marketing messaging
- Global advocacy

2. Create demand pull with consumers

- Consumer campaigns to create awareness and a buzz around millets
- Facilitate quality processed products
- Facilitate the Food service, Health, Export & Media industries



3. Ensure farmers & rural communities benefit

- Rural nutrition improved
- Rural livelihoods improved
- Advocacy for supporting policies and on-farm support

4. Fill knowledge gaps

Why Millets & Sorghum

- Smart Food
- Traditional crop
- Suitable as staple & other
- Resilience

The time is right NOW

- Urban food trends (aspirational)
- Nostalgia

Western food trends

- Super food
- Ancient grain
- Gluten free
- Low Glycemic Index (good for diabetics)
- Good for losing weight

Reference

Khoury C.K., Bjorkmanc A D., Dempewolf H., Ramirez-Villegasa J, Guarinof L., Jarvisa A., Loren H. Riesebergd L H. and Struik P C. 2014. Increasing homogeneity in global food supplies and the implications for food security. Proceedings of the National Academy of the Sciences of the United State of America. www.pnas.org/cgi/doi/10.1073/pnas.1313490111

Bio-fortified wheat - A Smart Way to Promote Nutrition Sensitive Agriculture and Food Security

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Biofortified wheat

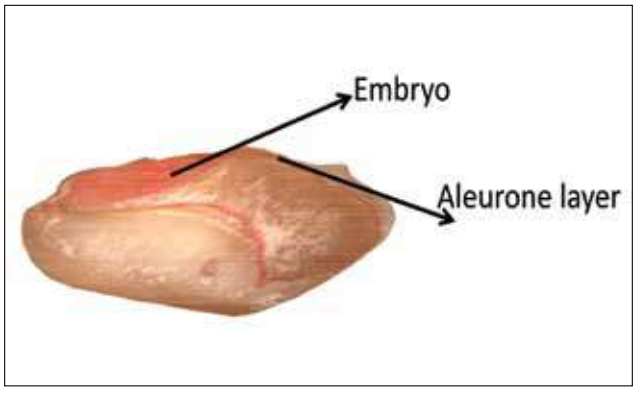
The biofortified staple food crops such as wheat, is an important channel to contribute to the hidden hunger problem in low income countries. Wheat with significantly high level of grain *Zinc* concentration is biofortified wheat.

Central Role of Zinc in Life on Earth

Genome	Total proteins	Zn	Cu	Mg	Fe	Ca	Ni	Co	Mo
Homo sapiens	25,319	925	31	74	86	59	0	4	6
Arabidopsis thaliana	27,243	536	19	51	81	14	1	4	6

Metal-containing & metal-binding proteins in 2 species identified by proteomic techniques. Gladyshev et al., 2004

Wheat biofortification research in CIMMYT is focused on grain Zinc concentration. "Due to Central Role of Zinc in Life on Earth, 10 times more than other microelements; & widespread Zn deficiency - Globally 17.3%; Africa (23.9%) and Asia (19.4%) including India and other South Asian countries.



Zinc is important for wheat as well Example from Turkey – Chakmak and Kitman U.B. 2018

Minor things can give major impact

What can Biofortification do?

- Nutritional benefits, with no additional costs
- Reach those who are not reached by other interventions

But we can not breed for grain Zinc alone

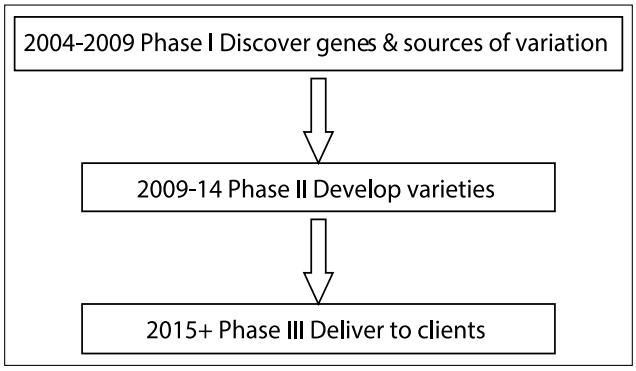
Core traits

- High and stable yield
- Durable resistance to diseases
- Heat tolerance
- Water use efficiency/ Drought tolerance
- Appropriate end-use quality
- Enhanced Zn and Fe content for nutrition (South Asia)

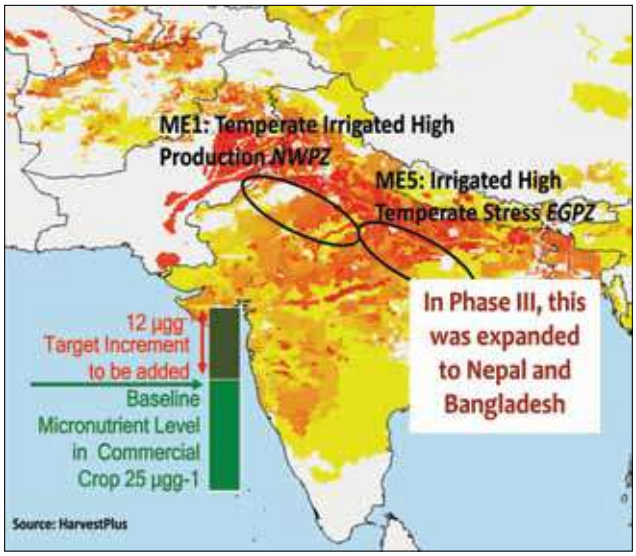
Harvest Plus initiative for wheat

Frequently asked questions in Phase I

- Will it be possible to Zn rich varieties?
- Will such varieties meet farmers expectations?
- Will these be bioavailable?



Map source: Dave Hodson, CIMMYT



Initial Target Country / Areas for Zinc Wheat

India is ranked second in the world with respect to the number of children suffering from malnutrition, despite its impressive economic growth. The absolute numbers and the prevalence of young children affected by stunting, underweight, and wasting have not changed significantly in the last two decades, it is estimated that less than 55% of women and children receive any basic health and nutrition interventions. The 2008, Global Hunger Index (GHI - a composite indicator that accounts for inadequate food consumption, child underweight and mortality) ranked India 66th out of the 88 developing countries for which the GHI was calculated, slightly above Bangladesh and below all other South Asian countries. Within India, the state-specific GHI's highlight wide regional disparities: Punjab ranks 34th (comparatively between Nicaragua and Ghana) and Madhya Pradesh ranks 82nd (between Chad and Ethiopia). However, even the best performing state, Punjab, ranks below countries like Honduras and Gabon, and none of the states falls in the "low hunger" or "moderate hunger" category defined by the GHI 2008.

Von Grebmer et al. The Challenge of Hunger 2008: Global Hunger Index. 2008. Concern Worldwide. Accessed via internet on April 30, 2013 (http://www.ifpri.org/publication/challenge-hunger-2008-global-hunger-index)

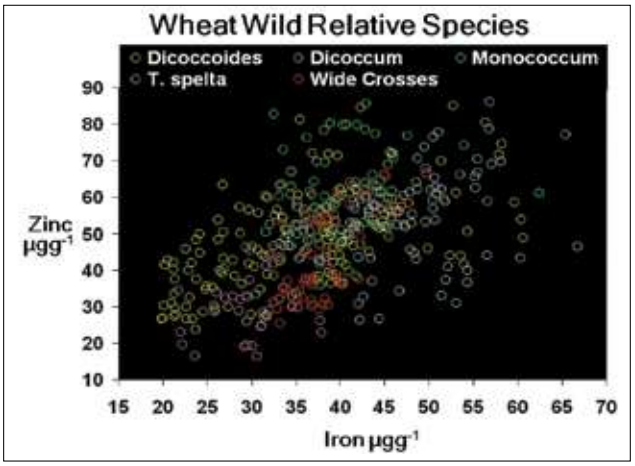
Fe and Zn grain concentrations are internal traits, so non-visible; agronomic or external advantages are most appealing to farmers.

How to make Zn/Fe visible?

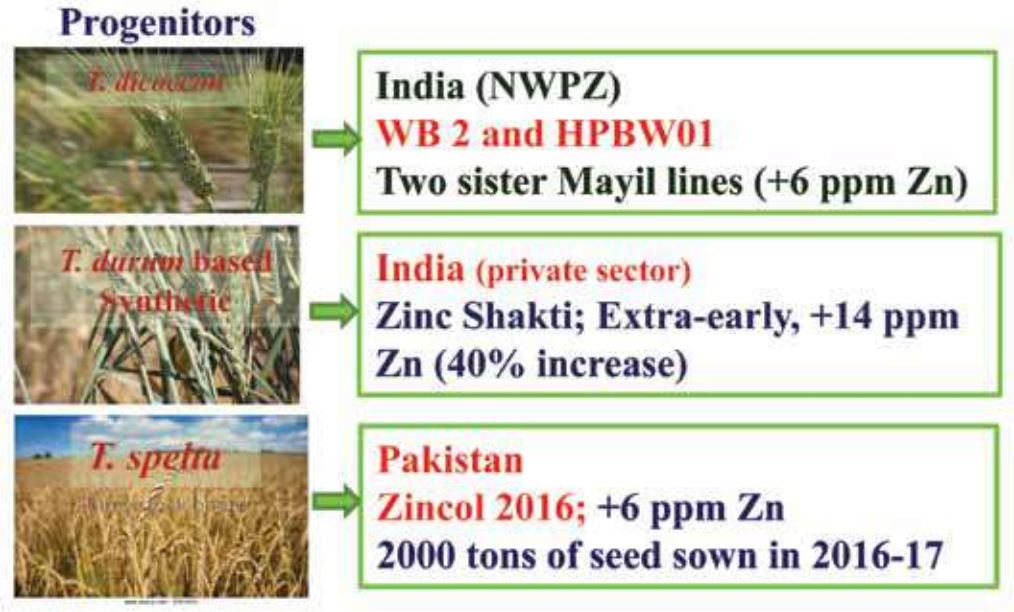
- Using a quicker and cheaper way of measuring micronutrients
- Integration of these traits in on-going breeding programs?

So, breeding for high Zn is complicated from genetic resources to high zinc wheat in farmers' fields of South Asia in less than 10 years.

Wild relative species are best Zn sources



2017: Biofortified wheat released



Source: Ravi Singh and Govindan Velu

Nirmal seeds, Ankur seeds & other SMEs promoting zinc wheat in India

Abhay

Characteristics

Duration ..... 115-120 days
Plant Height (cm) 95-100
No. of Tillers/Plant .....15-20 (standard cultivation)
Spike Length (cm) 10-12

Special features

- Excellent medium bold shiny quality grains
- Brown spike colour after maturity
- Recommended for timely sowing
- Recommended seed rate 40 kg per acre
- Highly tolerant to rust
- Nutritional rich product (High zinc content).

Akshay

Characteristics

Duration ..... 110-115 days
Plant Height (cm) 95-100
No. of Tillers/Plant 15-20
Spike Length (cm) 10-12

Special features

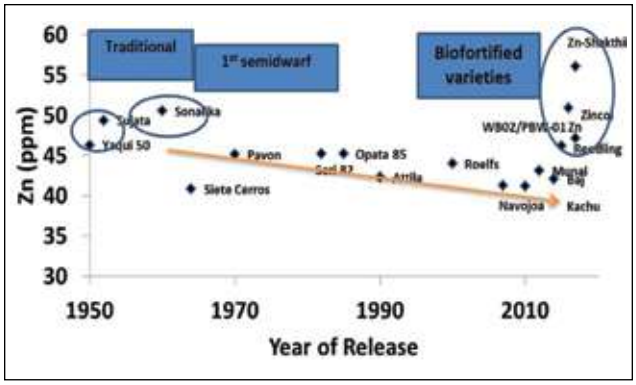
- Medium bold shiny grains
- Excellent grain quality and taste
- Highly tolerant to rust disease
- High yielding
- Highly tolerant to rust
- Nutritional rich product (High zinc content).

Source: Govindan Velu

Ist biofortified variety released in Bangladesh (Bari Gom 33)

- Kachu/Solala
- 2NS segment for blast resistance
- + 7 ppm Zn advantage
- It is also the first wheat blast tolerant variety in south Asia

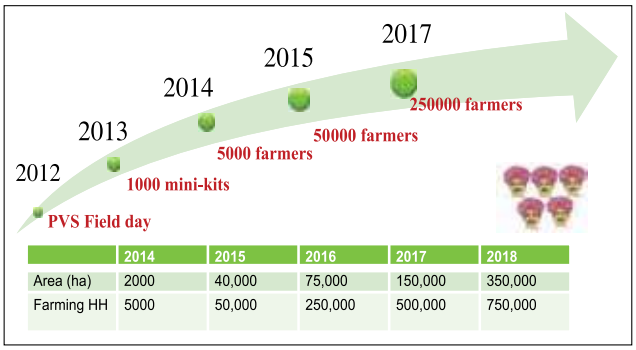
Zn levels in historic and modern wheats vs biofortified wheat



Velu. et al., 2015

Implementation of biofortification is not only development of a variety; it also means its release so that it can enter the seed chain; seed production and dissemination are equally important.

High Zn Wheat Delivery in South Asia



	2014	2015	2016	2017	2018
Area (ha)	2000	40,000	75,000	150,000	350,000
Farming HH	5000	50,000	250,000	500,000	750,000

Delivery – the way forward

- Fast track release
- Quick seed multiplication, may be pre-release
- Participatory approach
- Engage private sector & other stake holders
- Policy change - marketing

Conclusion

- Impressive progress in breeding for biofortified wheat
- Varieties released in 3 countries of South Asia; more to come
- Largescale seed dissemination underway
- Genetics - better understood, so this trait will be mainstreamed in breeding program
- Much more progress will be possible in future

References

Chakmak and Kitman U.B. 2018. Agronomic biofortification of cereals with zinc: a review. European Journal of Soil Science. 69:172-180.

Gladyshew V.N., Kryukov G.V., Fomenko D.E., and Hatfield D.L. 2004. Identification of Trace-element containing protiens in genomic databases. Annual Review of Nutrition. 24:579-596

Singh R. and Govindan Velu. 2017. Zinc-Biofortified Wheat: Harnessing Genetic Diversity for Improved Nutritional Quality. Science Brief: Biofortification No. 1 May 2017. CIMMYT, Harvest Plus, and the Global Crop Diversity Trust. Bonn, Germany.

Velu G., Singh R., Balasubramaniam A., Mishra V.K., Chand R, Tiwari C., Joshi A., Virk P., Cherian B. and Pfeiffer W. 2015. Reaching out to Farmers with High Zinc Wheat Varieties through Public-Private Partnerships – An Experience from Eastern-Gangetic Plains of India. Advances in Food Technology and Nutritional Sciences. 1(3):73-75.

Agriculture and Nutrition Key Challenges in Reconciliation

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'Agriculture' and 'Agriculture Investment'

'Agriculture' includes all food production activities, including crop production, horticulture, livestock, Fisheries, and forestry.

'Agriculture Investment' programmes are seldom limited to food production and often include value chain development, social development, and rural development.

'Food Systems' encompass all processes whereby food is produced, processed, transported, marketed and consumed. Finally, the term 'Food and Agriculture' is used to cover both food systems and agriculture *(**Charlotte, 2016**)*.

Malnutrition

Malnutrition: abnormal physiological condition caused by deficiencies, excesses or imbalances in energy and/or nutrients necessary for an active, healthy life.

Undernutrition, overnutrition and micronutrient deficiencies:

- **Undernutrition**, too little food intake relative to nutrient requirements wasting (low weight for height), chronic malnutrition or stunting (low height for age) and underweight (low weight for age).
- **Overnutrition** is a result of excessive food intake relative to dietary nutrient requirements.
- **Micronutrient deficiencies** (shortage of minerals or vitamins) can be associated with both over and undernutrition
  - Malnutrition undermines economic growth.
  - Well-nourished children perform better in school than malnourished children
  - Can add at least 10 percent to their personal lifetime earnings
  - Contribute to a more productive labour force–resulting in 2–3 percent increase in annual GDP for the country (World Bank, 2006).

World's dependence on cereals

- Cereal grains have been a primary source of nourishment for humans for thousands of years.

Domestication of cereals

- Rice about 10,000 years ago in Yangtze Valley, China
- Maize (corn) in Southern Mexico/Central America
- Wheat in the Fertile Crescent of the Near East
- All around the same time contributing immensely to transforming human civilization.

Cereals the most important food commodity

Cereals are the most important food commodity. It is single most important source of calories to a majority of the world population. The developing countries depended more on cereal grains for their nutritional needs than the developed world. About 60% of calories in developing countries are derived directly from cereals with values exceeding 80% in the poorest countries. Approximately 30% of calories in the developed world are derived directly from cereals. However, even in these more affluent societies that rely less on direct cereal consumption, cereals remain the most important food commodity since cereal supply most of the nutrients for the livestock that form a major part of diet in these regions.

Stripping Grains of important nutrients

Rice, wheat, and maize, and to a lesser extent, sorghum and millets, are important staples critical to daily survival of billions of people around the world. More than 50% of world daily caloric intake is derived directly from cereal grain consumption. Most of the grain used for human food is milled

to remove the bran (pericarp) and germ, primarily to meet sensory expectations of consumers. The milling process strips the grains of important nutrients beneficial to health, including dietary fiber, phenolics, vitamins and minerals.

(**Awika M. Joseph, 2011**)

Defining Nutrition Sensitive Agriculture

- An approach that seeks to ensure the production of a variety of affordable, nutritious, culturally appropriate and safe foods.
  - In adequate quantity and quality to meet the dietary requirements of populations in a sustainable manner.
- Nutrition requires taking action at all stages of the food chain.
  - From production, processing, retail to consumption.
  - A broader focus which encompasses the entire food system.
- Making agriculture and food systems nutrition-sensitive necessitates
  - Taking action to address input quality, production, post-harvest handling, processing, retailing and consumption,
  - In Order to deliver safe and nutritious foods all year round to the consumer.

(**FAO, 2017**)

" To re-envision agriculture as the primary source of sound nutrition through the food people harvest and eat.

This is a radical concept in the true sense of the word - returning to the root or fundamental purpose of agriculture."

Agriculture must, become Nutrition-Smart

Three staple crops - wheat, rice and maize provides most of the world's calories to the people. One way we can help is to ensure the rice the farmer grows is more nutritious as wheat and maize. Such nutrition-smart food crops are being developed, evaluated, and released all over the world.

Harvest Plus, has partnered across sectors to release these crops in seven countries. While also working with both private and public sector partners to educate farmers and consumers, and to build markets for these foods.

SMART Nutritional Goal Setting

- It's an acronym from Paul J. Meyers book Attitude is Everything.
- It supports the goal-setting process.
- It's a way to look at goal-setting as specific, measurable, attainable, realistic and time-bound.
- In other words, it's just a smart (or, in this case, S.M.A.R.T.) approach to running nutrition programme.
- An objective is a statement which describes what an individual, team or organisation is hoping to achieve.
- Objectives are 'SMART' if they are specific, measurable, achievable, realistic and, timely (or time-bound).

Nutrition in rice science in solving malnutrition

Micronutrient deficiency, also called hidden hunger, a major nutrition problem affecting especially in Asian countries, where rice is the major staple food. Huge opportunities exist to improve the nutritional content of rice varieties to solve the micronutrient-deficiency problem. Health problems from deficiencies in iron, zinc, and vitamin A are highly evident in Asian populations. Children and pregnant and lactating women are especially vulnerable to malnutrition.

Zinc is needed for the body's immune system and its absence /deficiency causes stunting, diarrhea, reduced immunity, and poor cognitive development. The key role of zinc is in cell division, cell growth, healing of wounds, and the breakdown of carbohydrates. It is the major part of more than 300 enzymes of the human body, so enzymatic activities in the body need zinc as a catalytic compound and getting an adequate amount of zinc in our daily diet a must.

A high-zinc variety in the Philippines and three varieties in Bangladesh have already been released in collaboration with the Philippine Rice Research Institute (Phil Rice) and Bangladesh Rice Research Institute. If the content of micronutrients in rice is increased, naturally people will be consuming more micronutrients (Lamigo-Rosellon Elemarie, 2017).

Healthy Rice in INDIA

"In India more than one-fifth of the population

lives in poverty and more than 15% of the people are undernourished thus vulnerable to various health problems. Nutritional supplementation is done through many modes like commercial fortification, medical supplementation, dietary diversification and biofortification.

ICAR has recognized the pressing need for the nutritional biofortification of the staples and initiated many programmes in different crops said Shri Radha Mohan Singh, Minister of Agriculture and Farmers Welfare, Government of India.

Variety	Nutrient	Grain Yield q/ha	Maturity (days)	Area of Adaptation	ICAR-Institute Developed	Year of Release
CR Dhan 310 (Pure line variety)	10.3% protein in polished grain vis-à-vis 7.0-8.0% in popular varieties 15 ppm zinc	45.0	125	Odisha, Madhya Pradesh and Uttar Pradesh	ICAR-National Rice Research Institute, Cuttack, Odisha	2016
CR Dhan 311 (Pure line variety)	10.1% protein in polished grain 20 ppm zinc	45.0	120 to 125	Odisha, Madhya Pradesh and Uttar Pradesh	ICAR-National Rice Research Institute, Cuttack, Odisha	2016
DRR Dhan 45 (Pure line variety)	Zinc (22.6 ppm) in polished grains vis-à-vis 12.0-16.0 ppm in popular varieties	50.0	125 to 130	Karnataka, Tamil Nadu, Andhra Pradesh and Telangana	ICAR-Indian Institute of Rice Research, Hyderabad	2016

Healthy Wheat in INDIA

Variety	Nutrient	Grain Yield q/ha	Maturity (days)	Area of Adaptation	ICAR-Institute Developed	Year of Release
WB 02 (Pure line variety)	Rich in zinc (42.0 ppm) and iron (40.0 ppm) vis-à-vis 32.0 ppm zinc and 28.0-32.0 ppm iron in popular variety	51.6	142	Suitable for irrigated timely sown conditions of Punjab, Haryana, Delhi, Rajasthan (excluding Kota and Udaipur division), Western UP (except Jhansi division), Jammu and Kathua district of J & K, Paonta Valley and Una district of HP and Tarai region of Uttarakhand	ICAR-Indian Institute of Wheat and Barley Research, Karnal	2017
HPBW 01 (Pure line variety)	High iron (40.0 ppm) and zinc (40.6 ppm) vis-à-vis 28.0-32.0 ppm iron and 32.0 ppm zinc in popular varieties	51.7	141	Do	PAU, Ludhiana under ICAR-AICRP on Wheat & Barley	2017

Healthy Maize in INDIA

Variety	Nutrient	Grain Yield Q/ha	Maturity (days)	Area of Adaptation	ICAR-Institute Developed	Year of Release
Pusa Vivek QPM9 Improved (Hybrid)	Country's first provitamin-A rich maize • High provitamin-A (8.15 ppm), lysine (2.67%) and tryptophan (0.74%) vis-à-vis 1.0-2.0 ppm provitamin - A, 1.5-2.0% lysine and 0.3-0.4% tryptophan content in popular hybrids	Grain yield: 55.9 q/ha [Northern Hills Zone (NHZ)] and 59.2 q/ha [Peninsular Zone (PZ)]	93 (NHZ) 83 (PZ)	Kharif season in J&K, Himachal Pradesh, Uttarakhand (Hill region), North Eastern states, Maharashtra, Karnataka, AP, Telangana and Tamil Nadu	ICAR-IARI New Delhi	2017

Variety	Nutrient	Grain Yield Q/ha	Maturity (days)	Area of Adaptation	ICAR-Institute Developed	Year of Release
Pusa HM4 Improved (Hybrid)	Contains 0.91% tryptophan and 3.62% lysine, significantly higher than popular hybrids (0.3-0.4% tryptophan and 1.5-2.0% lysine)	64.2	87	Kharif season in Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region)	ICAR-IARI, New Delhi	2017
Pusa HM8 Improved (Hybrid	Rich in tryptophan (1.06%) and lysine (4.18%) vis-à-vis 0.3-0.4% tryptophan and 1.5-2.0% lysine in popular hybrids	62.6	95	Kharif season in Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu	ICAR-IARI, New Delhi	2017
Pusa HM9 Improved (Hybrid)	Contains 0.68% tryptophan and 2.97% lysine vis-à-vis 0.3-0.4% tryptophan and 1.5-2.0% lysine in popular hybrids	52.0	89	Kharif season in Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region) and West Bengal	ICAR-IARI, New Delhi	2017

Designing Nutrition Sensitive Agriculture Investments

- Incorporate explicit nutrition objectives and indicators into their design
- Assess the context at the local level
- Target the vulnerable
- Collaborate and coordinate with other sectors (health, environment, social protection, labour, water and sanitation, education, energy) and programme
- Maintain or improve the natural resource base (water, soil, air, climate, biodiversity), critical to the livelihoods and resilience,
- Empower women by ensuring access to productive resources, income opportunities, extension services and information
- Facilitate production diversification, and increase production of nutrient-dense crops and small-scale livestock (for example, horticultural products, legumes, livestock and fish at a small scale, underutilized crops, and biofortified crops),
- Improve processing, storage and preservation to retain nutritional value, shelf-life, and food safety
- Expand markets and market access for vulnerable groups, particularly for marketing nutritious foods or products, and
- Incorporate nutrition promotion and education around food and sustainable food systems that builds on existing local knowledge, attitudes and practices.

Scaling up Nutrition (SUN)

A Framework for Action:

- Use the "Three Ones": The "Three Ones" are:
  - "One agreed framework that provides the basis for co-ordinating the work of all partners;
  - One coordinating authority, with a broad multisectoral mandate;
  - and one agreed national monitoring and evaluation system".

Sixty countries and three states of India (Jharkhand, Maharashtra and Uttar Pradesh) are leading a global movement to end malnutrition in all its forms.

Main Elements of SUN

- Start from the principle that what ultimately matters is what happens at the local/country level.
- Sharply scale up evidence-based cost-effective interventions to prevent and treat undernutrition,
- Take a multi-sectoral approach that includes
  - Integrating nutrition in related sectors and using indicators of undernutrition as one of

the key measures of overall progress in these sectors.

- **The closest actionable links are food security**
  - Agriculture,
  - Social protection (including emergency relief) and health (including maternal and child health care, immunisation and family planning).

There are also important links to education, water-supply and sanitation as well as to cross-cutting issues like gender equality and governance (including accountability). The major efforts at the national and global levels for strengthening the evidence base-through better data, monitoring and evaluation, and research and, importantly, for advocacy.

SMART FARMING

Weather Smart • Weather forecasts • ICT based agro-advisories • Index based insurance • Climate analogues	**Water Smart** • Aquifer recharge • Rainwater harvesting • Community management of water • Laser-leveling • On Farm water management
Carbon Smart • Agroforestry • Conservation tillage • Land use systems • Livestock management	**Nitrogen Smart** • Site specific nutrient management • Precision fertilizers • Catch cropping/legumes
Energy Smart • Biofuels • Fuel efficient engines • Residue management • Minimum tillage	**Knowledge Smart** • Farmer to farmer learning • Community seed and fodder banks • Market information • Off farm risk management
Nutrient Smart • Undernutrition • Overnutrition • Micronutrient Deficiencies • Maternal • Child health immunisation • Cross cutting issues	

Way Forward

'WILL MAKE ONE VILLAGE OF EACH BLOCK NUTRITION SMART VILLAGE' …….

Said the Hon'ble CM, Madhya Pradesh while addressing a Nutrition Smart Village workshop.

The Pioneer, 3.4.2018

References

Avika M. Joseph, 2011. Sorghum Flavonoids: Unusual Compounds with Promising Implications for Health. 2011, 171-200. DOI: 10.1021/bk-2011-1089.ch009.

Lamigo-Rosellon Elemarie 2017. Improving health and nutrition through rice science.https:// www. harvestplus.org/ viewpoints/improving-health-and-nutrition-through-rice-science

Unlocking the Potential of Charlotte's Food System and Farmers' Markets. July 2018. Prepared for City of Charlotte by KarenKarp& Partners, 27 East 21st Street, 3rd Floor T: 212.260.1070 kkandp.com New York, NY 10010.

https://www.worldbank.org/

http://www.fao.org/publications/en/

Innovative Practices to Promote Nutrition Sensitive Agriculture

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In Indian situation poverty, hunger and malnutrition was the main problem. Green revolution reduced poverty and hunger and food production is increased to five fold. But still 250 million people live in poverty and about 47 million children below five year malnurshied. Food security and improved nutrition is now major issues to growing population. Food systems must deliver more nutritious food to populations. It can be possible by strengthening of value chains for micronutrient-rich foods and food availability at affordable to consumers.

To achieve food security there are major challenges like decline in factor productivity, poor soil health, increase in cost of inputs, decline in farm profits, climate change, increase in population, stagnation of yield in major food crops, declining R&D investments in Agri sector and small holding farming is not profitable.

Agriculture is the main source of food, employment and income for 70 to 80 percent of people and biggest private sector. Slow promoting and implementing nutrition-sensitive strategies. Micronutrient supplementation can contribute to physiological, mental and social development. Reduce nutritional disorders and contribute to the prevention of diet-related diseases later in life.

Agriculture investments made with the intention of improving nutrition. The programme will level linkages and implementation. There is a need of more investments on nutrition for good health and wellbeing and requirement of development of nutrient-rich value chains to maximise agriculture research contribution to nutrition.

The major focus areas of agricultural research must address the nutritional issues and important role of small holding farmers in nutritional security. Targeting poor households and promoting gender equity and providing nutrition education to people and interventions with promotion of healthy diet and nutrition and product diversification with dedicated budget.

A food-based approach is required to put nutritionally rich foods, dietary diversity, and food fortification at the heart of overcoming malnutrition and micronutrient deficiencies. Multiple benefits derived from enjoying a variety of foods, recognizing the nutritional value of food for supporting rural livelihoods to make the global food system better equipped to produce good nutritional outcomes.

Improving nutrition through agriculture

By designing agricultural projects, programmes and policies on nutrition sensitive agriculture can improve nutrition in food. Local context to understand how best to address nutrition problems. Identify and mitigate potential harms to nutrition of agricultural investments. Convergence, collaborate and coordinate with other sectors to reach nutritional security. Increase equity through ensuring participation, access to resources and decent employment for the most vulnerable. Empower women and ensure equal access to resources and technologies, services and information. Support women's voices in household, farming and other business decisions. Incorporate nutrition promotion, education and behavior change communications. Maintenance or improvement in natural resources, including biodiversity and management of water resources to reduce illness and ensure safe household water sources. Facilitate diversification of production and livelihoods to improve availability and resilience. Increase incomes through production and development of value chains for a variety of nutritious foods. Improve processing, storage and preservation to retain nutritional value, address food safety and reduce post-harvest losses. Expand markets and market access for nutritious foods and promote availability, access and consumption of diverse nutritious and

safe foods. Improve governance for nutrition by drawing up a nutrition strategy and action plan and promotion of gender equality and environmental sustainability. Development of information systems for production, processing and marketing aspects of nutrition sensitive agriculture and food systems to advocate for improving nutrition through agriculture at global, national, subnational and local levels.

Nutrient-rich Value Chains

Bio-fortified

- **Legume**, nut, or some seeds such as sesame, sunflower, pumpkin seeds, barley and wheat germ, or sprouted legume seeds.
- **Animal source food**, including dairy products, fish, eggs, organ meats, meat, flesh foods, and other miscellaneous small animal protein.
- **Dark yellow or orange**-fleshed root or tuber.
- **Fruit or vegetable** that meets the threshold for being a "high source" of one or more micronutrients on a per 100 calorie and per 100 gram basis.

Biofortification in different Crops

Practices

- Development of nutririch crop varieties.
- Seed system development.
- Agrregation of produce.
- Local food value chain development.
- Local food supply system at best price.

Biofortification in Pearl Millet

ICRISAT- developed high iron (71 mg/kg), early maturing biofortified Pearl Millet Variety Dhanshakti

Source: ICRISAT :Biofortification

Biofortification in Sorghum

Identification of micronutrients-dense sorghums for better health in Western and Central Africa (WCA) and India.

ICRISAT-bred biofortified sorghum line ICSR 14001 with 50% higher iron and zinc

Source: Harvest Plus-ICRISAT (2014)

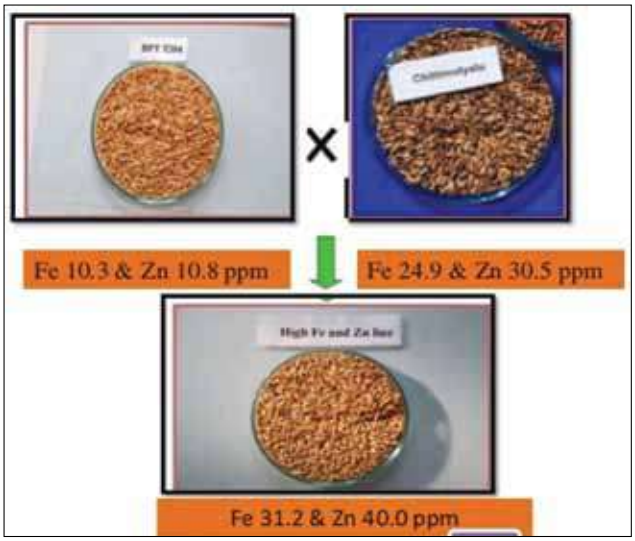
Biofortification in Rice

Zinc biofortified rice variety "Chhattisgarh Zinc Rice-1"(CGZR-1) developed in IGKVV, Raipur

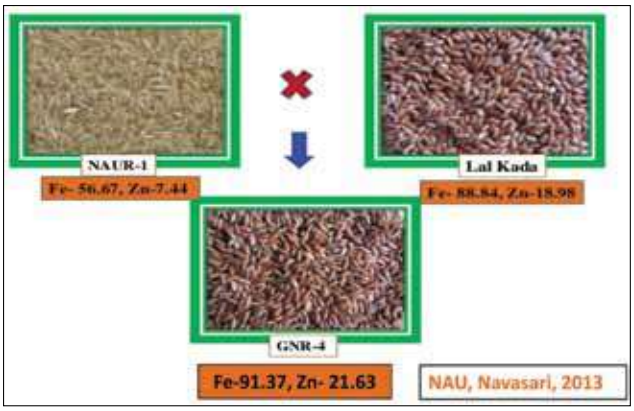
Source: ICAR –IIRR Report and IGKVV, Raipur

Achievement at DRR through conventional breeding approach

- Short bold grains, semi dwarf with high yield potential (>4.5 t ha-1)
- Medium duration
- With high iron (31.2 ppm) & zinc (40 ppm)
- Possessing good quality
- Good head rice recovery 67.5%
- Intermediate alkali spreading value 5.01
- Amylose 24.05%
- Mild aroma



Rice (iron and zinc)



Low Glycaemic Index (GI), Rice

IGKVV, Raipur, Chhattisgarh developed Chhattisgarh Madhuraj paddy-55 (CGMP-55) variety has low Glycaemic Index (GI) with 91% of total carbohydrates and it has slow releasing sugar tendencies, blend of taste and healthy values for diabetics."

Source: IGKVV, Raipur (News)

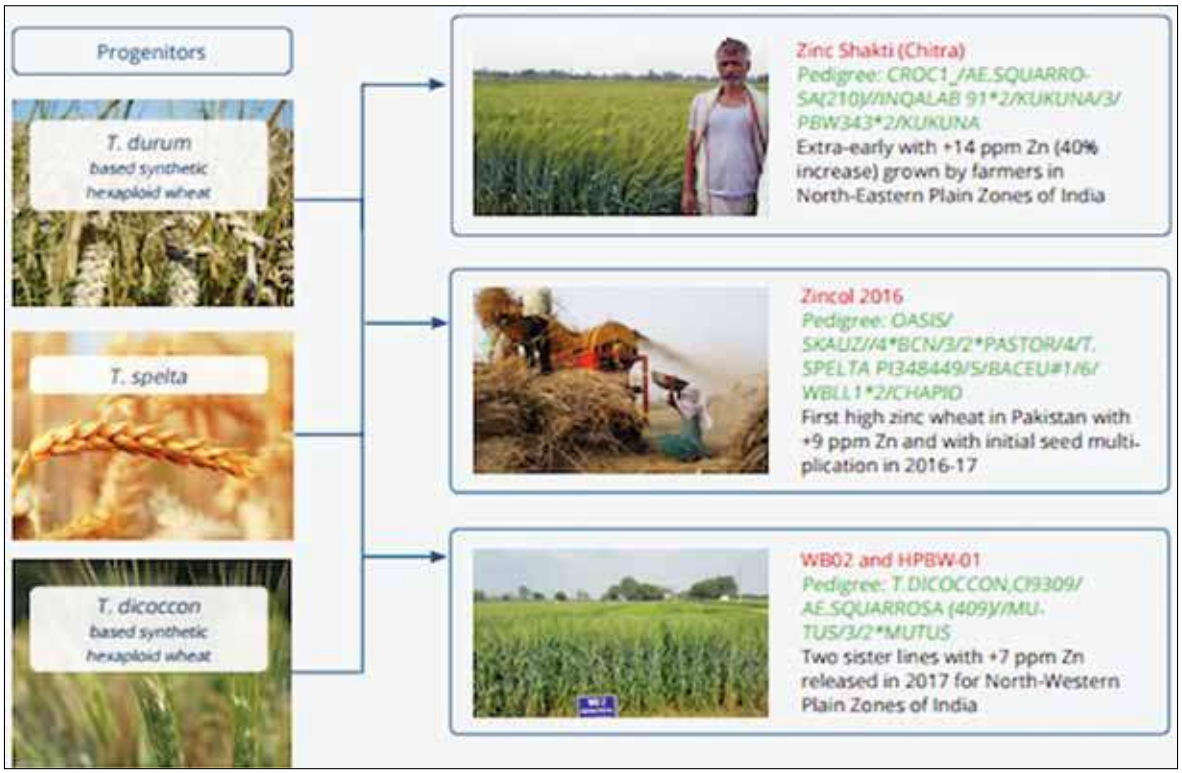
Genetic Modification : Golden Rice

Genetically modified to contain beta-carotene, a source of Vitamin A

Source: IRRI

Biofortification in Wheat

High-yielding lines with high Zinc content provides up to 50% of daily Zinc need



Six biofortified wheat varieties have been released – 'Zincol 2016' in Pakistan, 'Zinc Shakti (Chitra)', 'WB02' and 'HPBW-01', BHU-1, BHU-3, BHU-5, BHU-6, BHU-17, BHU-18 in India

Source: : Harvest Plus: Biofortification Progress Briefs (2014)

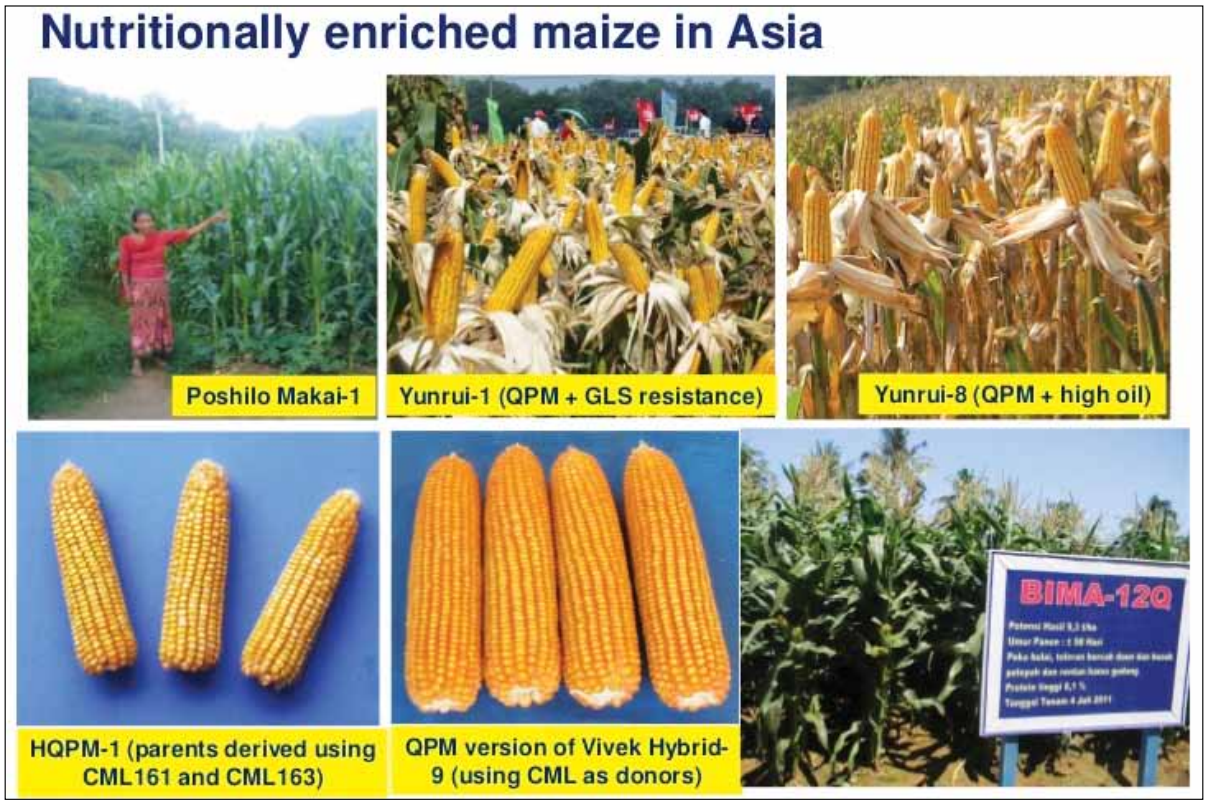
Wheat variety UAS-428 has bolder seeds with grain weight of 43.79 gm, higher iron (38.2 ppm) and zinc (30.4 ppm) content.

Suitable for pasta, dalia and noodles with high beta carotene variety

Source: JNKVV, Jabalpur

Wheat Variety MPO 1255 with High Beta Carotene

Biofortification in Maize



QPM protein contains, in general, 55% more tryptophan, 30% more lysine and 38% less leucine than that of normal maize. The biological value of normal maize protein is 45%, while that of o2maize is 80%.

Developed at ICAR – Vivekanand Parvatiya Krishi Anusandhan Sansthan, Almora.

Biofortification in Cowpea

Variety Name	Release Year	Iron Content	Zinc Content	Av. Yield (Kg/ha)
Pant Lobia-1	2008	82 ppm Fe	40 ppm Zn	1500
Pant Lobia-2	2010	100 ppm Fe	37 ppm Zn	1500
Pant Lobia-3	2013	67 ppm Fe	38 ppm Zn	1500
Pant Lobia-4	2014	51 ppm Fe	36 ppm Zn	1700
Buksora local	-	26 ppm Fe	30 ppm Zn	800 Kg/ha

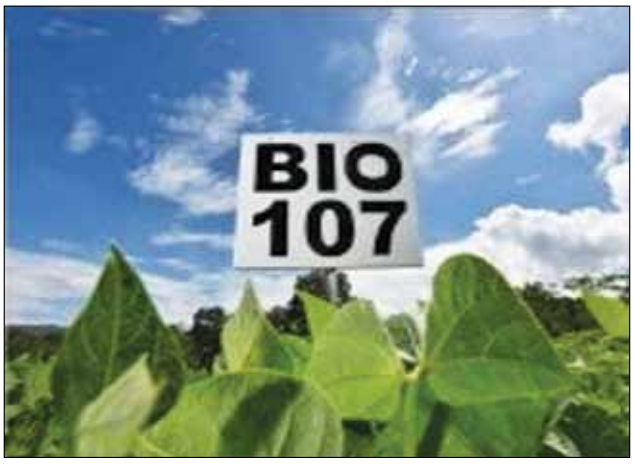
Source: G.B. Pant University of Agricultural and Technology

In harvest Plus Phase II, cowpea research conduced at G.B. Pant University of Agriculture and Technology, Pantnagar, India. It focused on the introduction and further improvement of recently developed photo-insensitive and heat-tolerant "60-day cowpea "varieties by IITA. Two early maturing high-iron and zinc cowpea varieties, Pant Lobia-2, were released by the Uttrakhand Government in 2008 and 2010, respectively.

Biofortification in Common Bean

A new "super food" for Colombia

On June 9th, 2016, two biofortified varieties of iron + zinc beans were released in Colombia in Barichara, Santander. The release of these biofortified bean varieties BIO-101 and BIO-107 with high content of iron (83ppm) and zinc (44 ppm). It is the first time biofortified beans have been released in the Andean zone of Colombia, with the departmental governments of Santander.



CIAT, Colombia

Biofortification in Lentils

Variety Name	Iron Content	Zinc Content
India-Released in 2012		
L4704	85 ppm	74 ppm
Nepal-Released in 2013		
ILL 7723	43 ppm	61.5 ppm
Bangladesh-Released in 2013		
Barimasur-7	41 ppm	-

Source: ICARDA Sarker (2009)

Biofortification in Chickpea

Two high protein varieties have been released in India. The high protein variety IPC 2005-62 (26.8% protein) has been released for cultivation in Uttar Pradesh that has been developed by ICAR-IIPR, Kanpur. Similarly, high protein variety JG 36 (26.4% protein) has been released for cultivation in Madhya Pradesh from JNKVV, Jabalpur.

Source: ICRISAT (Annual Report)

Biofortification in Horticulture Crops

Biofortification in Banana

Variety Name	Country of Origin	Genome-Sub group	Fruit Ripening Stage	Total Carotenoid Content (FW)
Apantu	Ghana	AAB-Plantain	Unripe Ripe	46.83 ppm 100.71 ppm
Bira	Papua New Guinea	AAB-Pacific plantain	Unripe Ripe	43.42 ppm 106.38 ppm
Pelipita	Philippines	ABB-Plantain	Unripe Ripe	25.35 ppm 17.44 ppm
To 'o	Papua New Guinea	AADessert	Unripe Ripe	5.60 ppm 77.69 ppm

Note: A= Acuminata, AA= Diploid Acuminata, AAA= Triploid Acuminata, B= Balbisiana, BB= Diploid Balbisiana

Source: Bioversity International- Uganda Ekesa (2013)

Conventional Banana

Vitamin A Banana

Biofortification in Tomato

Variety : Arka Vikas (ICAR-IIHR, Bengaluru)

The average anthocyanin content of the transgenic fruit was 0.1 mg g-1 fresh weight, which were 70-100 folds higher than that of the control fruits

Biofortification in Brinjal

S. No.	Parameters	NSRP-1	GJB-3 (C)	GOB-1 (C)
1.	Total Phenol (%)	2.07	2.11	2.19
2.	Vitamin C (mg/100g of edible portion)	2.90	2.90	2.5
3.	Total Soluble Sugar (%)	3.09	3.00	2.88
4.	β-carotene (mg/100 g)	0.77	0.72	0.67
5.	Crude fiber (%)	1.42	1.42	1.44
6.	Glycoalkaloids (%)	0.162	0.175	0.173
7.	Anthocyanin (mg/100g)	475.3	390.1	419.9

Source: Annual Report on Vegetable improvement Dept. of Vegetable Science, ACHF, Navsari

Biofortification in Cauliflower

Year of Identification	2015-16
Characteristics	This is the first ever indigenously bred bio-fortified beta carotene (800-1000 ug/100 g) rich cauliflower variety, an attempt to tackle beta carotene deficiency related malnutrition problem in India. Its curd are orange coloured, compact and very attractive with semi-self blanching growth habit. It is suitable for September-January growing period. Average marketable curd weight is about 1.250 kg with an approximate marketable yeild of 42.0 to 46.0 t/ha

Cauliflower variety Pusa Betakesari

Biofortification in Cabbage

Anthocynanin rich cultivar Kinner Red developed Dr. Y S Parmar University of Horticulture and Forestry.

Biofortification of Selenium (Se) in Onion

Varieties	Treatments		
	Control	20 mg Se	50 mg Se
	mg Se Kg-1		
Summit	0.07 ± 0.06 a	2.95 ± 0.48 a	6.11 ± 1.98 a
Hytec	0.04 ± 0.02 a	2.66 ± 1.15 a	7.46 ± 1.60 a
Red Baron	0.05 ± 0.02 a	2.65 ± 1.19 a	8.31 ± 4.86 a

Source: Department of Plant and Environmental Sciences (IPM) Norwegian University of Life Sciences

The Se concentration increased with increasing Se fertilization for all varieties. 'Red Baron' Variety had the tendency of highest Se concentration when it was treated with 50 mg of Se.

Biofortification in Lettuce

Effect of soil fertilization and foliar application of iodine in Lettuce cv. Melodion

Combination	Iodine (mg I / kg d.w)
Control	12.1
Soil Fertilization 0.5 kg I/ha	15.7
Soil Fertilization 1 kg I/ha	19.9
Soil Fertilization 2 kg I/ha	18.4
Foliar application 0.02 kg I/ha	8.5
Foliar application 0.2 kg I/ha	16.7
Foliar application 2 kg I/ha	54.3
Test F	*

Biofortification in Potato

Wide variability of nutrients in existing potato varieties	Iron	Fe
	11-30 ppm	0-25 ppm

CIP, Peru developed iron and zinc fortified variety of potato by selection and breeding. *i.e* RL-12 which has lower phenolic compound, hence better absorption of iron in human body.

Endorsement of orange flesh Sweet Potato

S. N.	Parameters	Bhukanti	Gouri (C)	Local (C)
1.	Dry matter (%)	27	30	24
2.	Total sugar (%)	2.3	2.6	2.5
3.	Starch (%)	16.8	22.3	12.7
4.	Beta carotene (mg/100g)	7.4	1.1	1.3

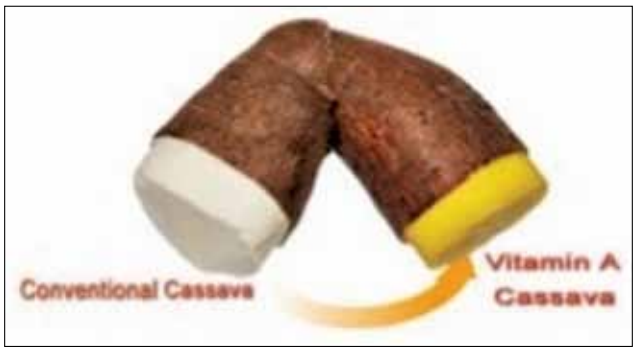
Biofortification in Cassava

Variety Name	Origin	Total Carotenoid Content (FW)*	Pro vitamin A Content (FW)*	Fresh Root Yield	DM
I011661	IITA (Nigeria)	9.4 ppm	7.6 ppm	34.9 t/ha	30%
Butamu (Check)	IITA (DRC)/ INERA	4.4 ppm	3.9 ppm	35.0 t/ha	35%

Biofortification in Sweet Potato

Variety	Colour	Source	DM (%)	Mean β-carotene mg/100 g fresh wt	Source of roots assayed
Kala	Deep yellow	Local landrace from Uganda	37	183 to 1592	Uganda
Karoti Dar	Orange	Local landrace from Tanzania	31 to 36	2490 to 10281	Tanzania
Resisto	Deep Orange	American variety	25 to 33	3140	Mozambique
Simama	Deep yellow	Improved variety from Tanzania	42	73	Tanzania
SPK 004 - Kakamega	Orange	Kenyan improved variety	23 to 42	800 to 13336	Tanzania, Uganda
Tainung	Deep Orange	CIP-introduced	24 to 34	10570 to 17326	Mozambique
Zapallo	Deep Orange	Tanzania/Uganda	20	1526	Tanzania

Pro vitamin A content is approximately 80% of total Carotenoid Content (fresh weight – FW) measured with spectrophotometer.



Nutri-Smart Village

"Nutri- Smart Village" is a scientific approach to provide nutrition using existing resources of farmers, farm labourers and other people living in the village through demonstration, training, awareness and input support. Nutrition Smart Village in convergence with agriculture and allied departments in convergence mode. Lead role of KVK's are working out nutrition requirements of the selected villages and crop plan to meet nutritional requirements.

Gender and Nutrition perspective in achieving holistic Agricultural growth

Investing in smallholder farmers is an important way to increase food security and nutrition for the poorest, as well as food production for local and global markets. Agricultural Extension Services can assist rural communities to become gender-responsive, nutrition sensitive and, by assessing and responding to the needs of both men and women farmers.

Create approaches in rural households to remove gender barriers by disseminating nutrition-enhancing technologies. Integrate nutrition and gender within agricultural extension and advisory services, delivery mechanisms through Extension advisory Services could use, including i.e. on-farm demonstrations, farmer field schools and associations, public health and school platforms.

Increasing awareness and interest, decision and uptake, evaluation, adaptation, and finally, adoption. Technical knowledge regarding crop production for improving nutrition and training on diets, food preparation, preservation, and hygiene should be organised. More emphasis on creating awareness of the potential causes of malnutrition.

Extension agents need soft skills such as facilitation, negotiation, communication, gender sensitivity, and sensitisation to minimise harmful effect. More emphasis on integrated approaches in agricultural research and development projects on agriculture–nutrition research with interdisciplinary academic collaborations, programes and policies. (Kadiyala et al., 2014).

Develop effective models of connecting agriculture with the nutritional outcomes, bio-fortification of crops, production, income, and food prices as pathways through which agriculture can influence nutrition.

References

https://www.irri.org/golden-rice

https://www.harvestplus.org/sites/default/files/Biofortification_Progress_Briefs_August2014_WEB_0.pdf

https://apps.icarda.org/wsInternet/wsInternet.asmx/DownloadFileToLocal?filePath=Annual_report/ICARDA_2009.pdf&fileName=ICARDA_2009.pdf

https://www.bioversityinternational.org

https://www.iihr.res.in/

https://ciat.cgiar.org/what-we-do/crop-conservation-and-use/bean-diversity/

http://jnkvv.org/Departments/Dep_DRS_VarietiesDeveloped.aspx

http://www.gbpuat.ac.in/colleges/COA/genetics-ach.pdf

http://www.nau.in/assets/uploads/952d2-ic_mrrc_information.pdf

https://timesofindia.indiatimes.com/city/raipur/IGKV-scientists-develop-diabetic-friendly-rice/articleshow/51722631.c

http://www.igau.edu.in/

http://www.nau.in/

https://www.nmbu.no/en

http://www.icar-iirr.org/Jan_March_2016%20Final.pdf

https://www.icrisat.org/biofortification-icrisat/

https://www.icrisat.org/india-gets-its-first-biofortified-sorghum/

Kadiyala S., Harris J.,Headey D., Yosef S., and Gillespie S. (2014).Agriculture and nutrition in India: mapping evidence to pathways.Annals of the New York Academy of Sciences.ANNALS OF THE NEW YORK ACADEMY OF SCIENCES Issue: Paths of Convergence for Agriculture, Health, and Wealth Agriculture and nutrition in India: map. doi: 10.1111/nyas.12477

Nutritional Aspects of Traditional Indigenous Edible Oils A Comparative Overview To Promote Nutrition Sensitive Agriculture

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Relationship of agriculture, food, cooking processes and nutrition are highly complex and profoundly significant with respect of Health. In India, where native and natural oil seeds such as mustard, ground nut, sesame and coconut are traditionally cultivated for their nutritionally rich oil, this linkage can be clearly seen here. With a high oil content, these seeds are traditionally extracted by cold pressings technique called Ghani (an activity used by small scale producer). The resulting oils are nutritious and high in natural flavors and colour with excellent aroma, since they are traditionally used and stored in their unrefined state, they are long lasting. (Charak Sanhita Part I, 1975; Sharma et al., 2007) A large proportion of the Indian population is vegetarian and therefore, oils are the main source of dietary fats hence choice of edible vegetable oils is of great importance.

- **Distinct oils are used in different regions.**

South India	:	Coconut
East and North India	:	Mustard
Rajasthan	:	Sesame
Central India and Gujarat	:	Ground nut.

Sesame

Ground nut

Mustard

Coconut

Traditional Indian Oil Seeds & Crops

The specific choice of edible oil is based upon traditional eating and cooking habits, local climate, soil and production of oil seed .

- Relatively recently, some nontraditional new oils: Soyabean, Sunflower, Ricebran and Safflower have been introduced in India.
- Most of these oils, extracted with heat or solvents, are very high in PUFA and are unsuited to Indian cooking methods or for long term storage (Meyer, 1960; Byers, 1997).
- Sold only in a 'Pure' i.e. highly refined, transparent and almost colourless form and often fortified with vitamines and antioxidants.
- Traditional oils, in nutrition and health respects, are superior to non traditional oils as food (Table 1).

Table 1. Oil Content of Different Oil Seeds

Oil Seed	Percentage of Oil
Coconut	57-75%
Mustard (Raya, Brown, Yellow)	40-43%
Ground nut	47-55%
Sesame	50%
Niger	40%
Soyabean	18%
Sunflower	48-53%
Safflower (Kusumbha)	20-30%

Traditional Oils and Health :

For thousand of years we have been growing distinct oil seeds such as mustard, rapeseed, groundnut, sesame, niger seed and coconut. According to our ancient Ayurvedic system, sesame oil is the best for edible purpose, though mustard groundnut and coconut oils are not only healthy but possess medicinal properties as well, where as safflower oil is, said to be most inferior due to high PUFA content for Internal use [Table-2]. In depth scientific studies of these oils supports traditional (Ayurvedic) understanding and indicate that these new oils are harmful for health, especially in India cuisine where they are mostly used for frying and for pickles. (Ascherio, 1999; Shiva, 2000)

Table 2. Percentage Fatty acid Composition of Commonly Used Oils

Oil Seed	Saturated	Mono unsaturated	Poly unsaturated
Coconut	91	8	1
Mustard	6	73	21
Ground nut	20	54	26
Sesame	14	46	40
Niger	12	35	55
Soyabean	15	25	60
Sunflower	8	34	58
Safflower	11	13	76

Thus it is generally accepted that oils with a higher percentage of polyunsaturated fatty acids (PUFA) such as soyabean, sunflower and safflower lower both harmful LDL cholesterol and useful HDL cholesterol. On the other hand edible oils rich in monounsaturated fatty acids such as mustard, groundnut and sesame lower harmful LDL cholesterol level without affecting useful HDL cholesterol and hence are better for balancing cholesterol profiles. [Table-2]

In western countries the susceptibility to deterioration of soyabean oil was in the past remedied by hydrogenation. More recently, with growing evidence of the harmfulness of transfatty acids, rancidity and reversion are increasingly being prevented by the addition of anti-oxidants (Ascherio, 1999). However, according to studies conducted on soyabean oil by V.K. Tyagi and Pramod Kumar (1995) at Kanpur, deterioration of nutritional quality at high frying temperature is rapid and added antioxidants are almost ineffective in regarding this deterioration.

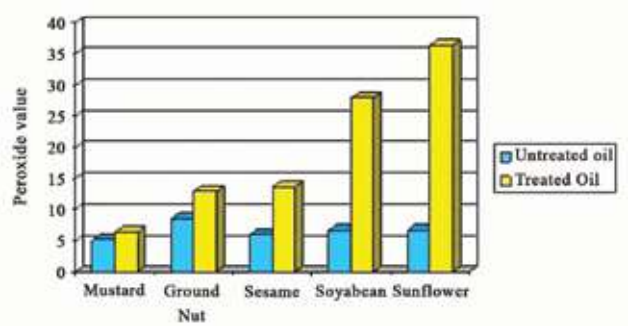
Moreover, in oils prepared traditionally, additional cholesterol - reducing properties are likely to come from the natural plant sterols and stanols contained in oils extracted without heat or solvents. Sesame contains 594 mg/100 g of soluble phytosterols while ground nut contains 247 mg/100 g and olive oil 210 mg/100g Soya and Corn oils also contain phytosterols when raw (380 mg/100g and 580 mg/100g respectively), but since these latter

need solvent or heat for extraction the sterols are invariably lost in mechanical processing (Law, 2000).

On the other hand edible oils rich in monounsaturated fatty acids such as mustard, groundnut and sesame lower harmful LDL cholesterol level without affecting useful HDL cholesterol and hence are better for balancing cholesterol profiles. [Table-2] Our studies also show that traditional Indian oils have a low tendency to oxidize in light, temperature, air and metal contact. In their natural form they contain antioxidants which prevent rancidity and reversion. In contrast, due to higher percentage of PUFAs soyabean, safflower and sunflower oils are prone to oxidation in the presence of light, temperature, air and metal. Since in India edible oils are mainly used for frying, such oils become harmful. [Table-3 & graph]

Table 3. Physico-Chemical Characteristics of Oils

Oil untreated (treated)	Iodine Value untreated (treated)	Peroxide value Untreated(treated)
Mustard	108.0 (103.6)	5.16 (6.37)
Ground Nut	90.18 (85.67)	8.55 (13.0)
Sesame	111.1 (106.2)	5.97 (13.7)
Soyabean	127.4 (121.4)	6.7(28.0)
Sunflower	134.7 (123.7)	6.7 (36.4)



Graphical Representation

According to H. Esterbauer (1993) of Institute of Bio-chemistry, University of Graz, Austria, experimental animal studies and Bio Chemical investigations lead support to the hypothesis that lipid oxidaiton products, ingested with food or produced endogenously, represent a health risk, chronic uptake of large amount of such materials increases tumour frequency and incidence of atherosclerosis in animals.

According to Tewfik I.H., Ismail H.M., Surnars (1998) of Deptt of Nutrition University of Alexandria, Egypt, ingestion of decomposition products formed as a result of thermal abuse and oxidation of frying oils are known to lead to a variety of symptoms and diseases such as allergies, atherosclerosis, coronary heart diseases etc.

'According to CFTRI, Mysore excessive intake of the PUFA content in edible oil could pose problems of another kind especially among elderly'. This could impair the ability of the antioxidants in the human system to control free radicals. Too much intake of PUFA could lead to oxidation and thereby enhance the risk of cancer. Thermo-oxidative changes in vegetable oil blends at frying conditions were studied recently at CFTRI by Nasirullah and RangaSwamy, (2009) and they also found that raw sesame oil blended with raw groundnut oil was most stable where as blend with sunflower oil was least stable during heating only due to natural antioxidants which makes the oil more stable (Ranga Swamy et al., 2008)

In another study, scientists suggested that the replacement of synthetic antioxidants like BHT in foods and vegetable oils by natural counter parts and they found seasam cake concentrate was better than BHT among six oil cakes studied by them. Sesamin, Sesamolin etc inherent Lignans are responsible for greater stability against autoxidation (Huixiao, 2015)

All the above studies clearly indicates that natural sesame and groundnut oils due to presence of natural tocopherols exhibit the protective effect against heat deterioration and autooxidation even at high temperature and long storage (Nasirullah and Rangaswamy, 2009). It also has the ideal ratio of omega-3 and omega 6 fatty acids [World Health Organization (W.H.O.) recommends N3/N6 ratio of 4:5 which is almost closer to mustard oil], a high content of antioxidants and vitamin E, as well as the fact that it is cold pressed add to the nutrition value of this oil.

India has a population of over 1 billion people and the significance of the eating habits of such a population are hard to overestimate. Their culinary preferences are important not only for their own

long term health but also because these impact directly on farmers and the ecology of the planet. Indian consumers are being denied healthy and culturally appropriate oils, which are being replaced by unhealthy and culturally inappropriate oils (Shiva, 2000). Indian farmers are being deprived of their indigenous agricultural bio-diversity.

Efforts should be made to promote native and natural oil seeds such as sesame, groundnut, mustard and coconut which are rich in oil content require less water and can be grown in suitable climatic conditions which as compared to soybean, sunflower, ricebran & safflower. The country has sufficient potential to fullfill country's need.

Some Food Items for Nutrition : Comparative View

- Gur , Desi Khand, Boora -or White Fine Sugar?
- Salt- Sea , Rock or Iodized, Refined and Purified?
- Milk- Desi Cow (A2) or Any other(A1)?
- Ghee- Bilona or any other (Cream)?
- Cearial- Fresh, Local grain, Fibrous or Fine without fibre ?

Conclusion :

Indigenous oil seeds being high in oil content are easy to process at small scale decentralized levels with eco friendly and health friendly technologies. The sustainable agriculture of these oil seeds should be promoted in India. The focus should be on the promotion of the freshly prepared and locally precured food items with rich nutritional values rather than appearance, refinement, flavours, packeging and shelf lives.

Safe, pure and full of Nutrition are those foods which nature provides and humans process with the least use of energy and no use of chemicals.

"We should honour the nature's law"

References

Ascherio, A., Katan, M.B. and Stampfer, M.J. 1999. Trans fatty acids and coronary heart diseases. New England Journal of Medicine 340: 1994-98

Byers, T. 1997. Hardened fats, hardened arteries? New England Journal of of Medicine 337: 1543-1545.

Charak Sanhita Part I 1975. Jaynendra Press New Delhi 27:249. Note: "Charak Sanhita" is an ancient Literature available on health in the Sanskrit language. It is translated by various authors and easily available in India.

Esterbauer H. 1993. Cytotoxicity and genotoxicity of lipid-oxidation products. American Journal of Clinical Nutrition 57: 7795.

Huixiao W.Y.L. 2015. Journal of the Science of Food and Agriculture,95,13,2571-2578

Law, M. 2000. Plant sterol and stanol margarines and health. BMJ 320: 861-864.

Meyer, L.H. 1960. Food chemistry. Litton Educational Publishing, Inc. USA.

Nasirullah and Rangaswamy B.L. 2009. Journal of Lipid Science and Technology, 41, 1, 10-14.

Rangaswamy B. L., Prabhdial Singh and Nasirullah 2008. Journal of Lipid Science and Technology, 40, 2, 59-64.

Sharma, R., R. Bhutra, S. Acharya and M.R.K. Sherwani 2007. Comparative analysis of four edible oils for stability against longer storage and heat deterioration during frying. Journal of Lipid Science and Technology 39:3.

Shiva, V. 2000. Stolen Harvest: The Hijacking of the Global Food Supply. South End Press, Cambridge, MA.

Tewfilk, I.H., Ismail, H.M. and Sumar, S. 1998. The effect of Intermittent heating on some chemical parameters of refined oils used in Egypt. A Public health nutrition concern. International Journal of Food Science and Nutrition 49: 339.

Tyagi, V.K. and Kumar P. 1995. Formation of polymeric fractions in frying fats. Journal of Oil Technologist's Association of India 26: 363.

Tyagi, V.K. and Vashishtha, A.K. 1994. Effect of deep fat frying on the characteristics and composition of soyabean oil. Journal of Oil Technologist's Association of India 26: 111

Nutrition Sensitive Secondary Metabolite Containing Product Development for Maternal and Child Health

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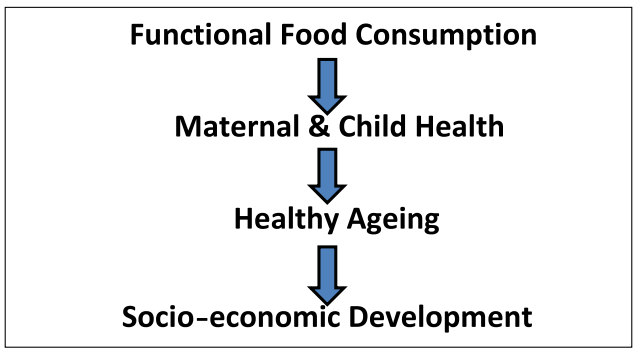
The critical challenge to effective applications of botanicals in terms of nutrition sensitive secondary metabolites is the challenge of dealing with their complexity and variability. Complexity limits effective quality control and standardization efforts to develop nutrition sensitive secondary metabolites containing modern herbal products of traditional importance for maternal and child health. As a means of addressing this problem, there is a need to identify specific lead compounds of botanical extracts and nutrition sensitive secondary metabolites that can be used for quality control and standardization.

Functional Foods

Some foods and food components have beneficial physiological and psychological effects over and above the provision of the basic nutrients. Functional foods are foods that have a potentially positive effect on health beyond basic nutrition. Nutrition science has moved on from the classical concepts of avoiding nutrient deficiencies and basic nutritional adequacy to the concept of "positive" or "optimal" nutrition.

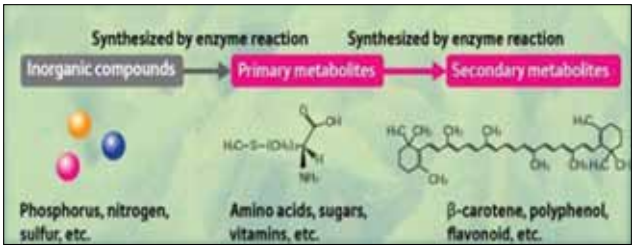


Research Trends

The research focus has shifted more to the identification of biologically active components in foods that have the potential to optimise physical and mental well being and which may also reduce the risk of disease.

Holistic Potentials

Traditional & ethnic food products including traditional recipes, fruits, vegetables, soya, whole grains and milk have been found to contain components with potential health benefits.



Metabolites: Primary & Secondary

Quantification and localization of nutritional & bioactivity

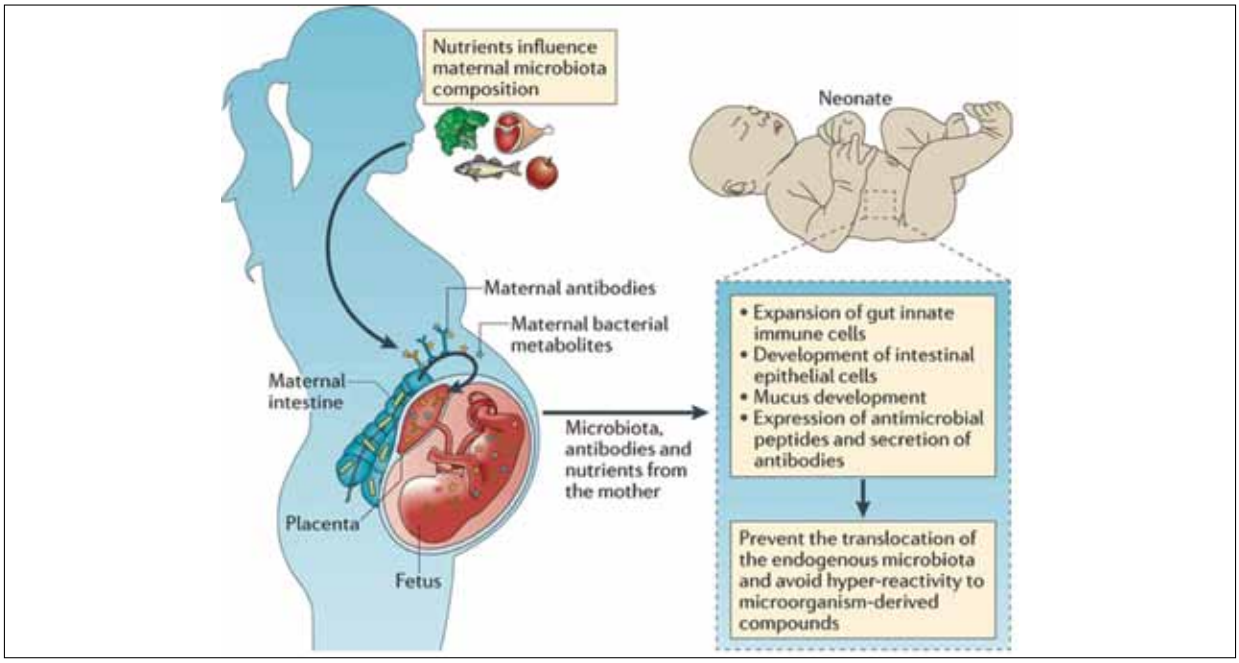
- Molecular standardization
- Metabolomics
- Receptor & Psychological responses *Anandamide & Virodhamine*
- Marker components

Ethnopharmacology & Ethnic Food Functionality

- Evidence based functional foods.
- Synergistic role of active components.

Nutrition Sensitive metabolites for maternal health

Soya contain a number of soy isoflavones including Genistein, Diadzein, and Glycetin, which are structurally similar to estrogen and exhibit;

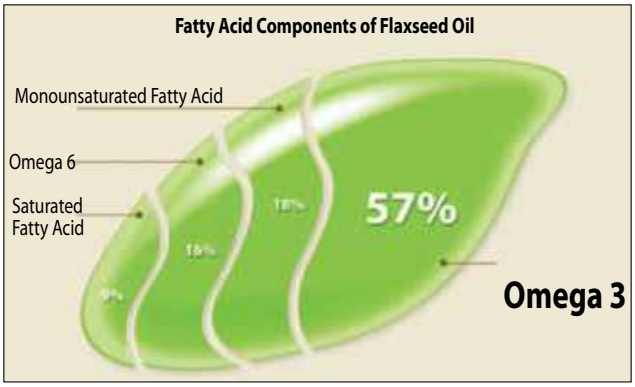


Courtesy: Nature Reviews Soya products

- Estrogen-like effects,
- Binding directly to estrogen receptors
- Inhibiting aromatase
- Disrupting estrogen signaling.

Chia seed is obtained most commonly from *Salvia hispanica* of the Lamiaceae family.

Now Chia crop production is being done by many farmers in India.



Linseed Oil

Chia seed source of omega-3 fatty acids

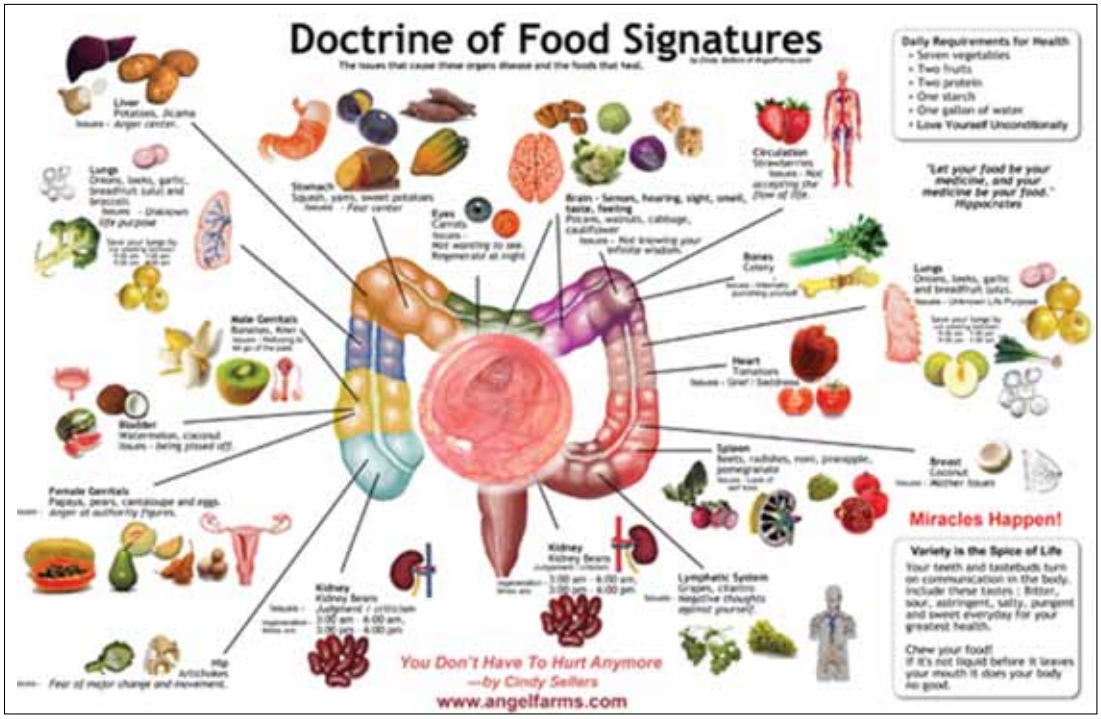
Doctrine of Signature: Linking of Herbs to Human Health

Nature has marked everything and created with a sign (signature).The Doctrine states that, by observation, one can determine from the color of the flowers or roots, the shape of the leaves, the place of growing, or other signatures, what the plant's purpose was in creators plan. If a part of the plant was shaped like part of the body it would be useful in treating a disease of that body part. Signature plants were first time recognized in ancient China, where there was a classification that correlated plant features to human organs like:

- Yellow and sweet = spleen
- Red and bitter = heart
- Green and sour = liver
- Black and salty = lungs

Modern science confirms that the ancient 'Doctrine of Signatures' is astoundingly accurate. Why does this vital knowledge remain hidden? Kidney Beans actually heal and help maintain kidney function and they look exactly like human kidneys

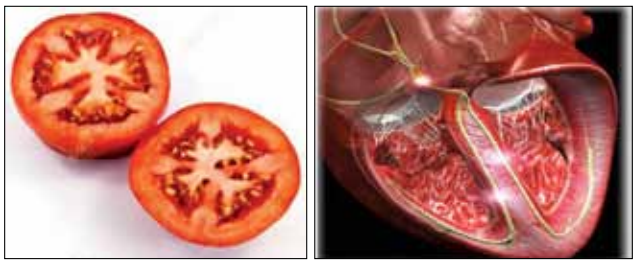
A Walnut looks like a little brain, a left and right hemisphere, upper cerebrums and lower cerebellums. Even the wrinkles or folds on the nut



are just like the neo-cortex. We now know walnuts help develop brain function. In fact, the 17th-century herbalist William Coles, author of *The Art of Simpling and Adam in Eden*, stated that walnuts were good for treating head ailments because "they have the perfect Signatures of the Head." Modern science now confirms walnuts contain nutrients that are necessary for healthy brain function, such as omega-3 fatty acids and vitamin E.

The cross section of a Carrot looks like the human eye. The pupil, iris and radiating lines look just like the human eye, and science now shows carrots greatly enhance blood flow to the eyes and aid in the general function of the eyes.

Tomatoes are red and have four chambers, just like the human heart. Modern science has now justified that tomato-lovers may be more likely to reduce the risk of serious heart disease. Lycopene, the antioxidant which gives tomatoes their dark red color, also helps remove free radicals from the body. Lycopene in its natural from also helps to prevent formation of the bad cholesterol. The bad cholesterol contributes to the buildup of plaque that narrows and constricts arteries and can lead to heart attacks.

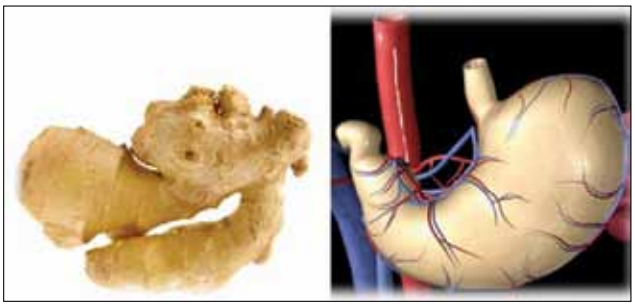


Slice a Mushroom in half and it resembles a human ear. Mushrooms have been found to improve hearing, as mushrooms are one of the few foods that contain vitamin D. This particular vitamin is important for healthy bones, even the tiny ones in the ear that transmit sound to the brain.

Our lungs are made up of branches of ever-smaller airways that finish up with tiny bunches of tissue called alveoli. These structures, which resemble bunches of Grapes, allow oxygen to pass from the lungs to the blood stream. A diet high in

fresh fruit, such as grapes, has been shown to reduce the risk of lung cancer and emphysema. Grape seeds also contain a chemical called proanthocyanidin, which appears to reduce the severity of asthma triggered by allergy.

Ginger, commonly sold in supermarkets, often looks just like the stomach. So its interesting that one of its biggest benefits is aiding digestion. The Chinese have been using it for over 2,000 years to calm the stomach and cure nausea, while it is also a popular remedy for motion sickness



Pharmaceutical perspectives of nutrition sensitive metabolites containing functional agricultural products

- Holistic Evaluation and Standardization of Functional foods of optimal bioactivity.
- Metabolomics based evaluation of ethnic foods.
- Safety & toxicity profiling of crops.
- Micro-propagation of secondary metabolites.

Conclusion

It can be concluded here that the challenges & current opportunities existing in nutrition sensitive secondary metabolites containing product development, functional foods of optimal bioactivity, sustainable socioeconomic development, elderly care & healthy ageing, and effective applications of agricultural products in terms of nutrition sensitive secondary metabolites.

Agro-biodiversity Utilization – To Achieve Sustainable Development Goals

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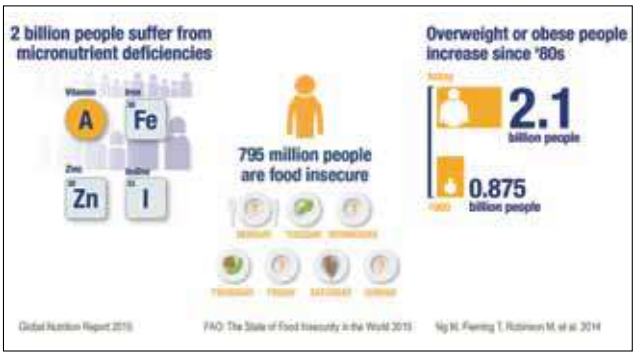
The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all**.** The SDGs are more complex and interconnected. The SDGs are:

1. No poverty
2. Zero Hunger
3. Good Health and Well-Being
4. Quality Education
5. Gender Equality
6. Clean water and sanitation
7. Affordable and clean energy
8. Decent work and Economic growth
9. Industry, Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Climate Action
13. Life below water
14. Life on land
15. Peace, Justice and strong Institutions
16. Partnerships for the Goals
17. Sustainable development Goals

Challenges

1. Global malnutrition

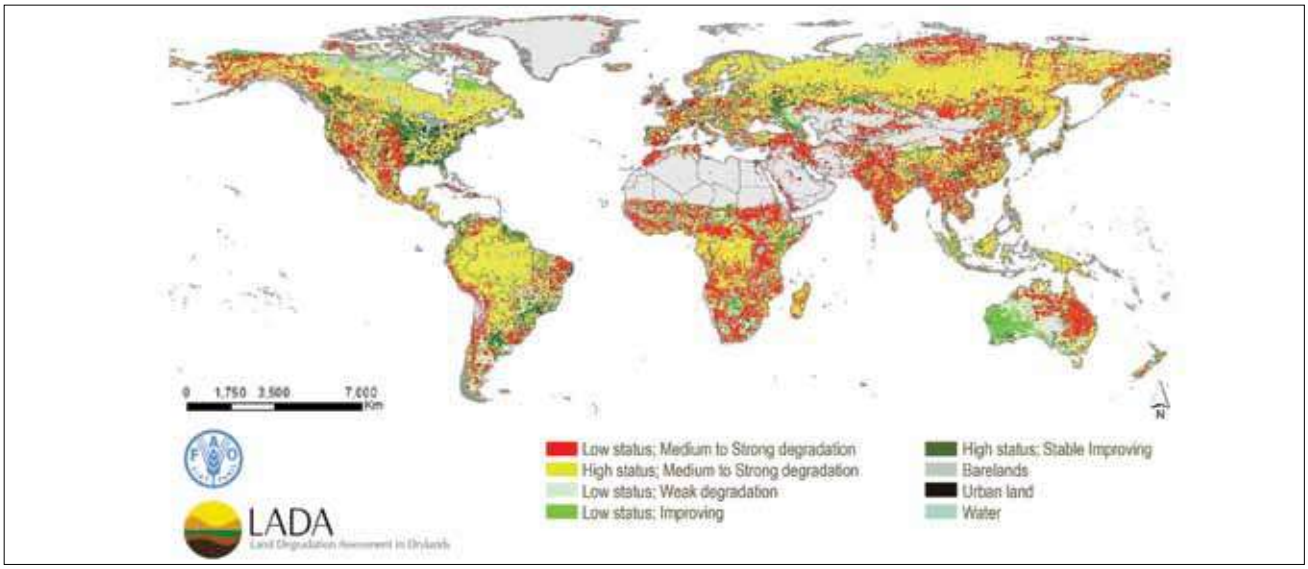


2. Climate change

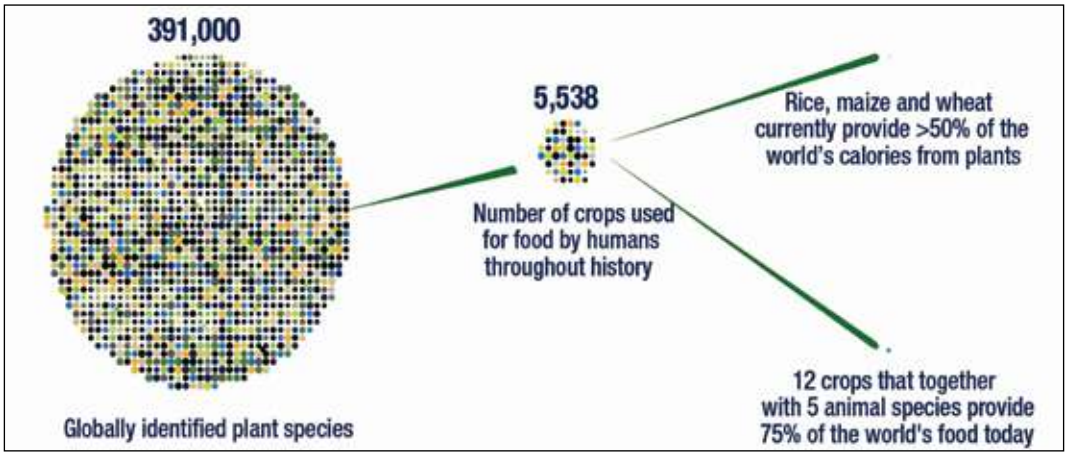
Average decline in yields for eight major crops across Africa and South Asia by 2050

(Data source: IPCC, 2014)

3. Land degradation



4. Shrinking biodiversity



Who knows that due to global climatic changes these four species will also be wiped off in future and we may end up with nothing or may be some new unknown species become our staple foods.

Data source: RBG Kew, 2016; FAO, 1997

Where do we (India) stand globally!

- Global hunger Index India ranks 100th out of 119 countries
- Global Multi-Dimensional Poverty Index - 37th out of 103 countries
- India ranks 114th out of 132 countries in stunting among children aged <5 years
- India is ranked the 3rd most obese country after US and China
- 39% of children under five are underweight
- Many suffer from deficiencies of micronutrients such as iron (>70%), vitamin A (65%) and zinc (45%).
- 51 per cent of the women of reproductive age suffer from anaemia as India ranks 170th among 185 countries
- 22 per cent of adult women are overweight.
- India Ranks 154 among 195 Countries in Healthcare Index
- India is among the bottom five countries on the Environmental Performance Index, it ranks 177 out of 180
- Human development Index, India ranks 131 among the 188 countries
- India's Healthcare Access and Quality (HAQ) index 44.8 and lags behind Sri Lanka (72.8), Bangladesh (51.7), Bhutan (52.7) and Nepal (50.8)

Our Mission

Bioversity International delivers scientific evidence, management practices and policy options to use and safeguard agricultural and tree biodiversity to attain sustainable global food and nutrition security.

Agro-biodiversity has solutions because it is

- An indispensable resource for agriculture
- Essential to ensure the production of food, fibre, fuel, fodder...
- Maintain ecosystem services essential to human survival
- Allow species adaptation to changing environments and sustain rural peoples' livelihoods

Today's crop and livestock biodiversity are the result of many thousands years of human intervention

Indian Subcontinent - Gene Rich Center

Indian subcontinent is one of the 12 world mega biodiversity centers and 17 mega diverse regions and one of the 8 centers of origin of crop plants .

- **Parts of 04 of the 35 Hot Spots of Biodiversity**
  - Himalayas, Indo-Burma, Western Ghats , Sundaland
- **About 29% of flowering plants are endemic**
  - 19000 species of higher plants
  - 5500 economically useful species
  - 583 crop species cultivated
  - 450 native crops wild relatives
  - 1000 naturally occurring edible plant species

- **Large ex situ collections**
  - Third largest base collection in NGB (~0.43 million accessions of over 1300 crop species)
  - Active collections (~0.3 million at Regional Centres of NBPGR and 59 NAGS)

Native Crops and Varieties

- Crops of antiquity and traditional farming systems of mountains
- Assured source of food and nutritional security to invalids and people from disadvantaged regions
- Highly resilient in adapting to different ecological conditions (climate change)
- Unique nutritional properties – high fiber, quality protein & mineral and amino acid composition

Finger millet

Foxtail millet

Proso millet

Barnyard millet

Small millets

Grain amaranth

Buckwheat

Chenopod

Pseudocereals

Nutritional composition (per 100 g)

Food grain	Protein (g)	Carbohydrate (g)	Fat (g)	Dietary fibre (g)	Mineral matter (g)	Calcium (mg)	Phos-phorus (mg)	Fe (mg)
Finger millet	7.3	72.0	1.3	18.8	2.7	344	283	3.9
Kodo millet	8.3	65.0	1.4	15.0	2.6	27	188	12.0
Proso millet	12.5	70.4	3.1	14.2	1.9	14	206	10.0
Foxtail millet	12.3	60.9	4.3	14.0	3.3	31	290	5.0
Little millet	7.7	67.0	4.7	12.2	1.5	17	220	6.0
Barnyard millet	6.2	65.5	2.2	13.7	4.4	11	280	15.0
Amaranth	16.5	61.4	5.7	20.6	2.8	180	535	9.2
Buckwheat	12.5	58.9	2.1	29.5	2.1	61	394	4.7
Chenopod	14.6	64.2	5.2	14.2	2.7	33	457	5.5
Wheat	11.8	71.2	1.5	12.9	1.5	34	124	3.5
Rice	6.8	782	0.5	5.2	0.6	45	113	1.8

Nutritional and Food value - Buckwheat (ogla and Phaphra)

Buckwheat is very rich in protein and amino acid lysine (deficit in what, rice and maize). It is virtually fat free and seed contains 1.5-3.7% total lipids. Rutin, the most important ingredient, keeps capillaries and arteries strong and flexible thus, results in a decreased incidence of vascular complications, effective preventative measure against high blood pressure or hypertension and has shown effect in lowering the level of blood sugar. It contains choline, which facilitates the working of the liver and also contains considerable amount of vitamins B1 and B2, potassium, magnesium, calcium, phosphate, zinc and iron are abundant.

Fagopyrum tataricum

Fagopyrum esculentum

Finger millet (mandua, kodo)

Its protein has high biological value with good amounts of tryptophan, cystine, methionine amino acids. It is rich source of minerals such as calcium, phosphorus, potassium and iron and considered to be one of the best seed for brewing. Indeed, finger millet has much more of this "saccharifying" power than does sorghum or maize: only barley, the world's premier beer grain, surpasses it.

The book 'Lost Crops of Africa' mentioned that "Outsiders have long marveled at how people in Uganda and Southern Sudan could develop such strapping physiques and work as hard as they do on just one meal a day. "*Finger millet seems to be the main reason*"

People with obesity can reduce half of their weight within short time. It is good for anemic persons, most preferable to ladies in their menopause stage (due to high calcium content), anemic and arthritis patients and a safer food for diabetic patients as its slow digestion keeps low blood sugar levels.

For obesity: One roti of finger millet (unleavened bread) at dinner along with 1 cup of cow's milk do enormous wonders to our health. After 15 days, you will feel your body weightless, extra fat reducing, sugar controlling, very good sleep at nights. This is because it filters unwanted water from our body and makes our bones and nerves tight & fit.

Quinoa

The crop of Andean origin getting popular in Europe and Western World due to its very high nutritive value. It is one of the few crops which contain all essential amino acids.

Miracle grain ideal for AP

The plants can survive the severe heat and do not need too much water

PRECAUTIONS

QUINOA FACTS

NUTRITIONAL VALUE FOR EVERY 100g

Quinoa is sold for ₹1,500 per kg in city

In Hyderabad it is being imported and sold in only 2 stores. The prices have tripled in the world market from 2006 to 2011.

Quinoa

Quinoa Nutrient	Values
Nutrients	**Amount**
Total Fat	4 g
Sodium	13 mg
Carbohydrate	39 g
Dietary fibre	5 g
Protein	8 g
Vitamin A	9.3 IU
Vitamin B1 (Thiamin)	0.2 mg
Vitamin B2 (Riboflavin)	0.2 mg
Vitamin B3 (Niacin)	0.8 mg
Vitamin B6 (Pyridoxine)	0.2 mg
Vitamin B9 (Folate)	77.7 mcg
Calcium	31.5 mg
Iron	2.8 mg
Magnesium	118 mg
Phosphorous	281 mg
Potassium	318 mg
Zinc	2.0 mg

Individual Amino Acids in Quinoa

Amino Acid	Amount
Alanine	0.34 g
Arginine	0.63 g
Aspartic Acid	0.65 g
Cystine	0.12 g
Glutamic Acid	1.07 g
Glycine	0.40 g
Histidine	0.23 g
Isoleucine	0.29 g
Leucine	0.48 g
Lysine	0.44 g
Methionine	0.18 g
Phenylalanine	0.34 g
Proline	0.44 g
Serine	0.33 g
Threonine	0.24 g
Tryptophan	0.10 g
Tyrosine	0.15 g
Valine	0.34 g

Protein

- **Complete protein** - contains sufficient amounts of all essential amino acids
- **Incomplete protein** – missing essential amino acids or contains inadequate amounts
- **Complementary proteins** – 2 or more incomplete protein sources combined

Amino Acids

Amino acids is building blocks of protein. There are 20 different amino acids out of which 9 essential amino acids which cannot produce in body so they must be provided through the diet and 11 Non-essential amino acids, **c**an be synthesized by the body.

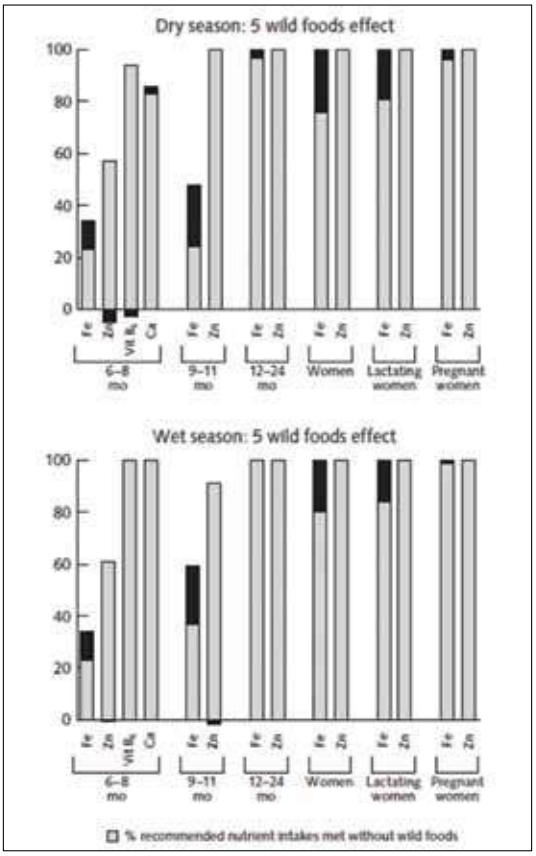
Potential of wild foods to reduce the cost of a nutritionally adequate diet

Case study in Baringo District, Eastern Kenya

Adding wild foods to modelled diets resulted in a lower-cost diet, while meeting recommended iron intakes for women and children between 12 and 23 months of age. Even after integrating wild foods into the model, targeted approaches are needed to meet micronutrient requirements for infants from 6 to 8 and from 9 to 11 months of age.

Loosing ground – Why?

- Changing cropping patterns (shift towards cash crops (off-season), which have well developed door step market)
- Changing food habits and life styles of the people particularly the young generation



% recomended nutrient intakes met without wild foods

Additional % of recommended nutrient intakes met with all wild foods respectively *Berchemia discolor*

- Lack of alternative uses/products and full R&D backup
- Food and pharmaceutical industry not exploiting for its bioactive contents; may be because of lack of published research data
- Lack of awareness about its food value among farmers and urban societies (in today's context deliberate ignorance)

Agro-biodiversity based integrated farming systems gives

Agro-biodiversity based integrated farming systems gives better nutrition, risk management, regular income & self employment and better conservation of natural resources thus better ecosystem services and capacity to adapt to climate change. The SDGs can achieve by agrobiodervisty reducing poverty, hunger, nutrition, ecosystem services / climate, life on earth, sustainable production and consumption and clean energy.

A consistent long-term monitoring system for agrobiodiversity to be applied across four sustainable food system components:


Water harvesting/ fish pounds

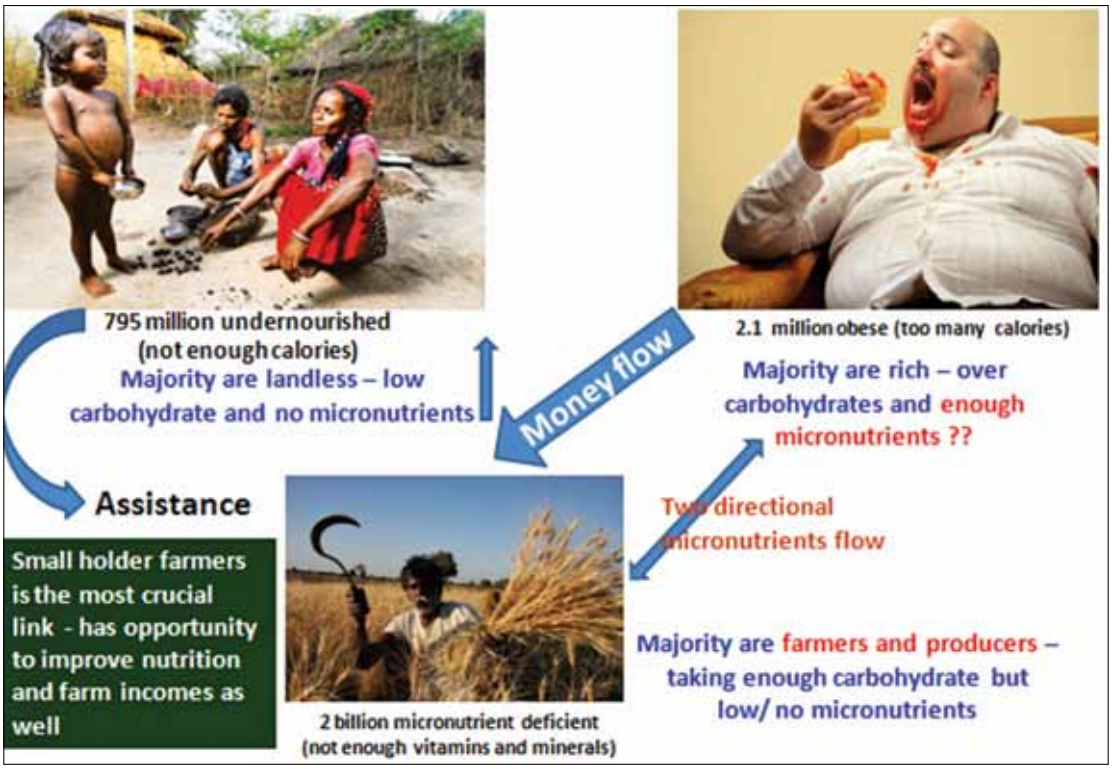

Vermicomposting


Backyard poultry


Honey


Backyard gardening


On farm processing & market link

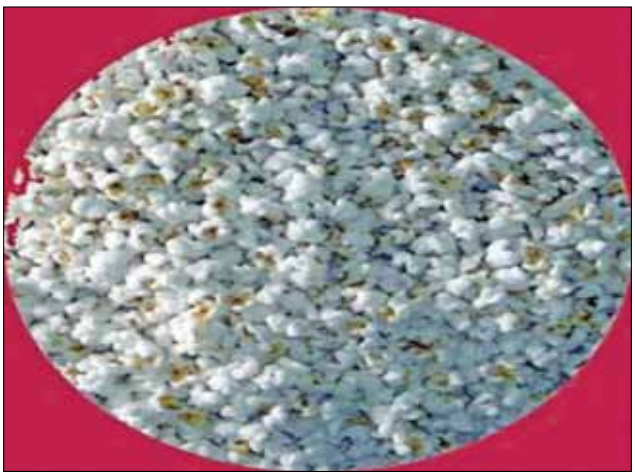


- Consumer demand can be increased by adding value through processing/packaging.

Packaged rajmash

Maize (Malan) Papad

Makki ki Chakli



Popped sorghum

A Consistent long-term monitoring system for agro-biodiversity to be applied across four sustainable food system components:

- Nutritious, diverse diets
- Productive and resilient farms and landscapes
- Farmers' access to quality, diverse seeds
- Conservation of agro-biodiversity for future options

References

http://www.fao.org/home/en/

https://www.kew.org/science/our-science/publications-and-reports/publications

https://www.ipcc.ch/report/ar5/wg2/

https://globalnutritionreport.org/reports/2016-global-nutrition-report/

Agriculture for Nutrition Secure Communities: PRADAN's Experience

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Project at a Glance

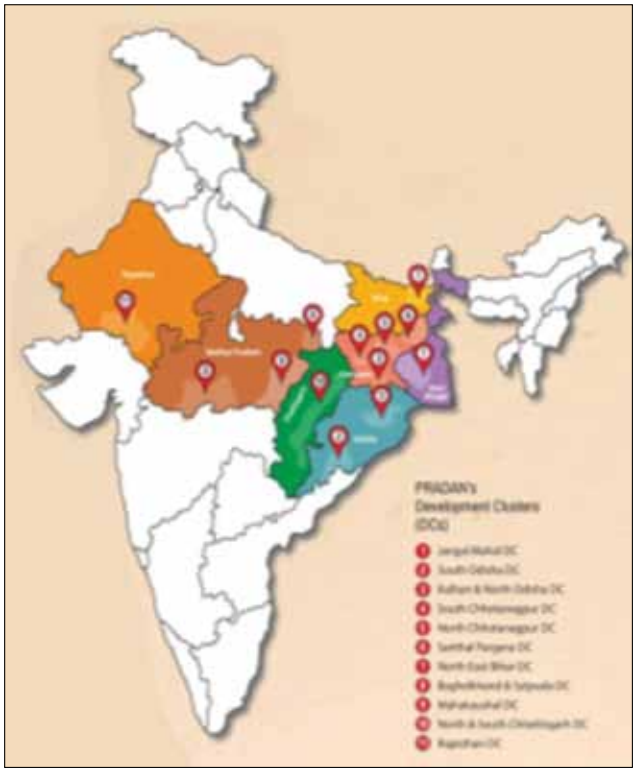
The project is running in 37 districts of 7 states covering 8732 villages of 117 blocks of these districts. Total 69889 SHGs were formed with 853928 members, and covered 3 million individuals.

Partners

- Government Departments (Central & State): 33
- Foundations & Multilaterals: 31
- Corporates: 6
- Research Institutes: 6
- Civil Society Organizations: 61

Nutrition Initiative

Nutrition initiative was started in 11 blocks of 5 States, covering 408 Villages and total 36723 Hhs covered. Technical support is given by PHRN organisation.



Our Founding Philosophy

- **Communities as Drivers :** We believe that the people have innate capability to be the drivers of change.
- **Professionals as catalysts :** Professionals with knowledge and sensitivity must work as a catalyst in stimulating the change.

Empowering Change: Our Approach

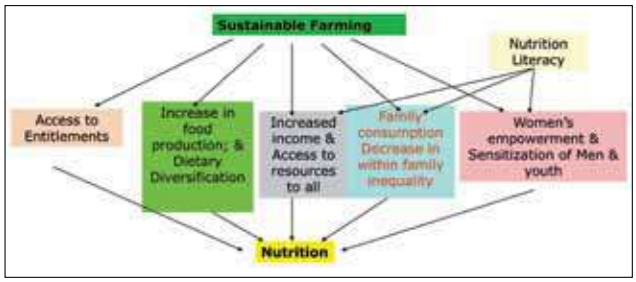
- **Social Mobilization :** Engaging with communities, building human capabilities
- **Food & Nutrition Security :** Reducing hunger, ensuring year round food production.
- **Managing Natural Resources :** Making most of Nature's gifts through husbandry, suitable technologies and investments
- **Livelihoods & Market Linkages :** Building models of alternative livelihoods, training the community in new skill sets & linking to markets, to funds, to government.
- **Governance :** Making the community aware of its rights, empowering them to have a say in the way the things are run.
- **Multi-Dimensional Change:** Helping communities to achieve better outcomes around health, nutrition, WASH, etc.
- Gender as an approach is integrated across all programmes.

Pathways

Pathways looked at:

- **0 :** Weak links between GDP growth, even from agriculture, and malnutrition reduction
- **1 :** Home production of more diverse foods leading to their consumption
- **2 and 3:** Increased income with from agriculture or not, affecting choices about food and healthcare purchase

- **4:** The impact of food prices on the types of diets people choose or can afford
- **5, 6 and 7:** The impact of women's empowerment through their control of income and subsequent household decision making; effects on their time use and child care and feeding; and their energy use in doing agricultural work and impacts on children through the lifecycle and on productivity. Left side is mostly at a macro level, and is what agriculture has typically focused on. Increased attention to the right side (red text) at a more household level is warranted if we really want to improve nutrition.

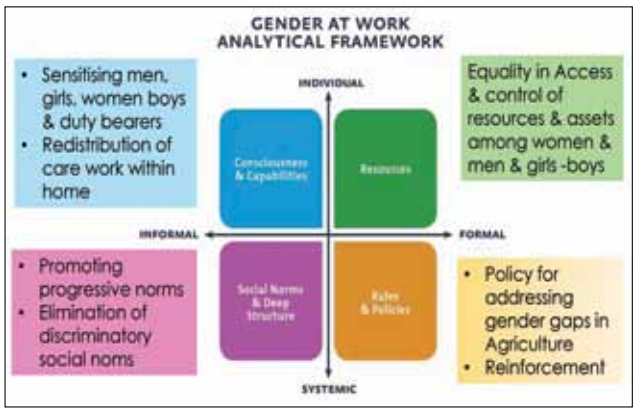


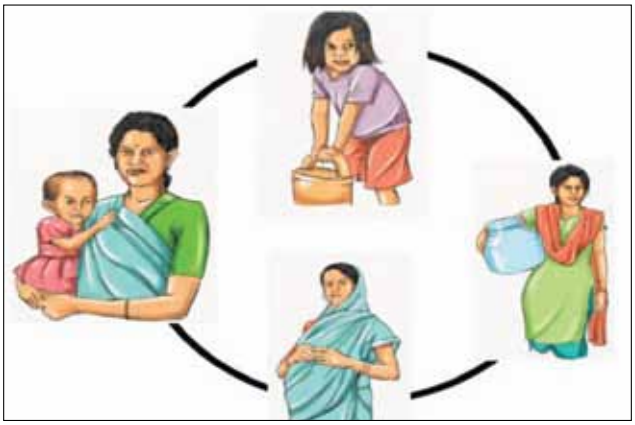
Domains of intervention

Women Collectives Led Change Process

- Adequate production of nutritious food
- Diet diversity, ensuring hygienic and nutritious Food
- IYCF, Care of infants, pregnant & lactating mothers
- Women's empowerment
- Access to and functioning of public services

Integrating Gender in Nutrition Sensitive Agriculture to break Cycle of Malnutrition





Adapted from Gender at work framework (Ken Wilber, 2000)

Nutrition-centric Crop Planning

- Assessment of Nutrition Requirement
- Farm decisions on- Crop, Variety & area based on
  - Nutritional requirement of family
  - Traditional & modern wisdom
  - local agro-eco conditions
  - Resource availability of Family

Prototypes for Nutritional Farming

Cereal

Leafy Vegetables

Pulses

Cash crops

Behaviour Change Communication

WINGS Early Findings

Research project (2015-19), Women Improving Nutrition through Group-based Strategies (WINGS), led by the International Food Policy Research Institute (IFPRI) in partnership with PRADAN, supported by the Bill & Melinda Gates Foundation and A4NH, aims to evaluate the impact and pathways to impact of SHGs on women's and children's nutrition in India, focusing on agriculture-nutrition pathways.

Few Early observations:

Compared to non-SHG members, SHG members are more likely to know and interact with other women, even those outside their locality, attend village meetings, have a voter's card, vote, and vote according to their own choice. SHG members are not only significantly more likely to know about certain public entitlements, particularly those targeting households, they are also more likely to use the programs they know about.

SHGs also appear to empower women by increasing their knowledge of agricultural practices. Providing agricultural extension services through women's groups offers an opportunity to overcome the inefficiency and limited reach of India's public extension system, which typically targets men.

Insights

1. Integrated Approach
2. Sensitisation of Men and Youth, PRI members led to faster results
3. Better coordination among key stakeholders like WCD, AGRI-HORTI, NRLM, NGNREGS Departments & CSOs

Challenges

1. Coordination among departments
2. Women access & control over resources
3. Poor access of farming schemes due to eligibility requirement of Land ownership. Due to policy
4. Level structural barrier, Land less/Lease Farmers, especially women farmers can not be benefitted from schemes
5. Patriarchal mind set of duty bearers & PRIs

About PRADAN

Established in 1983, PRADAN is one of India's oldest not-for-profit organizations registered in Delhi under the Societies Act. It is also India's foremost civil society organization striving to create a just and equitable society.

Nutrition Sensitive Agriculture - Sharing Experiences

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Introduction

Nutrition security is a prime concern of our country today, as the number of people suffering from lifestyle related diseases and specific nutrient deficiencies are on the steep rise. Agriculture aims to reduce nutrition inadequacy by dietary diversity and household food security through food crop diversification in own farmland and homesteads. Nutrition sensitive agriculture ensures steady inflow of nutritious food along with increased savings on food items bought from the market. Present study confined in Kochewada village of Balaghat district, Madhya Pradesh.

Distance from Balaghat	52 Km
Population	1598
Sex ratio	1010
Total Family	254
Schedule Trible (ST)	162
Schedule Caste (SC)	20
Other Backward Caste (OBC)	72
Literate women %	55
Total area (ha.)	234.94
Irrigated	219.59
Major Crops	Gram, Wheat, Paddy, Sorghum, Vegetable, Pulses, Oilseed etc.

Production (Yearly)

Crops	Production (q)	Vegetable	Production (q)
Pulses	1350	Brinjal	900
Wheat	7800	Cowpea	900
Paddy	1500	Tomato	600
Maize	150	Okra	300
Oilseed	200	Leafy vegetable	250
		Potato	300
		Bitter guard, Pumpkin, bottle guard	360
		Onion garlic	450
		Groundnut	30

Fruits	Production (q)	Forest	Production (q)
Mango	90	Chirozi	1
Papaya	10	Teandu, mahua	1500
Custard Apple	600		
Jamun	20		
Guava	15		
Lemon	20		

Consumption and sale of produce

Name of Crop	Consumption (q)	Sale (q)
Paddy	4500	10500
Wheat	800	7000
Pulses	350	1000
Oilseed	150	50
Vegetable	800	2700
Fruit	250	400
Milk (litre)	1000 ltr	800 ltr

Activities

Vermi compost production

Vermi compost production is low cost production technology of compost can be prepared at house hold level. Vermi compost production is done in every season. Vermi compost improves the fertility and humidity of land and decreases the dependency on chemical fertilizer like DAP, urea and potash. With the utilization of compost in land, they were selling verms also. Small farmers produced compost as per their requirement.


Vermi composting


Paddy nursery


Paddy transplanting

Per Acre	Before	After
	Traditional method	SRI Method
Seed	50 Kg	3 Kg
Production	7 q	16 q
Cost (Rs.)	6000	3000
Time	8-10 days	3 days
Seedling planting time	45 days	8-12 days
Profit per farmer (Rs.)	10,000	50,000


Seepage Tank

Production of chilli-100 qtl


Local Brinjal production – mixed cropping method – 900 qtl.

Major activity of women farmer empowerment project

SRI method is more economical than other method as profit is more than the other method of paddy cultivation. In SRI method 3 kg seed is sufficient for one acre land, for proper aeration and sun light 8-12 day old seedlings of paddy are planted at 10 inch distance and more production as compare to traditional method.

Conclusion : On the basis of experiences shared by practicing farm women, it is concluded that using technological interventions in right time both income and nutrition security could be achieved, even among resource poor farmers through group approaches.

SECTION-II

ENABLING SUITABLE GOVERNANCE AND POLICY

भाकृअनुप
ICAR

Food and Nutrition Security Governance: Growing Understanding and Emerging Perspectives

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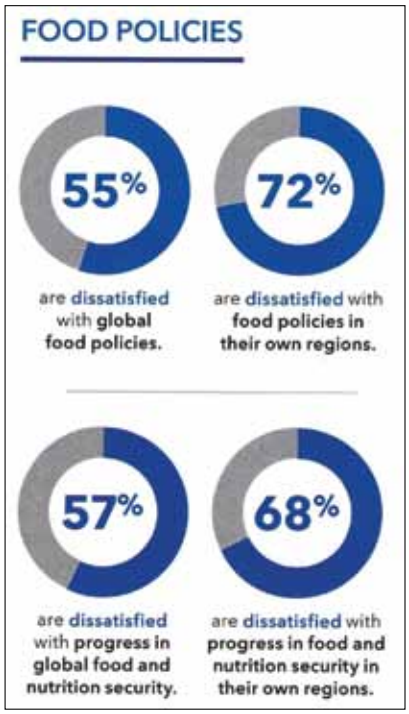
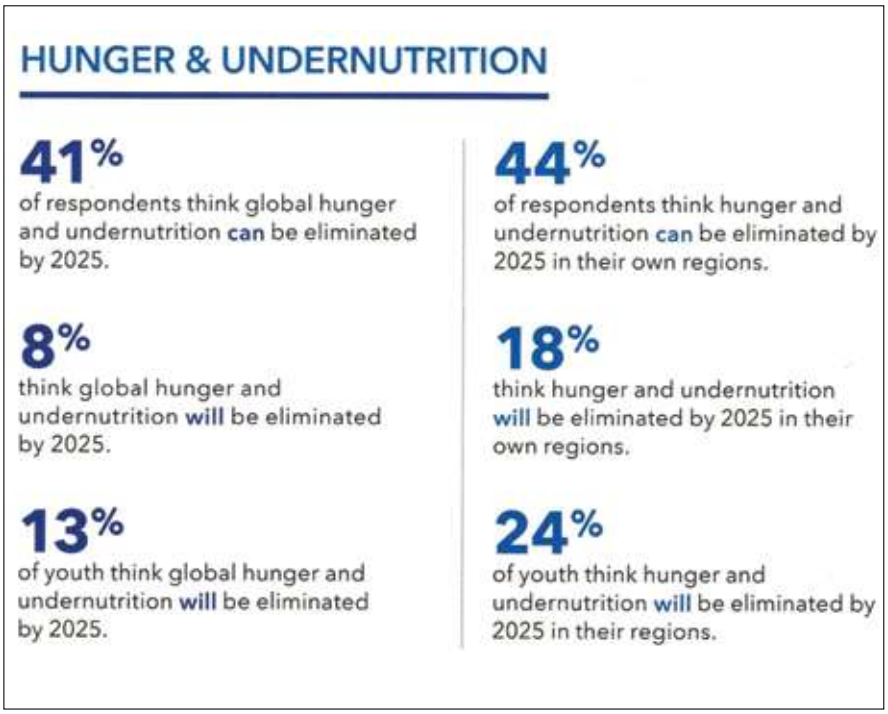
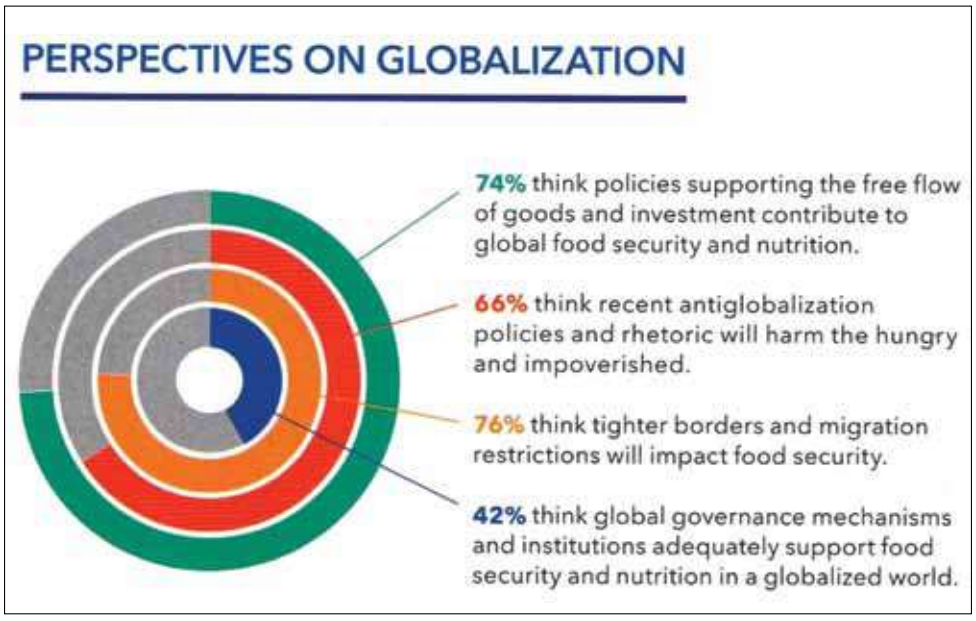
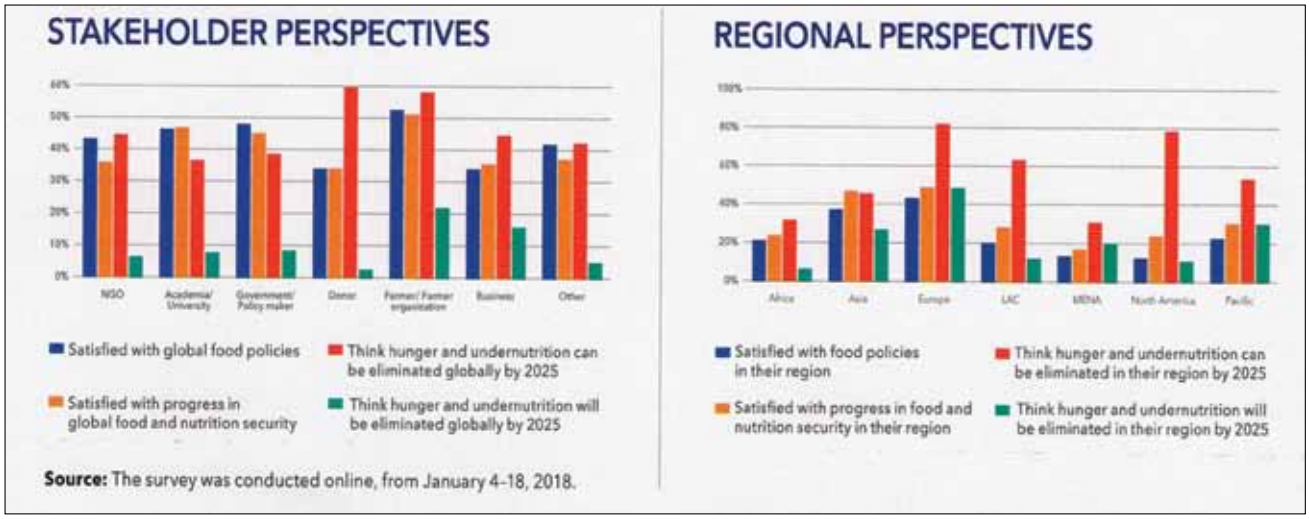
Over 1,000 individuals from 105 countries responded to the survey on perceptions about now and for the future, and on the impacts of globalization (*Source – Survey carried out for Global Food Policy Report 2018*).









Global Initiatives at Interface of Food Policy : 2017

UN adopts indicator framework to track progress toward the 2030 agenda for Sustainable Development Goals. Over 20 Million people at risk of famine in Nigeria, Somalia, South Sudan, and Yemen. UN appeals to the international community help avert devastating levels of food insecurity. G20 Agriculture Ministers commits to sustainable water use in food and agricultural production. Norway creates fund to protect land and reduce deforestation during the World Economic Forum. But child malnutrition remains alarming as in 2017, it was estimated that child malnutrition show that stunting is declining too slowly and overweight is rising, especially in Africa and Asia.

- **US Announces Withdrawal from Climate Agreement**
  - The US president announces plans to withdraw from the 2016 Paris Agreement committing countries to act to limit the global temperature rise.
- **China Issues National Nutrition Plan**
  - China launches new plan for achieving health and nutrition goals between 2017 and 2030 that includes regulations, research, and monitoring.
- **Bangladesh Rolls Out New Action Plan for Nutrition**
  - The 2016-2025 plan aims to improve the population's nutritional status and reduce all forms of malnutrition, with a focus on children, adolescent girls, pregnant, and new mothers.
- **World Hunger is Rising**
  - The State of Food Security and Nutrition in the World 2017 estimates that the number of undernourished people rose from 777 million in 2015 to 815 million in 2016.
- **Hurricanes Devastate Caribbean**
  - Two back-to-back category 5 hurricanes and other storms displace hundreds of thousands of people, destroy infrastructure, and cut off access to food and water supplies for weeks.
- **G7 Commits to Protect Farmers**
  - The G7 Agricultural Ministerial Meeting focuses on protecting farmers' incomes and market crises, natural disasters, and climate change.
- The Global Nutrition Summit draws $640 million from Donors and Govts to Fight Global Malnutrition
- UN Climate Change Conference brings together signatory governments of the Paris Agreement
- WTO fails to reach agreement on farm and fisheries subsidies and other issues.
- Economic inequality is widespread and growing suggesting that policies have an impact

SDGs: India's Preparedness and the Role of Agriculture

Almost all the 17 SDGs are interdependent and influence total agriculture food system.

India Launches National Nutrition Strategy

The Strategy commits to ensuring that every child, adolescent girl, and woman attains optimal

nutritional status by 2022, linked to a "Clean India" and "Healthy India". India is implementing numerous nutrition specific and nutrition sensitive programs to address the intermediate and underlying causes of under-nutrition, ongoing reforms to its PDS, double farmers' incomes by 2022.

Making the Governance Work

Moving toward Nutrition Sensitive Food Systems through Polycentric/Distributed Governance should make external and internal current technical and institutional arrangements to shape favorable policies to achieve food systems diversity through direct interventions by structural changes in relative prices and targeted food subsidies and indirect measures by improving agricultural infrastructure & economic environment. ACZs/ACSZs undergoing economic and nutrition transitions and examine policy options and their impacts on a nutrition sensitive approach.

Innovations for Improving Nutritional Security: Lessons from Chhattisgarh, India

Changes in nutrition and health outcomes have been mixed in Chhattisgarh between 2006 and 2016. Considerable improvements across nutrition determinants and intervention coverage in the last 10 years.

Chhattisgarh now needs to put in place a strategy that considers all forms of malnutrition captured in the WHA indicators – Stunting (among children<5 years), anemia among women of reproductive age, exclusive breastfeeding, wasting (among children<5 years), low birth weight. (Source: George, N.R., P.H. Nguyen, R. Avula, and P. Menon, 2017)

Efforts to Improve Nutrition Basket: CGSPC

- Long term Multidisciplinary Action Research connecting to Nutrition Policy.
- Develop R&D mechanism to integrate nutrition outputs in agricultural monitoring systems.
- Identify nutrition gaps at HHs level and the potential of agriculture to fill these gaps.
- Assess and strengthen synergies between agriculture, health and other sectors for improved nutrition security.

Validation of TEK through Genomics, Maps & Markers:

Chhattisgarh has traditionally been home of aromatic and medicinal rice and other crops, NTFPs, and freshwater aquaculture. Tribal, farming and village communities have collective TEK. Efforts have been made at IGKV and other R&D institutions of the State to validate TEK/ITK through Genomics, Maps & Markers.

Few examples of Synthesis between TEK and Genomics:

Rice varieties (Gathuan, Lycha and Maharaji) were tested at BARC for their anticancer efficacy in human breast cancer cells; high zinc rice variety Chhattisgarh Zinc Rice-1; Sugar balanced white rice suitable for Type 2 diabetes; Bio-fortified little Millet Chhattisgarh Kutki-2, which is highest iron containing variety; Linseed is main plant based source for Omega 3 fatty acid and is good source of protein, Vit B, Cu, Zn, K, Fe, bio-fortified tuber crops for food and traditional medicare process technology for Ragi based food product.

Advent of a Link between Ayurveda and Modern Health Science through Genomics, Maps & Markers

Focus KVKs priorities on understanding and leveraging the potential of agriculture and food systems for nutrition security, particularly in villages and cluster of HHs where levels of malnutrition and hunger are highest. Model of nutritional gardens of vegetables and fruits for round the year availability is designed. Implemented in 50 schools of Kanker, Raipur, Dantewada, Gariyaband, Balrampur and Mahasamund districts. Scaling up of Nutritional Garden models of KVKs to a large number of Aashram Schools and Peri Urban Schools in different agro-climatic regions according to food consumption pattern. Also Promote family farming systems through IFS. Converting rice bund to nutritional bund for household nutritional security – cultivation of fruits, vegetables, pulses and drumsticks

Scaling of Kadaknath – high nutritional poultry breed, small ruminates and mushroom production for landless and marginal farmers, also through SHGs and FPOs. Utilization of wetlands for food, nutritional and livelihood security, i.e. freshwater aquaculture and aquatic crops (Water Chest Nut,

Foxnut and Lotus and other). Diversification of smallholder production systems towards more nutritious crops and livestock products is catching up in three agro-climatic reason through network of SHGs, FPOs/FPCs and cluster/common pool resource based farming. Introduction of millets, pulses and fortified crops in PDS through decentralized governance systems.

Shaping Actionable Policies to Achieve Nutrition Sensitive Food System

Understanding nutritional attributes of different crops including fruits and vegetables and aquatic crops, fisheries, poultry and small ruminants, and NTFPs . Budgeting for a diversified food system for improved nutritional outcome - agriculture policy in India and even in many developing countries continues to be largely in favour of staples - be it the input policy, credit policy or the procurement policy. Design crop neutral agriculture policy, investments in research, innovation, information, communication, and training for promoting diversified food system.

Introduce pulses, regionally appropriate millets, or other nutritious crops under the cover of the MSP and the Public Distribution System (PDS). Assured procurement of these nutritious crops will encourage farmers to increase production and also will subsidize the consumption of these crops for low-income consumers. The promotion of animal husbandry for meat and dairy is equally important. Poultry production is on the rise in India. Goat and other small ruminant include also in production systems.

Develop institutional mechanism, involving KVKs, Agril. and other universities/ institutions, Departments of Agriculture, Primary school education, Health, Rural Development, Tribal welfare and Panchayats, WCD, UNICEF, NGOs/ CSOs, MGNREGA, RKVY, PMKSY, NAFM, MSAD, NHM for self governing convergence systems to improve nutrition outcomes of agriculture.

Focus on using a food systems approach to tackle the multiple challenges of hunger, climate change, inequality, jobs, and growth. Examine the links between agriculture, migration, and rural development due to natural disasters, and climate change. The government needs to review Food safety policy

At the global, regional, and national levels, data and evidence must remain at the heart of more open, transparent, and inclusive food systems and create common pool nutritional fund for sustaining nutritional security of children. Develop distributed governance/decentralized/polycentric governance to establish dynamic feedback systems.

Reference

George N.R., P.H., Nguyen, R. Avula and P. Menon. 2015. Improving Nutrition in Sikkim: Insights from Examining Trends in Outcomes, Determinants and Interventions between 2006 and 2016. POSHAN Policy Note 31. New Delhi: International Food Policy Research Institute.

Efforts of KVKs in Improving Nutritional Literacy at Grass Root Level in Northern States

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The past two decades have witnessed a sizeable expansion in agricultural production and food supply. The fast-developing Indian economy during this period has enabled higher disposable income in the hands of people. In spite of all this, the incidence of malnutrition in India is still widespread and much higher than the reasonable levels and most vulnerable are children, girl & women. Child under-nutrition rates in India are among the highest in the world with nearly half of all children under three years of age are either underweight or stunted. The children and women made 70 percent part of total population of India. In India every 3rd child is under nourished and every 2nd child is anaemic.

The situation of malnutrition in India is really worrisome and disgraceful. Children and youth in this condition suffer from numerous nutritional deficiencies which adversely impact their health. In India, the new National Family Health Survey-4 (2015-16-NFHS-4) data for 2015-16 unveiled that 38% of children below five years of age are stunted, 21% are wasted and 36% are underweight. The nutritional status of children under five years of age is critical in Bihar, Jharkhand, Uttar Pradesh, and Dadra and Nagar Haveli whereas situation is better in Kerala and Mizoram. Body Mass Index (BMI) below normal is the most evident in Bihar, Jharkhand, Madhya Pradesh, and Uttar Pradesh while the condition is better in Sikkim.

Global Hunger Index score of India and neighbouring countries

Countries	1992	2000	2008	2016
India	46.4	36.2	36.0	28.5
China	26.4	15.9	11.5	7.7
Nepal	43.1	36.8	29.2	21.9
Pakistan	43.4	37.8	35.1	33.4
Bangladesh	52.4	38.5	32.4	27.1
Sri Lanka	31.8	27.0	24.4	25.5

Source: IFPRI (2017), Global Hunger Report-2016

How India compares with its neighbours

Rank	Country	GHI score	% of malnourished	% under 5 stunted
29	China	7.7	8.8	8.1
72	Nepal	21.9	7.8	37.4
75	Myanmmar	22	14.2	31
84	Sri Lanka	25.5	22	14.7
90	Bangladesh	27.1	16.4	36.4
97	India	28.5	15.2	38.7
107	Pakistan	33.4	22	45

Source: Global Hunger Index

Note: *A higher rank implies a worsening hunger situation*

- Investment in Nutrition leads to benefit cost ratio of 16:1 for 40 low and middle-income countries (Global Nutrition Report 2015)
- Universalisation of optimal breastfeeding practices in India could reduce around 156,000 child deaths Lancet (2016)
- Optimal breast feeding could lead to saving of cognitive losses tune to Rs. 4300 crores annually in India Lancet (2016)

Factors causing under-nutrition at different stages of life

During early years

- Delayed initiation of breastfeeding
- Low birth weight
- Delayed introduction of weaning foods

During adolescence

- Low dietary intake
- Consequential occurrence of anaemia

Young and pregnant women

- Early marriage and child birth
- Low intake of protein and iron rich foods
- Inadequate birth spacing

Old age

- Poor absorption of nutrients
- Vulnerability to frequent infections and illness

Extent of malnutrition among children (<5 years) in Northern states

Category and State/ UT	Stunted	Wasted	Underweight	Anaemic
Punjab	25.7	15.6	21.6	56.6
Haryana	34.0	21.2	29.4	71.7
Himachal Pradesh	26.3	13.7	21.2	53.7
Jammu & Kashmir	27.4	12.1	16.6	43.3
Uttarakhand	33.5	19.5	26.6	59.8
India	38.4	21.0	35.7	58.4

Source: National Family Health Survey – 4, 2015-16

Extent of malnutrition among adults (15-49 years) in Northern states

Category and State/ UT	Low BMI@		High BMI#		Anaemic	
	Women	Men	Women	Men	Women	Men
Punjab	11.7	10.9	31.3	27.8	53.5	25.9
Haryana	15.8	11.3	21.0	20.0	62.7	20.9
Himachal Pradesh	16.2	18.0	28.6	22.0	53.4	20.1
Jammu & Kashmir	12.1	11.5	29.1	20.5	40.3	15.1
Uttarakhand	18.4	16.1	20.4	17.7	45.2	15.5
India	22.9	20.2	20.7	18.6	53.0	22.7
Note: @=underweight; #=overweight;						

Source: National Family Health Survey – 4, 2015-16

Extent of obesity in Northern states

State/UT	Urban		Rural		Overall	
	Men	Women	Men	Women	Men	Women
Haryana	21.0	24.3	19.3	18.8	20.0	21.0
Jammu & Kashmir	30.1	40.6	15.8	24.1	20.5	29.1
Himachal Pradesh	26.9	38.4	21.0	27.6	22.0	28.6
Punjab	32.1	32.4	25.0	30.6	27.8	31.3
Uttarakhand	23.0	28.4	14.1	16.0	17.7	20.4
India	27.2	31.4	16.8	18.2	18.6	20.7

Source: 2015-16-NFHS-4

The number of children under 5 who are overweight is approaching the number who suffer from wasting. This number is increasing rapidly in ASIA (Global Report in Nutrition, 2016). NFHS-4 reports that overweight/ obesity has affected almost- 20% women & 18.6% men. Over nutrition is becoming an emerging issue. Chandigarh is on top with obesity in women by more than 40%, proportion of obese individual was higher in urban than in rural areas; proportion of females obese individuals was higher than in males; obese person was higher in Punjab & Haryana than the national average; obesity in urban men in HP & rural men in J&K was lower than National Average; proportion of obesity in Uttrakhand was lower than national average in all categories.

Convergence Model at District Level for improving nutritional literacy

Women & Child Development

- Drinking water & Sanitation
- Agriculture
- Public Distribution System
- Rural Development
- Health & Family welfare
- Education

Nutrient SMART Villages: Nutrient SMART villages were made to mitigate malnutrition through Krishi Vigyan Kendras. It is a framework which includes the various agriculture interventions, awareness campaigns and capacity building programmes, field days and field demonstrations on nutri rich crops and varieties, farmers-scientists interface, exposure visits, streaming of videos on healthy practices as well as on nutri rich varieties, minimal processing techniques of pulses, fruits and vegetables etc. The interventions target various stakeholders such as farmers, farm women, Self Help Group members, anganwadi workers, school children etc.

Nutirtional garden: Nutritional security can be achieved by nutritional garden. For promotion of health and prevention of malnutrition, there is need to create awareness among farmers and farm women to develop nutrition gardens in order to grow fresh and clean vegetables for making them a part of our daily diet. Based on the concept that the human diet in India is mainly cereal based food and the consumption of even low cost protective foods is far below the satisfactory levels. Vegetables, fruits and pulses constitute the major source of all types of protective elements like vitamins, minerals and proteins, hence their inclusion in everyday diet is absolutely necessary. KVKs are playing very important role to guide farmers by laying out demonstrations in selected households and model nutri-gardens in KVKs so that the visiting farmer(s) can visualize and replicate the same model in their backyard.

Importance of nutrition garden

Due to inadequate consumption of vegetables, deficiency of micro-nutrients especially of iron, vitamin A and iodine are prevalent in the developing world. Vegetables reaching the market are contaminated with pesticides

The importance of nutrition garden

- Year round availability of vegetables
- Production of safe and nutritionally rich vegetables
- Save on grocery bills
- All ages can participate

Details of Existing KVKs of ICAR-ATARI, Ludhiana

S. N.	State	Host Institution	Type of Host Inst.	Total
1	Punjab	PAU, Ludhiana	SAU	18
		GADVASU, Ludhiana	SAU	3
		ICAR-CIPHET, Ludhiana	ICAR Inst.	1
2	Uttrakhand	GBP University of A&T, Pantnagar	SAU	9
		V.C.S.G. Uttarakhand University of H&F, Bharsar	SAU	2
		VPKAS, Almora	ICAR Inst.	2
3	Himachal Pradesh	CSKHPKV, Palampur	SAU	8
		Dr.YSPUH &F, Solan	SAU	5
4	Jammu & Kashmir	SKUAST, Jammu	SAU	7
		SKUAST, Srinagar	SAU	13
		ICAR-CITH Srinagar	ICAR Inst.	1
Total				**69**

Nutritive Value: Fruits and Vegetables

a) Vitamins

Components	Fruits	Vegetables
Vitamin A (Retinol)	Mango, Persimmon, Apricot, Passion fruit, Papaya, raspberry, Loquat, Date palm, jackfruit	Carrot, amaranthus, palak, spinach, fenugreek, mustard leaf, drumstick leaf, partulaca, cowpea leaves, broccoli, kale, muskmelon, winter squash
Vitamin B1 (Thiamin)	Cashew nut, walnut, almond, apricot, banana, apple, plum	Palak, pea, ripe tomato, chilli, muskmelon, garlic, leek, tannia, asparagus, artichokke, agathi
Vitamin B2 (Riboflavin)	Bael, litchi, papaya, pineapple, pomegranate	Palak, chilli, capsicum, cauliflower, broccoli, brussels sprout, garlic lettuce, salery, okra, winged bean, asparagus, partulaca, parsley
Vitamin B3 (Niacin)	Apricot (Dried), bael, cherimoya, custard apple, mango	Palak, amaranthus, bitter gourd, pointed gourd, bottle gourd, pumpkin, chilli, radish lettuce, carrot, pea, cowpea, okra, sweet potato, spinach, methi
Folic acid	Avocado, peach, grapes, guava, plum	All green leafy vegetables, palak, lettuce, cabbage, spinach, french bean
Vitamin C (Ascorbic acid)	Barbados cherry, aonla, guava, orange, lemon, lime, grapefruit, strawberry, cape gooseberry, pineapple, ber	Chilli, capsicum, cabbage drumstic leaf, broccoli, kale, parsley, cauliflower,
Vitamin E (Tocopherol)	Almond, avocado,	Spinach, kale

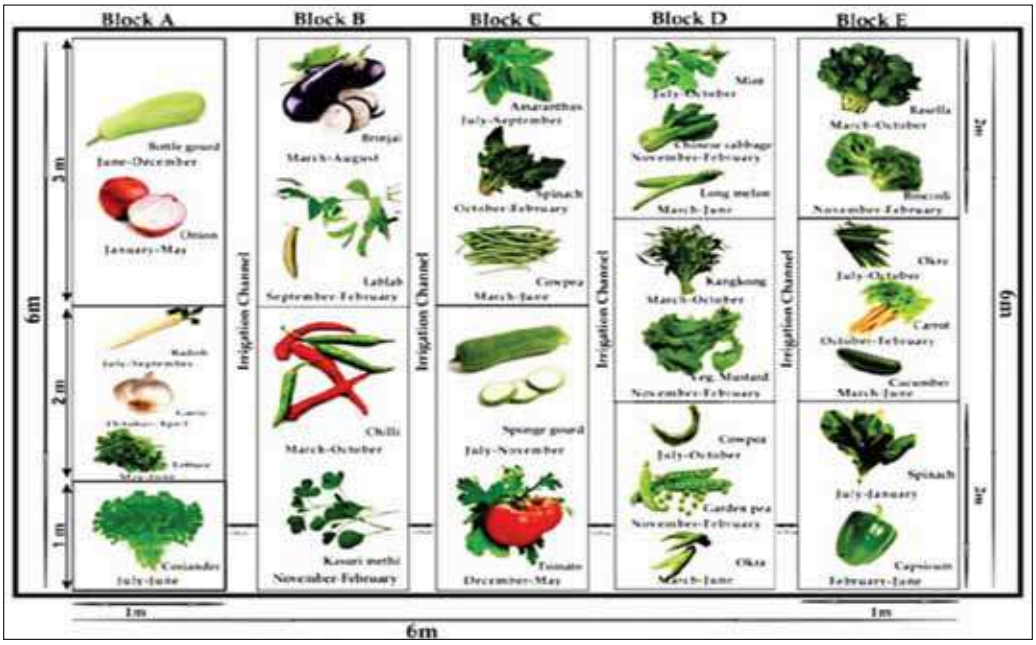
b) Minerals

Minerals	Fruits	Vegetables
Calcium	Litchi, dry karonda, aonla, guava, orange	Curry leaf, hyacinth bean, amaranthus, palak, spinach, methi, onion, chow-chow
Iron	Dry karonda, date, walnut, green mango, green banana	Amaranthus, palak, spinach, partulaca, methi, lettuce, watermelon,
Phosphorus	Cashew nut, walnut, litchi, wood apple	Pea, lima bean, carrot, broccoli, brussels sprout, cowpea, artichoke
Potassium	Banana	Parsnip, potato
Iodine	Jamun, banana	Tomato, capsicum, carrot, onion, garlic, beet root, agathi
Sodium		Green onion, chinese cabbage

Requirements of Vegetables

Requirements / Commodity	Vegetables	Fruits	Pulses
Per Day	300 g	50 g	85 g
Per day/4-5 member family	1200 g	200 g	340 g
Annual Requirement	450 kg	73kg	125 kg

Planning and Preparing a Nutrition Garden



Vegetable Nutrition Garden

Table 1: Cropping span and agronomic practices in 6 x 6 m Model Nutrition Garden

S. No.	Name of Vegetable	Cropping span	Harvesting period	Plot size (m x m)	Spacing (cm)	Plants per plot
1	Bottle gourd	Jun-Dec	Oct-Dec	3 x 1	80 x 45	12
2	Onion	Jan-May	May	3 x 1	15 x 7.5	267
3	Radish	July-Sept	Aug-Sept	2 x 1	45 x 7.5	60
4	Garlic	Sep-Apr	April	2 x 1	15 x 7.5	267
5	Lettuce	May-June	June	2 x 1	45 x 30	15
6	Coriander	Jul-Jun	Oct-Jun	1 x 1	15 x 10	67
7	Brinjal	Mar-Aug	Jun-Aug	3 x 1	80 x 30	20
8	Lab lab	Sept-Feb	Nov-Feb	3 x 1	45 x 30	22
9	Chilli	Mar-Oct	May-Oct	3 x 1	60 x 45	12
10	Methi	Nov-Feb	Dec-Feb	3 x 1	15 x 10	200
11	Amaranthus	Jul-Sept	Aug-Sept	3 x 1	45 x 30	22
12	Palak	Oct-Feb	Dec-Feb	3 x 1	15 x 5	400
13	Cowpea	Mar-Jun	May-Jun	3 x 1	30 x 15	67
14	Sponge gourd	Jul-Nov	Sept-Nov	3 x 1	80 x 45	12
15	Tomato	Dec-May	Apr-May	3 x 1	80 x 30	20
16	Mint	Jul-Oct	Sept-Oct	2 x 1	15 x 15	88
17	Chinese cabbage	Nov-Feb	Dec-Feb	2 x 1	30 x 20	33
18	Long melon	Mar-June	May-Jun	2 x 1	80 x 30	12
19	Kang kong	Mar-Oct	May-Oct	2 x 1	20 x 20	50
20	Vegetable mustard	Nov-Feb	Jan-Feb	2 x 1	15 x 10	133
21	Cowpea	Jul-Oct	Sept-Oct	2 x 1	30 x 15	44
22	Pea	Nov-Feb	Dec-Feb	2 x 1	30 x 7.5	88
23	Okra	Mar-June	April-June	2 x 1	45 x 15	30
24	Basella	Mar-Oct	May-Oct	2 x 1	20 x 20	50
25	Broccoli	Nov-Feb	Jan-Feb	2 x 1	45 x 30	15
26	Okra	July-Oct	Sept-Oct	2 x 1	45 x 15	30
27	Carrot	Oct-Feb	Jan-Feb	2 x 1	45 x 7.5	60
28	Cucumber	Mar-June	May-Jun	2 x 1	80 x 30	12
29	Palak	July-Jan	Oct-Jan	2 x 1	15 x 5	267
30	Capsicum	Feb-June	Apr-Jun	2 x 1	60 x 30	12

Nutrition Garden Model Details

- Net Area : 6 x 6 square meter
- Suitability (family size) : 4 (2 adults and 2-3 children)
- Number of vegetables grown : 27
- Yield : 450 kg
- Number of plots : 13
- Crops sequences : 13

Table 2: Monthly availability of vegetables (Kg) in Model Nutrition Garden

S. No.	Month	Mean
1	January	65.50
2	February	55.85
3	March	13.10
4	April	30.55
5	May	49.48
6	June	32.88
7	July	16.98
8	August	28.42
9	September	43.13
10	October	47.81
11	November	35.91
12	December	35.38
	Total	450 kg

Table 3: Nutrient availability from Model Vegetable Nutrition Garden and recommended dietary allowance

Nutrient	RDA	Nutrient supply
Vitamin A, I.U.	3000-10,000	6387
Iron, mg	10-20	11.62
Calcium, mg	600	315
Vitamin C, mg	50	105
Leafy vegetables, g Other vegetables, g Roots and tubers, g	125 75 100	120 125 28*

*excluding potato and sweet potato

Model Nutrition Garden

Acceptability of Model Nutrition Garden- A brief survey

Observations	Frequency
Household having teenaged children	72 %
Recommended model adequate to meet family requirements	62 %
Time spent (hours/week) by family members in Model Nutrition Garden	5.6
Vegetables harvested (Kg/week)	4.8
Surplus vegetables shared with friends/ neighbourers	28 %

Economics of nutrition garden

Seed- Rs 200

Seedling- 60

Manure and Ferlilizer (2 q FYM,10 Kg DAP, 5 Kg Urea)= Rs 400

Working Hours= 5-6 /Week

Fruit Nutrition Garden Model Details

- Net Area : 25 x 25 square meter
- Suitability (family size) : 4 (2 adults and 2 children)
- Number of fruits grown : 22
- Yield : 800 kg
- Number of plots : 4
- Crops availability : Through out the year

KVK Web during special campaigns

Krishi Vigyan Kendra

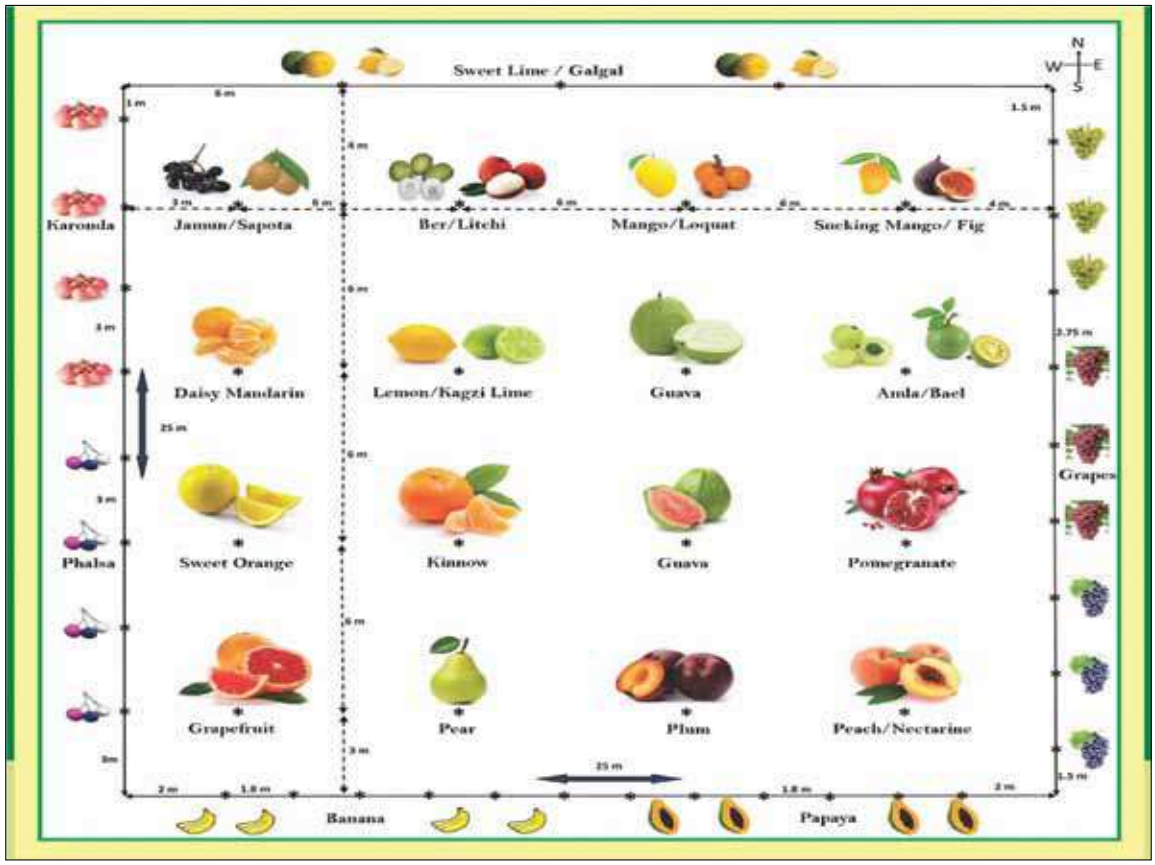
- Primary Health Centres
- Community Centres
- Schools
- IEC
- Nutrition Garden
- Breastfeeding Week (Aug)
- National Nutrition Week (Sept)
- Beti Bachao Beti Padhao (Oct.)
- Mahila Kisan Diwas (15 Oct.)

National Nutrition Week in Northern States

National Nutrition Week (NNW)

NNW is regularly celebrated in India since 1982 from 1 to 7 September. KVKs distributing free vegetable

Fruit Nutrition Garden



kits and plants to women during National Nutrition Week.

NNW-2017 theme

The theme was "Optimal Infant & Young Child Feeding Practices: Better Child Health".

Child feeding practices

Adequate maternal nutrition before and during pregnancy and lactation period.

Promotion of breast feeding by promoting:

- Early initiation of breastfeeding within 1 hour of birth,
- Exclusive breastfeeding for 6 months of child's age, and
- Continue breastfeeding during illness

The main goals of NNW celebrations:

- Empowering mothers with nutrition and health education
- Reaching the adolescent girls
- Ensuring better coverage of expectant and lactating mothers
- Improving dietary pattern of infants and children
- Ensuring community participation in various programmes
- Harnessing traditional knowledge of grandmothers

Innovative extension strategies during NNW

- Organization of exhibitions at district level
- Nutrition quiz competitions
- Nutrition rally
- Poster competition
- Slogan making competition
- Recipes competitions
- Puppet shows
- Street play

NNW impact enhancement techniques

- Video clipping for creating mass awareness
- Radio talks
- TV talks
- Awareness through Facebook/ WhatsApp
- Other websites
- Print media

- SMSs through mobile phones
- Exhibitions in various Kisan Melas/ fairs

State	Extension Activities	Farm women	AWW	CPDO
Punjab	Awareness camps	1229	684	42
	Recipes competition	59	15	0
	Group meeting/Mahila Ghosti	1248	110	30
	Lecture	691	213	24
	Lecture cum demonstration	1889	193	40
	Poster/ slogans competition	364	186	10
	Essay writing	38	50	3
	Film show (2)			
	Distributed vegetable kits	22	14	0
	Total	5540	1465	149
Uttrakhand	Awareness camps	1540	67	4
	Essay writing	120	0	0
	Group meeting	336	28	4
	Lecture	281	13	0
	Lecture cum demonstration	433	28	4
	Poster/ slogans competition	176	29	5
	Total	2886	165	17
Total of the Zone 1 states >18600		15515	3048	243

Capacity building during National Nutrition Week

State	Method of Demonstrations	Farm women	Anganwari workers	CPDO etc
Punjab	Nutritional diet for women	647	102	64
	Weaning foods among the children	993	232	18
	Nutritional recipes for mothers	631	108	61
	Nutritious and low calories food	513	36	4
	Integrated Nutrition Garden	1126	64	7
	Iron rich recipes	795	44	5
	Total	4705	586	159
Uttrakhand	Nutritional diet for women	162	9	1
	Weaning foods among the children	78	7	24
	Nutritional recipes for mothers	83	19	6
	Nutritious and low calories food	107	21	9
	Integrated Nutrition Garden	236	14	4
	High Iron rich recipes	213	19	5
	Total	879	89	49
Grand total of Zone-I >11200		**9821**	**1469**	**301**

State	Method of Demonstrations	Farm women	Anganwari workers	CPDO etc
Himachal Pradesh	Nutritional diet for women	298	53	4
	Weaning foods among the children	130	14	0
	Nutritional recipes for mothers	187	34	2
	Nutritious and low calories food	138	95	3
	Integrated Nutrition Garden	103	3	0
	Iron rich recipes	303	39	2
	Total	1159	238	11
Jammu & Kashmir	Nutritional diet for women	445	89	16
	Weaning foods among the children	307	75	16
	Nutritional recipes for mothers	433	105	12
	Nutritious and low calories food	1419	105	14
	Integrated Nutrition Garden	140	90	13
	Iron rich recipes	334	92	11
	Total	3078	556	82
Grand total of Zone-I >11200		**9821**	**1469**	**301**

Publications: Publications being an important part in disseminating technological information among different categories of stakeholders were prepared and distributed during method demonstrations and extension programmes in the form of leaflets, pamphlets, handouts and folders. This printed material contained the information on specific topics discussed during the programme organized during the week. The literature was provided to the educated women so that it can be read repeatedly and as and when the stakeholder wishes he/ she can refer to it again and again. The literature was published in the regional languages for better understanding of the message disseminated to the farm women. A total of 17676 documents were distributed among farm women of Zone-I during the awareness generation about nutrition. The highest number of documents (5342) was distributed by the KVKs of Punjab to the farm women during the programmes conducted in National Nutrition Week. These documents were primarily on recipes of Amylase Rich Food, how to reduce anaemia, layout of kitchen gardens, low cost nutritious recipes, iron rich recipes and weaning foods for children *etc*.

Documents published/ distributed to farm women (No.)

State	Folders	Handouts	Leaflets	Pamphlets	Total
Punjab	229	2253	898	1962	5342
Uttarakhand	584	602	458	338	1982
Himachal Pradesh	143	131	221	248	743
Jammu & Kashmir	486	216	200	640	1542
Total	2398	6188	3354	5736	17676

Mass media coverage

Mass media, the most important method of dissemination, was utilized by the scientists of KVKs of Zone-I during this week for reaching to the farmers who were not able to attend the programmes conducted during this week. Mass media helps to reach the stakeholders in a short span of time without disturbing the daily schedule of the targeted farmers as it is the best way to reach and disseminate the information to the stakeholders these days.

Media	No. of KVK
Radio talk	10
Television talk	20
Mkisan	907729
Total	907759

Demonstration on kitchen gardening


Preparation of nutrition biscuits for children


Awareness on anaemia mitigation


Preparation of nutritious snacks for pregnant and lactating mothers


Preparation of nutritious weaning food for infants


Checking health status of women

POSHAN Mission

- National Nutrition Mission (NNM)
- Beti Bachao Beti Padhao (BBBP)

Special Programmes for Mitigating Malnutrition through Farmwomen Empowerment

- Knowledge System and Homestead Agriculture Management in Tribal Area (KSHAMTA)
- Nutri-Sensitive Agriculture Resource and Innovations (NARI)
- Value-addition and Technology incubation Centers in Agriculture (VATICA)

Way Forward

Combating malnutrition is a battle for all Stakeholders Nutritional awareness is imperative

- Convergence of various agencies working for the welfare of women and children
- Nutrient wise identification of local food sources
- Harness traditional nutritional wisdom and traditional foods for their nutritious attributes
- Right time to stress on 'Slow Foods' to prevent obesity
- Nutrition awareness needs to be linked to various Govt. Schemes e.g. Beti Bachao-Beti Padhao, Mid day meal etc.

References

NFHS 2016 National Family Health Survey 4 (2015-16) and 3 (2005-06). International Institute for Population Sciences; Ministry of Health and Family Welfare, Government of India, Mumbai

IFPRI 2017 Global Food Policy Report.Washington, DC: International Food Policy Research Institute. https://doi.org.10.2499/9780896292529

Strategies for Improving Maternal and Child Nutrition in Low Income Settings in India

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Introduction

Maternal undernutrition plays a crucial role in influencing maternal, neonatal and child health outcomes. With India's commitment to Millennium Development Goal (MDG 4), actions for maternal mortality has received substantial attention. New programme directions and strategies have been introduced. In recent past maternal mortality has received substantial attention, which include ANC, institutional delivery and family planning services. These include focus to increase antenatal service (ANC), institutional delivery coverage and provision of family planning services. With such intensive efforts, health services for women in India have increased substantially and the maternal mortality rate (MMR) has dropped from 301 per 100,000 live birth in 2003 to 212 in 2009. However, for reaching the MDG target of 109 and for reduction of stunting rates in children, interventions for improving nutritional status of womens crucial but has remained a low priority except for measures directed for reduction of anemia and policy for providing supplementary food to pregnant women under the Integrated Child Development Services (ICDS) programme of Government of India.

Nutrition Situation of Children in India

- Undernutrition among children -leading cause of death, disability and inequity.
- Maternal malnutrition leads to intrauterine growth restriction (IUGR) and low birth weight.
- Poor maternal nutritional status of women before and during pregnancy have serious implications on birth outcome.
- Short maternal stature due to mother's own childhood nutrition,
- Low BMI at conception,
- Inadequate gestational weight gain due to poor dietary intake

Some Facts Related to Nutrition Situation of Children

- Almost a quarter of children in India each year have a low birth weight (LBW) of less than 2.5 kg.
- Incidence of LBW is 3-4 times higher in mothers who are adolescents or below 18 years as compared to those over 18 years.
- LBW and preterm delivery are twice as common and neonatal mortality is almost thrice in adolescent pregnancies than adult pregnancies.
- LBW is associated with 2.5 to 3.5 fold higher odds of wasting, stunting and underweight in children

Nutrition Situation of Women in India

- Poverty, gender discrimination and illiteracy are the major barriers in implementation of health and nutrition programmes.
- About half of the women population is illiterate. This affects reproductive behaviour, use of contraceptives, health, upbringing of children, proper higienenic practices, employment and overall status of women.
- An early marriage and child birth is a major determinant of women's health and is also responsible for wide variation in the socio-economic status.
- Wide spread anaemia among all the reproductive age group leading to high maternal mortality is a matter of serious concern.

Some Facts Related to Nutrition Situation of Women

- Percentage of women with low body mass index (BMI) has remained almost stagnant in the last two decades despite improvement in the provision of maternal health services, including

institutional delivery which has increased significantly.

- There is a wide state – wise variation in rate of under nutrition in women. As per the last national survey 13 states in the Country have a higher percentage of mothers with low BMI compared to national average of 35.6 percent.
- The prevalence rate of undernutrition in women is much higher in rural areas (40.6%) compared to urban areas (25%).
- Anaemia is prevalent across all age groups. Anaemia is a severe public health problem in all the States of India except five States i.e. Punjab, Manipur, Mizoram, Goa and Kerala.
- Association between maternal nutritional and birth outcome is complex and is influenced by many biological, socio – economic and demographic factors, which vary widely in different populations.

Important Messages from the Nutrition Situation of Women and Children

- Vitamin A and Zinc deficiencies account for the largest remaining disease burden among the micronutrients considered.
- Iodine and iron deficiencies call for sustained effort in order to reduce the burden of disease associated with them.
- Suboptimum breastfeeding, especially non-exclusive breastfeeding in the first six month of an infant's life, results in 1.4 million child deaths annually and accounts 10 percent of the disease burden in children under five.
- Maternal short stature and iron deficiency anaemia increase the risk of death during delivery, accounting for at least 20 percent of maternal mortality.
- Poor foetal growth and stunting in the first two years of life lead to irreversible damage.
- Children who are undernourished in the first two years of life and who then rapidly put on weight later in childhood and adolescence are at high risk of nutrition-related chronic disease.
- The prevention of maternal and child undernutrition is a long-term investment that will benefit the present generation and their children.
- The period from pregnancy to 24 months (1000 days) is the crucial window of opportunity for reducing undernutrition and this is the period on which programmes and monitoring and assessment should focus.

Previous Strategies for Improving Maternal and Child Nutrition

- Interventions for improving women's nutrition gained attention in 1998 as breaking the inter-generation cycle of undernutrition.
- A list on 10 nutrition interventions was then prescribed by Nutrition Coalition of India.
- This included actions for improving nutrition of adolescent girls and pregnant women.
- Policy guideline regarding composition and cost of the supplementary food has undergone a number of changes in the last five decades.
- The food supplement policy of ICDS has also shifted from targeted pregnant and lactating mothers approach to universal coverage.
- However, translating policy into action has been rather poor with less than a quarter of women reported to be receiving supplementary food.

During last 5-7 years some other programmes of importance were :

- Adolescent Reproductive Sexual Health (ARSH) – the adolescent health programme of MHFW.
- Rajiv Gandhi Scheme for Empowerment of Adolescent Girls (RGSEAG) or SABLA programme of MWCD.
- Indra Gandhi Matritva Yojna (IGMY)
- Janani Suraksha Yojna (JSY)
- Weekly Iron – Folic acid Supplementation (WIFS) Programme
- Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCH+A) approach by MHFW
- Provision of only Folic acid supplement in preconception period

Prominent programmes of State Governments with emphasis on first 1000 days of life

- Ready to Eat (RTE) foods
- Take Home Ration (THR) supplementary food
- MAMTA Scheme
- Nutrition Missions

However, effective implementation and scaling up remains the primary challenge.

Proposed Strategies for Improving Maternal and Child Nutrition

- Nutrition counseling during pregnancy should be explicitly included in the ANC package.
- Inclusion of calcium supplement in the national ante natal care services.
- Maternity protection laws is another important measure for improving maternal and child nutrition in India with women increasingly getting engaged in formal and non-formal sector.
- Increased emphasis should be given on enhancing collaborative partnership across various sectors with a view to improving women's education, economic and social status.
- Education system should be more effectively used for systematically introducing health and nutrition education to girls enrolled in middle and high schools.
- Special attention is required to be given to intensify the activities to empower women and address the issue of gender inequality and limited decision making power.
- Special attention to enroll pregnant and lactating women in MNREGA and assigned soft or sedentary jobs, instead of manual work could be considered.
- Private sector may be involved in tracking the newly weds and linking the health and nutrition interventions until onset of first pregnancy, particularly in low income settings.
- Large scale awareness programmes are required to be launched through advocacy and information campaigns. The Department of Health and Family welfare should take a lead. The women Self Help Groups could play a greater role towards this.
- The Central and State Agricultural Universities through their Faculties of Home Science should reorient their research and teaching programmes towards nutrition sensitive agriculture with the objective of dietary diversification and production of protective foods.
- The Krishi Vigyan Kendras (KVKs) located in all the rural districts of the country could play a major role in dissemination of technologies related to nutrition sensitive agriculture.
- The KVKs may adopt villages on the pattern of NUTRI SMART Villages on the pattern of Madhya Pradesh to demonstrate its benefits.
- In agriculture nutrition should be viewed in a wholistic manner in which not only crop production but other enterprises like livestock, fisheries, poultry, apiary, mushroom etc. are integrated and right from production to protection, post harvest processing, value addition and marketing are combined together.
- Periodical update of national and state data on situation of women and child nutrition, dietary and nutrition intake pattern, maternal weight gain pattern, birth weight scenario and programme impact data through surveys and evaluations are critical for effective advocacy, programme planning and for enhancing commitment and investment in right direction.

Conclusion

- Nutrition sensitive interventions refer to strategies that address underlying causes of insufficient or inadequate food such as poor agricultural production, limited food markets, low levels of education, weak purchasing power. Nutrition sensitive programmes frequently involve multiple sectors and more diverse stakeholders than merely the supplementation programmes requiring different kinds of evidence and priority setting processes. Though many such programmes are now being designed and implemented to improve diet quality in low income settings, there is urgent need to collect empirical evidences on their costs and impacts on dietary intake.

Nutrition Sensitive Agriculture through Nutri-SMART Village

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Nutrition SMART Village (NSV)

A village having secured food availability, meeting nutrient requirement of all households of different age and physical condition for making them nutrition sufficient and healthy citizen. This is a scientific approach based on the concept "You grow what you eat". Its crop plan led nutritional security concept so that the nutritional gap should be reduced by minor adjustment in the dietary plan. It advocates the traditional recipe based "Poshan Thali" which will not only remove the deficiency rather will address the social health from chronic diseases. NSV is the unique architect for nutrition-sensitive agriculture which could be practiced in Kitchen garden, roof garden for nutrition supplementation. In nutshell, NSV could be considered a "minilab" for showcasing precise nutritional security through using available resources by proper motivation, nutritional literacy & attitudinal change.

KVKs in the Zone

S. No.	Host Institution	No. of KVKs
1.	Madhya Pradesh	51
	JNKVV, Jabalpur	20
	RVSKVV, Gwalior	21
	IGNTU, Amarkantak	1
	ICAR Institute	1
	NGOs	8
2.	Chhattisgarh	25
	IGKV, Raipur	24
	CGKV, Durg	1
	Total KVKs	76

Genesis of Nutri SMART Village

Workshop of Home Scientist Chitrakoot, 25-26 Feb 2016	The issue of reducing malnutrition among children, adolescent girls and women were discussed
Workshop on Agriculture for Nutrition and Nutritional Awareness at Bhopal, 9-10 Jan 2017	Roadmap, Poshan Thali and Exhibition of Nutritional Product
Meeting on Interface on Agriculture for Nutrition at ICAR-ATARI, Jabalpur, 8 Feb 2017	Preparation of blue print for Nutri Smart Village in M.P.
International Women Day, 8 March 2017	ICAR-ATARI organized Exhibition on International Women Day Programme in Madhya Pradesh Vidhan Sabha
Meeting on Nutritional Security for Block wise Malnourished Village of Jabalpur Division, 25 May 2017	Presentation of Jabalpur Division District's (Jabalpur, Katni, Narsinghpur, Mandla, Chhindwara, Dindori, Seoni, Balaghat)
National Level Workshop on Agriculture for Nutrition at Barapani, Shilong 23-24 June 2017	Workshop focused on local food habits, Nutritional supplementation, Medicinal & Therapeutic use of local feed.
Orientation workshop of field Level Officers/Workers on Nutrition Smart Village concept on 22 August 2017	Chief Minister Madhya Pradesh applauded Nutri SMART village initiative of ICAR-ATARI, Jabalpur
International Workshop on Nutrition-Sensitive Agriculture and Nutrition Literacy May 14-16, 2018	Systematic policy framework for agricultural extension systems to promote Nutrition Sensitive Agriculture

Implementation Process in Nutri Smart Village

Women and Child Department	Digestibility and nutrient absorption to ensure consumption of nutritious food at household level through various interventions like Poshan Vatika, Lalima Abhiyan, Panchavati se Poshan etc.
Department of Public Health and Engineering	Hygiene and Sanitation; regular health checkup and record benchmark and progress
Department of Horticulture	Supplying of seedling of fruits and vegetables
Agriculture and Allied departments	Ensure crop production to meet out nutritional requirements and rearing of Animals, Poultry, Fish etc
Krishi Vigyan Kendras	Design, develop and validate nutri smart village module Capacity building: Training , Demonstration Work in close association with WCD, Agriculture and allied departments

Role of Different Departments

Women & Child Department

Identification of malnourished children, monitoring the anthropometric measurements of the malnourished children, awareness through Mangal Diwas and VHND, conduct different activities at malnourished village i.e. Su-posan abhiyan, sneh sarokar abhiyan, nutri-corners, lalima yojna, udita corne, posan paricharcha, punchvati se posan, IYCF, mangal divas, bal choupal etc. training for aanganwadi worker and malnourished parents. Providing hybrid seed and plants for Aanganwadi center and malnourished parents. Motivate for establishing Kichen Garden. Cracked awareness regarding vaccination and conducting HB test and consumption of IFA.

Farmer Welfare and Agriculture Development

Providing various inputs through ATMA project to malnourished women, children and their family. Distribution of seed mini kit to malnourished families. Introduce pulse increasing production scheme in those areas where production of pulses is lesser. Ensure sowing of crops, based on the nutritional thali of malnourished families. Introduce agricultural schemes for suitable minor millet production and seed distribution of less water requiring crops in water scarce areas.

Horticulture Department

Distribution of vegetable and fruit plants mini kit to malnourished families. Impart trainings to malnourished families and establishment of kitchen garden in malnourished families and plantation of more fruits plants to increase consumption of Vitamin C, Vitamin A and iron. Impart trainings in processing of fruits and vegetables.

Veterinary Department

Various scheme of veterinary department to malnourished women and children family is provided by Veterinary Department. Increase milk production in agriculture families and impart trainings to agricultural families for making value added product from milk. Give poultry units to malnourished families from different schemes.

Health Department

Health checkup for malnourished women girl and children is done by health department. HB test for all women girl and children, provide IFA tablet for anemic women girl and children and vaccination for children and pregnant women.

Nutritional facts of Madhya Pradesh

M.P. is having more than 1/4th of total protein production of the country, more than 1/5th of vegetable fats, more than 1/10th of carbohydrates, largest producer of meat, second largest producer of milk and 4th largest producer of vegetables (nearly of fruits)

Protein Estimation	
Source	**Nutrient Content per 100 gms (approx)**
Soybean	50 gm
Pulse	22 gm
Milk	35 gm
Egg	13 gm
Fish	22 gm
Fruit	1.1 gm
Vegetable	2.9 gm
Meat	28 gm

Process Estimation	
Availability	Production x Nutrient content
Requirement	Population x Per capita requirement
Surplus/Deficit	Availability - Requirement

Protein Budgeting : Madhya Pradesh

Source	Production (million tonnes)	Protein Availability (million tonne)
Pulses	5.12	1.12
Soybean	4.91	2.12
Milk	12.14	4.25
Egg (m No)	1441.4	0.001
Meat	0.07	1.93
Fish	0.11	2.40
Fruits	6.290	0.07
Vegetables	14.79	0.43
Total	**1484.83**	**12.32**

(Source: Horticulture Statistics at Glance 2016, NDDB, 2016, Agriculture Statistics at Glance 2016)

- **Protein requirement:** 5.75 million tonnes
- **Surplus:** 6.57million tonnes
- **Can feed to additional:** 82.94 million population

District-wise protein mapping (Top 10 districts)

District Name	Requirement (t)	Availability (t)	Surplus/ Deficit (t)
Shahdol	175.10	2377.75	2202.65
Balaghat	279.50	2376.82	2097.31
Jabalpur	404.60	1766.03	1361.43
Anuppur	123.06	1433.89	1310.83
Dhar	359.02	1607.37	1248.36
Indore	538.20	1677.58	1139.39
Katni	212.22	1243.52	1031.30
Guna	203.92	1143.60	939.68
Shajapur	248.46	1093.24	844.78
Mandsaur	220.16	1061.06	840.89

Carbohydrate Budgeting : Madhya Pradesh

Source	Production (mill ton)	Carbohydrates Availability (mill ton)
Pulses	4.83	2.704
Cereals	6.35	16.701
Milk	10.78	0.539
Fruits	6093	0.792
Vegetables	14315	3.292
Total		**24.028**

- **Carbohydrates requirement:** 9.01 million tonnes
- **Surplus:** 15.02 million tonnes
- **Can be feed to additional:** 121.02 million population

District-wise Carbohydrate mapping (Top 10 districts)

District Name	Requirement (t)	Availability (t)	Surplus/ Deficit (t)
Khandwa	163	163905.6	163,743
Dindori	87	89768.31	89,681
Burhanpur	94	76354.38	76,260
Indore	407	49847.77	49,441
Chhindwara	259	40133.1	39,874
Khargon	232	23141.49	22,909
Jabalpur	306	22017.39	21,712
Katni	160	20816.27	20,656
Ujjain	247	16076.75	15,830
Barwani	172	15726.79	15,555

Fat Budgeting : Madhya Pradesh

Source	Production (mill ton)	Fat Availability (mill ton)
Oilseeds	2.90	0.58
Milk	10.78	0.43
Egg	11776.00	0.00
Meat	0.06	0.00
Fish	0.11	0.01
Total		1.03

- **Fat requirement:** 1.85 million tonnes
- **Deficit:** 0.83 million tonnes

District-wise Fat mapping (Top 10 districts)

District name	Requirement (t)	Availability (t)	Surplus/ Deficit (t)
Shahdol	1284.34	27.23	1257.10
Balaghat	1287.69	43.47	1244.21
Jabalpur	1182.63	62.93	1119.67
Indore	880.38	83.71	796.66
Dhar	828.67	55.84	772.82
Anuppur	775.08	19.14	755.94
Katni	650.04	33.01	617.03
Guna	571.92	31.72	540.207
Shajapur	542.59	38.64	503.948
Mandsaur	526.98	34.24	492.73

Age wise requirement of Foods and Nutrient

A. Foods (q/year) requirement

Population of Village			Requirement of food grain (q/year)						
Gender group	Age group (year)	Total	Pulses	Cereals	Oil	Fruits	Vegetables	Milk	Meat, Fish & Egg
Children	1 to 3	59	8.614	25.842	4.31	21.54	17.23	86.14	8.61
	4 to 6	86	15.695	53.363	7.85	31.39	39.24	125.56	15.70
	7 to 9	120	26.28	96.36	13.14	43.80	54.75	175.20	26.28
Boys	10 to 12	52	11.388	55.042	5.69	18.98	33.22	75.92	11.39
Girls	10 to 12	52	11.388	55.042	5.69	18.98	33.22	75.92	11.39
Boys	13-15	53	9.6725	77.38	5.80	19.35	48.36	77.38	11.61
Girls	13-15	33	6.0225	48.18	3.61	12.05	30.11	48.18	7.23
Boys	16-17	66	12.045	101.178	9.64	24.09	66.25	96.36	19.27
Girls	16-17	48	8.76	56.064	5.26	17.52	52.56	70.08	14.02
Male	Up to 18	657	155.87	1139.074	95.92	71.94	719.42	239.81	143.88
Female	Up to 18	664	133.298	848.26	96.94	72.71	666.49	242.36	145.42
	Total	1908	399.036	2555.785	253.86	352.33	1760.83	1312.91	414.79

Source: RDA 2010, NIN. Hyderabad & Swaminathan, 2011

B. Nutrient requirement

Population of Village			Energy (Kcal)	Nutrient Requirement (Kg)					
				Protein	Fat	Vitamin A	Vitamin C	Calcium	Iron
Gender group	Age group (in year)	Total							
Infants	0-5 month	13	20280.123	30	0	0	0	2.4	0
	6 - 11 month	5	10548.761	26	35	0.0000005	0.00005	0.9	0.01
Children	1 to 3	59	196408.3	360	581	0.0000069	0.00069	12.9	0.19
	4 to 6	86	456444.74	662	785	0.00001	0.001	12.6	0.41
	7 to 9	120	734885.58	1292	1314	0.000021	0.0021	26.3	0.7
Boys	10 to 12	52	357642.59	757	664	0.0000091	0.00091	15.2	0.4
Girls	10 to 12	52	328250.61	767	664	0.0000091	0.00091	15.2	0.51
Boys	13-15	53	457735.37	1050	871	0.0000093	0.00093	15.5	0.62
Girls	13-15	33	241477.15	625	482	0.0000058	0.00058	9.6	0.33
Boys	16-17	66	625973.49	1482	1205	0.0000116	0.00116	19.3	0.67
Girls	16-17	48	367821.37	972	613	0.0000084	0.00084	14	0.46
Male	Up to 18	657	5932077.9	14388	7194	0.0001151	0.01151	143.9	4.08
Female	Up to 18	664	4639828.8	13330	6059	0.0001163	0.01163	145.4	5.09
	Total	1908	14369375	35741	20467	0.0003232	0.03232	433.1	13.46

Source: RDA 2010, NIN. Hyderabad & Indian Food Composition Table, 2017

Nutrient Supplementation through value addition

Name Product	Nutrient Intake				Anthropometric measurements		
	Energy (kcal)	Protein (gm)	Iron (mg)	Calcium (mg)	Increase in Wt. (kg)	Increase in Ht.(cm)	Increase in BMI (%)
Wheat Ladoo	469.9	6.08	2.5	27.6	0.34	0.16	3.04
Gram flour Ladoo	485.4	10.43	2.7	31.6	0.42	0.26	3.33
Soya Poha Ladoo	948.5	11.78	4.9	63.6	1.28	0.86	9.80
Pearl-millet Ladoo	1042.7	11.12	4.6	84.4	1.06	1.12	7.53



Nutrient Content in Value Added Product

Nutrients / 100 g			
Nutrients	**T1 Wheat Ladoo**	**T2 Besan Ladoo**	**T3 Soya Poha Ladoo**
Energy (Kcal)	712.60	739.13	724.56
Fat (gm)	44.21	48.93	49.21
Protein (gm)	5.30	13.95	15.43
Fibre (gm)	0.82	1.06	1.21
Calcium (mg)	26.08	69.56	86.08
Iron (mg)	2.19	3.47	8.33
Folic acid (µg)	15.56	53.80	53.80
Vit.A (µg)	130	238.04	238.04



Nutrient Supplementation through ladoo

Nutritional Facts of Millets

Grain	Protien	Fat	Carbo	Fibre	Energy
Brown Rice	7.9	2.7	1.07	60	362
Wheat	11.6	2.0	2.0	71	348
Maize	9.2	4.6	2.8	73	358
Sorghum	10.4	3.1	2.0	70.7	329
Bajra	11.8	4.8	2.3	67	363
Ragi	7.7	1.5	3.6	72.6	336
Foxtail	11.2	4.0	6.7	63.2	351
Little (Sama)	9.7	5.2	7.6	60.9	329

* Quantity in gm.

Maize

Bajra

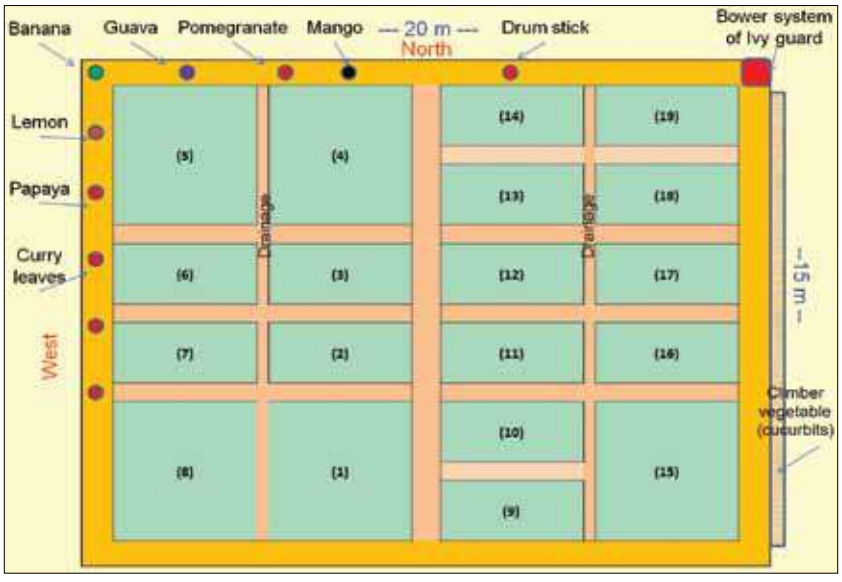
Changes in nutritional status of children in Morena district

Nutritional Status

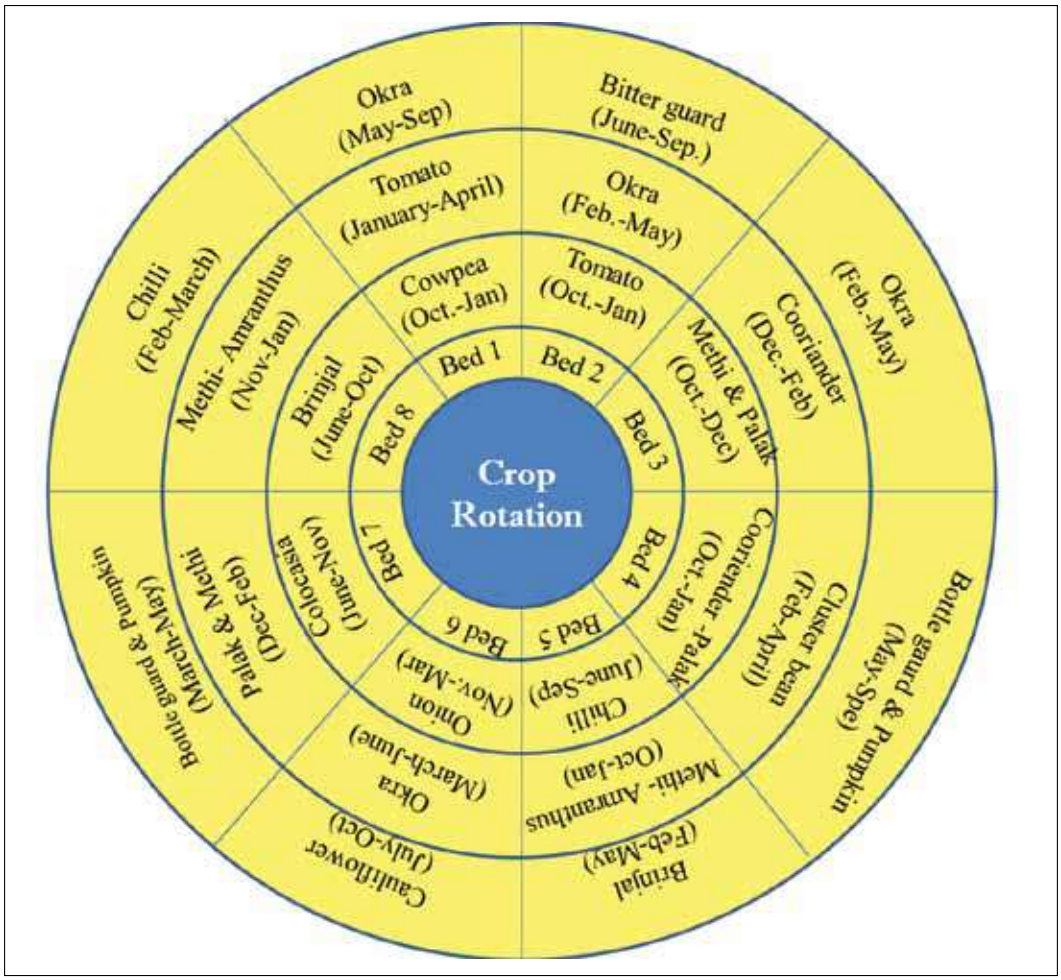
Categories	Before one year	Current
Total Children Weighed	226203	367649
Normal (Green)	186568 (82.48%)	302368 (82.24%)
Moderately Underweight (Yellow)	36552 (16.16%)	61038 (16.6%)
Severely Underweight (Orange)	3083 (1.36%)	4243 (1.16)

Source: Department of Women & Child Development

Model of Nutritional Garden



Crop rotation of vegetables for round the year availability



Impact of nutrition garden

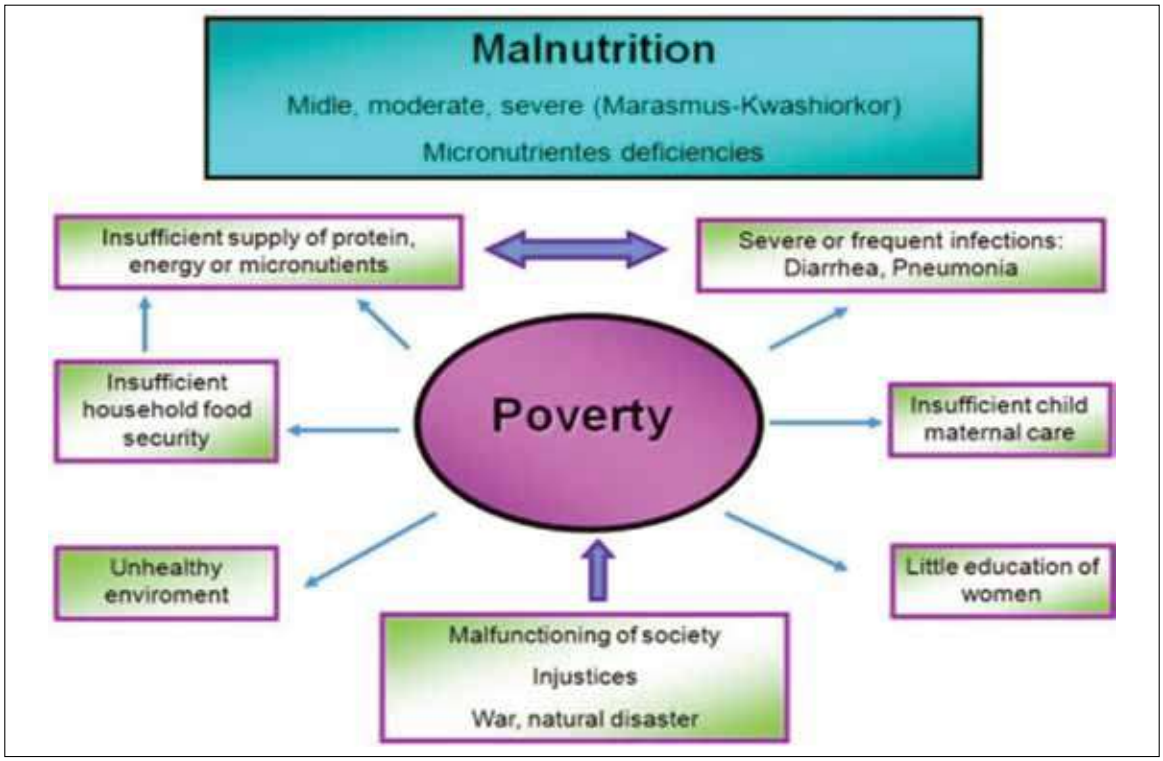
Due to replication of nutrition garden in schools, fresh and organic vegetable are available for students as well as saving an amount of Rs. 12000/- per school in six months. Besides seasonal vegetables perennial vegetables like Jackfruit, Drum steak, and fruits Papaya, Banana, Guava were also planted which provide regular fruits and vegetable.

Mid day meal with fresh vegetable

Number of farmers implemented the technology

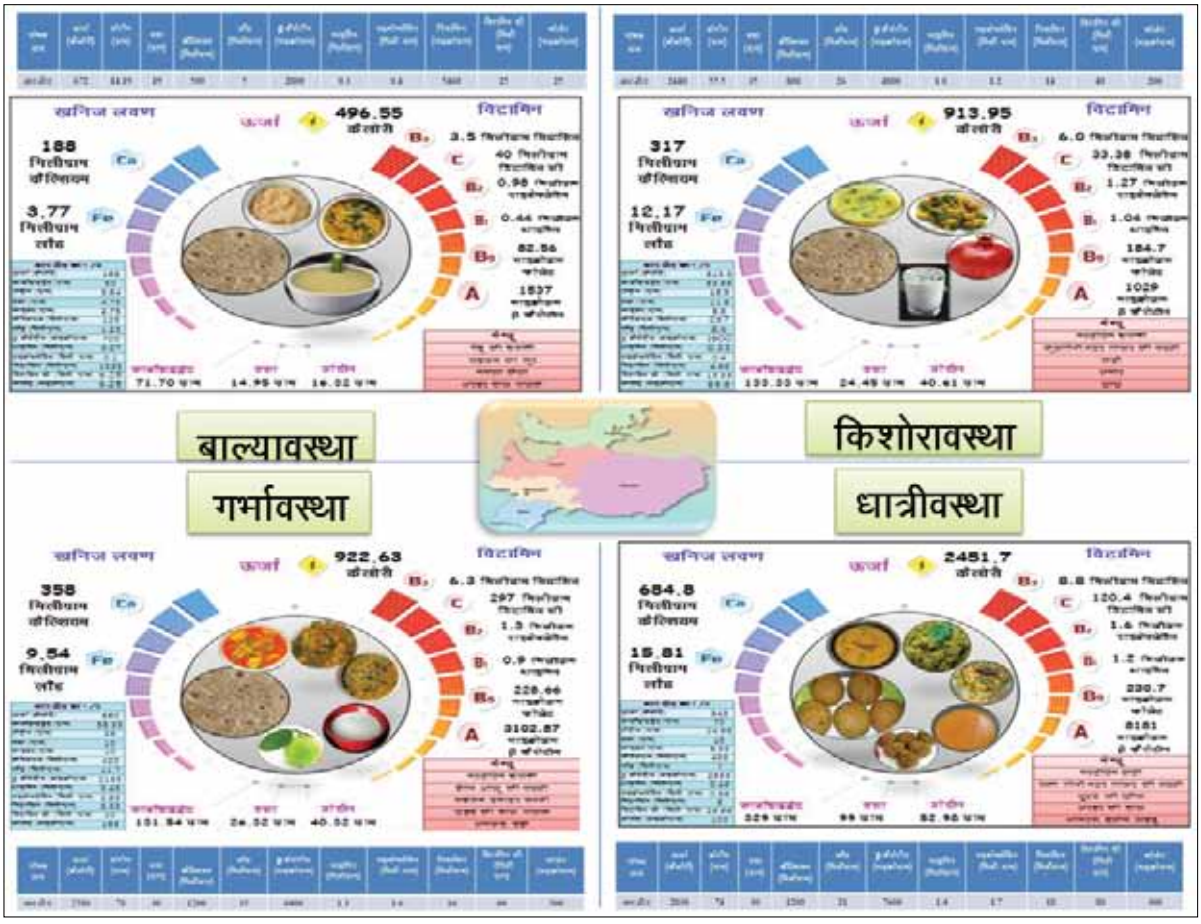
- At present 70 schools and 250 farmers of Kanker district implemented these technology. Due to success of this technology in the district the Chief Secretary Govt. of C.G. instructed to all district Collectors for implementation of this technology in whole Chhattisgarh state.

Causes of Malnutrition



The problem of malnutrition can be reduce by joint efforts of Health Development Dept. & Agencies, Local Administration, Academia, Charitable sector/ CSR and NGOs by making suitable policies and programmes.

Poshan Thali



Source-KVK Neemuch

Poshan Mala & Poshan Rangoli

Hansuli Mala emphasizing on balance nutrition provided by Mahua

Poshan Rangoli showing "Pulse diversity and its consumption pattern"

Nutritional security of vulnerable groups through oyster mushroom production using local straw as substrate

Season	Rabi 2017-18
Beneficiaries	Mushroom production in Anganwadi of Model Nutri Smart Village for Pre-school children Mushroom production in 5 malnourished Farm women's families of Model Nutri Smart Village

Training on Mushroom cultivation

Policy Recommendations

Initiating a food policy by development of a comprehensive, joined–up nutrition strategy led State Crop Plan. This Strategy should have following aims to address-

- Food access
- Nutritional literacy
- Poor quality nutritional care
- Gaps in service provision

This would enable for establishment of Nutri-SMART Village through NS.

References

Agriculture Statistics at Glance, 2016. by Department of Agriculture, Cooperation & Farmers Welfare, Directorate of Economics & Statistics, Ministry of Agriculture and farmers welfare, Government of India (https://eands.dacnet.nic.in/PDF/Glance-2016.pdf)

Horticulture Statistics at Glance 2016. by Horticulture Statistics Division, Department of agriculture, Coperation& Farmers welfare, Ministry of agriculture & Farmers Welfare Government of India (http://agricoop.nic.in/sites/default/files/Horticultural Statisticsa Glance2016/page.pdf)

https://www.nddb.coop/about/report

http://www.mp.gov.in/en/web/guest/mpwcd

Indian Food Composition Table 2017. by National Institute of Nutrition (Indian Council of Medical Research), Department of Health Research

Ministry of Health & Family Welfare, Government of India, Hyderabad- 500 007, Telangana State, India

Revised RDA, ICMR, 2010. http://ninindia.org/Dietary Guidelines for NIN website.

Swaminathan M. 2011. Handbook of food and Nutrition. N.R. Brothers Publication.158-172

Improving Lives of Women and Children by Addressing Undernutrition

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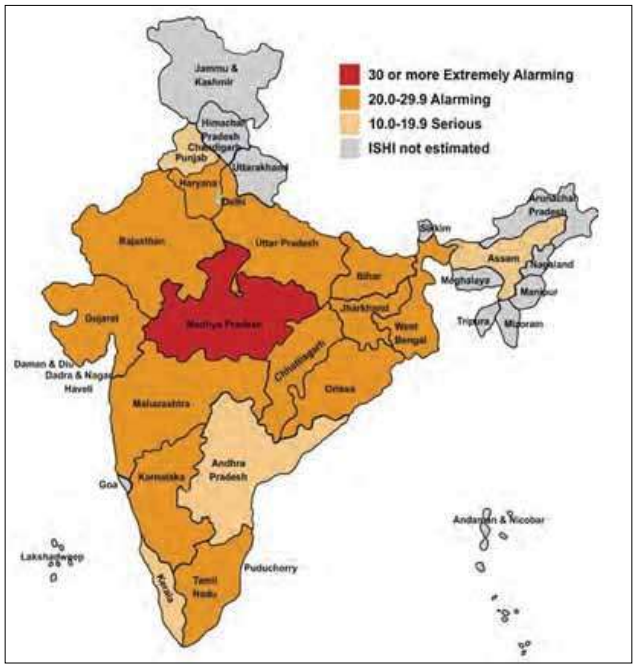
More than one third of the world's malnourished children live in India. About 38.4% of under 5 children in India are stunted has severe undernutrition and approximately 58 % under 5 children, 53% women and 22.7% men between 15-49 years old are anaemic. In MP prevalence of Severe Acute Malnutrition (SAM) is 8.3%, prevalence of Moderate Acute Malnourished (MAM) is 17.5% with 51.9% of children surveyed underweight and almost 48.9% stunted.

First 1,000 days of a child's life from pregnancy through a child's 2nd birthday is a critical period that sets the stage for much of child's intellectual and physical wellbeing for the future. Maharashtra loses 13,541 infants in one year between Feb 2017 to Apr 2018 due to malnutrition.



Root of the Problem

India has the highest level of public investment in food and nutrition security of all countries through its public funded programs and has the right to food and nutrition in its constitution. Despite policy, political will, investments and nearly 10 fold increase in GDP since 1991, more than one third of the world's malnourished children live in India.The causes of malnutrition in India are as varied as the Indian people. Its sources are economic, political, social and cultural.

The Possible causes can be broken down into 4 broad categories:

1. Health literacy
2. Poor access to care
3. Capacity of government health workers at rural levels
4. Exposure to infection and lack of involvement of other nutrition sensitive sectors.

Health Literacy

Low health literacy about proper child feeding techniques and proper nutrition is main cause for malnutrition. Widespread lack of education about what constitutes proper nutrition and what are the best IYCF practices. Many families and local health workers also do not recognize malnutrition when they see it, when a community has up to 90% malnutrition, malnutrition becomes invisible.

This lack of health literacy leads to:

- Superstitions regarding child feeding practices
- Improper breastfeeding techniques
- Low diet diversity
- Infrequent child health check-ups
- Poor access to care (Identification, treatment, & prevention)

Traditional methods of measuring malnutrition such as weight for age offer challenges. Families are of exact ages of their children, nor do they have scales. Lack of awareness and knowledge, coupled with inability to measure malnutrition

lead to low identification of malnutrition cases. Limited knowledge of locally available preventative services or prevention techniques that can be used at home. Low utilization of Anganwadi Centres (AWC), because of a variety of reasons, ranging from incompetence of AWW, unfriendly atmosphere at AWCs to a perception that community do not need the services of AWC.

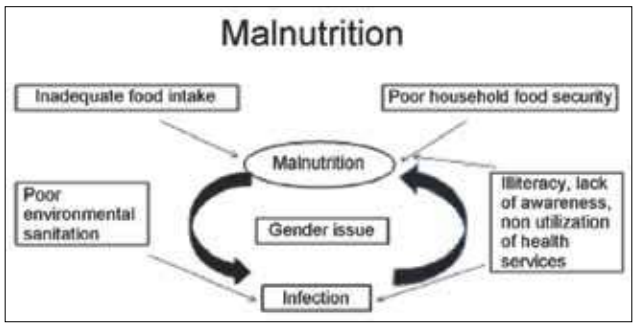
Nutrition Rehabilitation Centres (NRC) – referral centres for treatment of SAM, are located at district centres and large towns, hours away from rural/ tribal communities.

Weak local government systems and capacity

AWWs are overburdened and unprepared to meet the needs of the community and lack of on the job training. AWCs often lack proper infrastructure such as a scale. As a result of poor services provided at the Centres, they often have irregular attendance. AWCs, which are supposed to be welcoming environments for children to stay, learn, receive nutrition and get weighed, have typically unfriendly environments lacking visual stimulation or entertainment for children

High exposure to infection

Issues of sanitation, hygiene and access to clean water are closely tied to malnutrition. Unsanitary conditions lead to high exposure and subsequently to infections, especially in the weakened immune systems of children suffering with malnutrition. Diseases such as Tuberculosis and HIV are drivers of malnutrition for many children, and seasonal diseases such as Diarrhoea and Pneumonia exacerbate this condition in other children.



Lack of involvement of nutrition sensitive sectors

Presently in India, Departments of women and child development and health and family welfare are working to deliver nutrition-specific interventions. However, there are other sectors which are directly or indirectly working on issues which influence nutrition but may not necessarily incorporate nutrition goals explicitly in their programmes. These allied sectors include – Agriculture, Rural Development and Panchayati Raj, Drinking Water and Sanitation, Water and Land Resources, Tribal Welfare, Environment and Forest and Education.

Improved Nutrition

Improved nutrition can be achieved by integrating -

- Agriculture
- Social Protection
- Women's Empowerment
- Rural & Tribal Welfare
- Education
- Wash

Vision 2022 – *"Kuposhan Mukt Bharat"*

India has prioritised actions in high burden districts and is committed through its National Nutrition Mission (NNM).

Goals:

- To prevent and reduce undernutrition in children (0- 3 years) by 3 percentage points per annum from NFHS 4 levels by 2022.
- To reduce the prevalence of anaemia among young children, adolescent girls and women in the reproductive age group (15- 49 years) by one third of NFHS 4 levels by 2022.

Nutrition Interventions

- Infant and Young Child Care and Nutrition
- Infant and Young Child Health
- Maternal Care, Nutrition and Health
- Adolescent Care, Nutrition and Health
- Addressing Micronutrient Deficiencies -including Anaemia
- Community Nutrition (Interventions addressing the community)

The Nutrition Strategy Framework

The Nutrition Strategy Framework envisages a Kuposhan Mukt Bharat - linked to Swachh Bharat and Swasth Bharat. The Core Strategies were :

- **Governance Reform** - Nutrition Centre Stage and Public Accountability.
- **Leading by Example -** Kuposhan Mukt States, Districts and Panchayats.
- **Convergence -** of State/ District Implementation Plans for ICDS, NHM and Swachh Bharat and others. Also, convergence of major programmes and concerned sectors /Ministries which address various determinants of nutrition.
- **Prioritize Action -** Reaching the most vulnerable communities in the districts/blocks with the highest levels of child undernutrition.
- **Counselling to Reach the Critical Age Group** - pregnant and lactating mothers, and children under 3 years, through skilled counsellors, peer counsellors and support groups.
- **Continuum of care -** across the life-cycle that includes preventive, promotive and curative care, linking families, communities, AWCs, health centres and health facilities.
- **Innovative Service Delivery Models -** demonstration and ripple effect, with evidence of impact.
- **Community Based Monitoring -** Making undernutrition visible to families, communities, tracking and informed action.

Way Forward

By 2050, India is estimated to be home to 17.5% of the global population, with 1.7 billion people. With a growing population, the recurrent problem of undernutrition may get worse. Per capita net availability of food grains increased by about 10 per cent over the last few decades in India; however, this increase in food grains has not been able to keep pace with the increase in population. In addition, food security in India is under threat with considerable decline in the yields of cereals such as rice, wheat and pulses with significant changes in climate. In order to realise the vision and optimise impact, India needs multi-sectoral efforts to fight undernutrition.

SECTION-III

VALUE CHAIN AND VILLAGE TRADE RELATED ISSUES

भाकृअनुप
ICAR

Role of Local Biodiversity Resource & Traditional Knowledge Wisdom for Sustainable Food & Nutrition Sovereignty

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"When diet is wrong, medicine is of no use. When diet is correct, medicine is of no need." -Ancient Ayurvedic Proverb

Our Food system is based on (with Science & Traditional knowledge wisdom)

- Rich diversity of nutritive food ingredients
- Climatic changes & Ritucharya
- Seasonal changes
- Natural changes of body
- Biological needs of body

The basic principles of our Food system

- Rich diversity of food ingredients (flora & fauna) in food
- Food resource from healthy ecosystems (healthy soil, water, natural)
  - It attracts an attention to the effect of the cooking method on the quality of the foods, the importance of the vibrations of the cook and of the surrounding atmosphere, the compatibility of foods, the right time for cooking and eating, seasonal cycles and the effects of food on consciousness.
  - The five Elements, the three Doshas, the three Gunas, the seven Dathus and the six Tastes.

Major food supplying resources

- Forest
- Corridors between forest and villages
- Wilderness areas around villages / Village outskirts
- Agriculture fields
- Fences of agriculture fields

Common property resources (pastures, river banks, rivers, hillocks, sea shores, sea, lakes, fallow lands, 'waste' lands, etc.)

Resource Area	Flora Sp.	Fauna Sp.	Plants used by local community			
			Wild Edible	Medicine	NTFP	Fodder
Agriculture fields (Chhogala, Gunja, Mavli, Kada, Kheralu, Jhadol, Dungarpur, Visnagar, Nakalank, Kanthariya, Ghaghret, Kalpavalli	91	>140	104	67	3	41
Fences of agriculture fields (Chhogala, Gunja, Mavli, Kada, Kheralu, Visnagar, Jhadol, Upli Sigri, Undarada	189	>90	62	76	31	32
Forest (Jessore WLS, Balaram WLS, Polo, Kawant, Naswadi, Taranga, Kalpavalli, Kuvarsi-Danta, Shamlaji-Sabarkantha, Pavagadh, Sitamata & Mount AbuWLS	972	735	398	438	127	94
Corridors between forest & villages (Balaram WLS, Chitrasani-Palanpur, Zer Dhareshwar-Vijaynagar, Undapani- Bhiloda, Devas, Pachmadhi	476	>570	194	297	98	58
Wilderness/Village outskirts (Vadnagar, Ishwariya, Lakhabaval, Gunja, Jhadol, Gogunda, Valam, Udalpur, Valasana, Vadgam, Thalota, Mandropur, Nakalank, Mushtikovila)	269	>300	137	174	53	49
Common property resources						
Pastures (Kachchh, Tharad, Idar, Kalpavalli)	268	>180	79	163	41	52

Resource Area	Flora Sp.	Fauna Sp.	Plants used by local community			
			Wild Edible	Medicine	NTFP	Fodder
River banks, rivers, lakes (Narmada circumambulation, Tapi, Banas, Jaisamand	329	>400	91	168	82	71
Sea shores, Sea (Jamnagar, Chorwad, Kodinar, Pirotan Island, Navinal Island, Nana Layja, Mota Layja, Okha, Surat, Shravan Kavadiya,)	>294	>300	81	74	42	48
Hillocks (Taranga, Southern Aravallis- Rajasthan, Jhadol, Pavagadh, Shoolpaneshwar, Kalpavalli)	>349	>200	160	127	72	48
Waste lands (North Gujarat, Vadodara, Saurashtra,)	192	>200	76	71	37	69
Total	**1087**	**>900**	**387**	**483**	**241**	**167**

Between 30% & 50% or 1.2-2 bn tones of food produced around the world never makes it on to a plate (Murdo Macleod for the Guardian). As much as half of all the food produced in the world- equivalent to 2 bn tones- ends up as 'Waste' every year. Globally, an estimated more than 1.02 billion people are undernourished (FAO 2009). The literature on vulnerability, food security and ecosystem services has tended to emphasize cultivated foods (MEA 2005; Ericksen *et al.* 2009).

Over 50 per cent of the world's daily requirement of proteins and calories comes from three crops- Wheat, Maize and Rice (Jaenicke & Hoschle-Zeledon 2006); 12 species contribute 80 per cent of total dietary intake.

Strong contribution of Biodiversity in Food & Nutrition Security

Millets help in biodiversity conservation; birds and develops small animal associations.

Echinochloa colonum Sama

Kangani



Echinochloa frumentacea (Bati)



Eleusine coracana (Maal)

Ghooghari: an ideal traditional breakfast Sprouted grains + seeds of Millets + Pulses + Sahajan

Chatpati Ghooghari

Mithi Ghooghari

Millet diversity register: mapping of Millet areas in Gujarat & Rajasthan; millets can support Agro-forestry system in mountain ecosystem, can enhance food-fodder-nutrition security

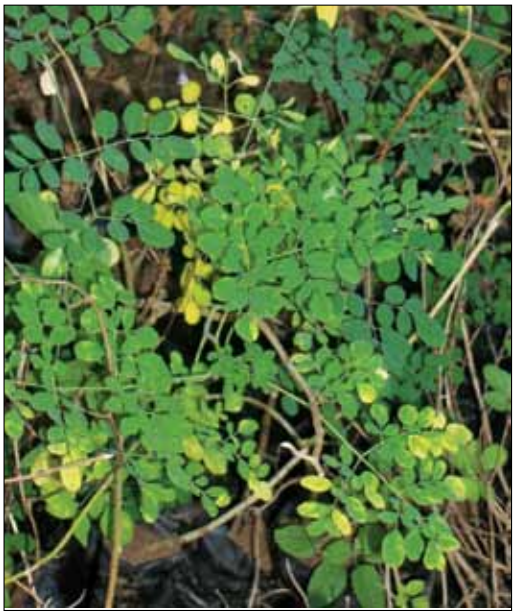
Zaika Taste of forest



Forest Plants under edible use

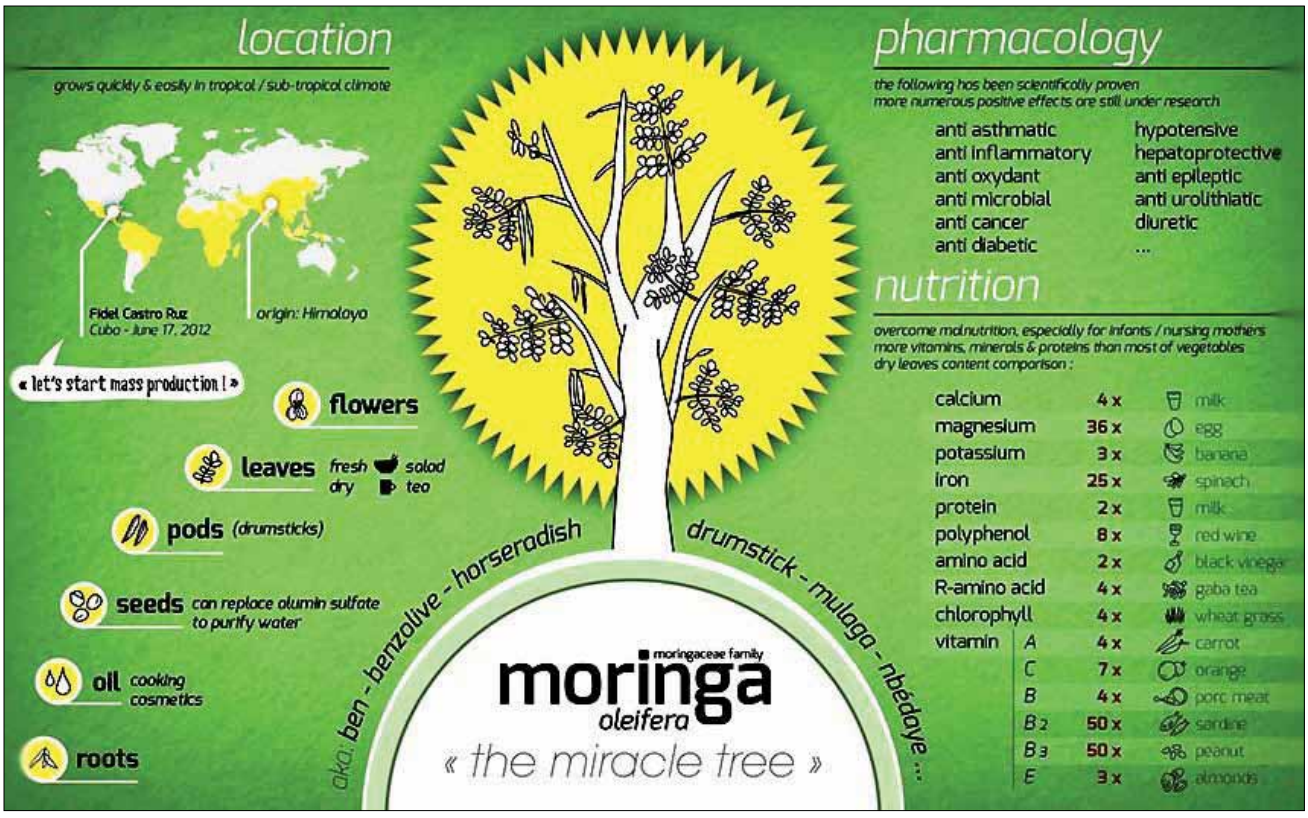
Saragavo, Sahajan, Sargu, Senjana, Moringa tree

Highly nutritive Rich with Calcium, protein, Vitamins Successfully solves Malnutrition problem





Moringa :The Miracle Tree



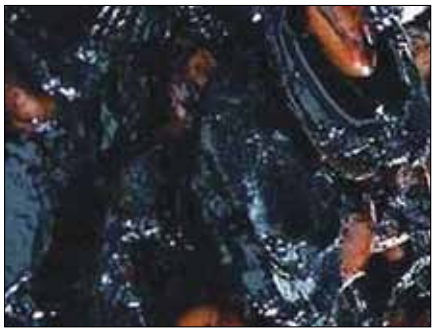
Emblica officinalis Gaertn (Aamala, Anwala)

Fruits are sour, astringent, bitter, acrid, sweet, cooling, anodyne, ophthalmic, digestive, carminative, stomachic, laxative, aphrodisiac, rejuvenative, diuretic, tonic.



Cassia fistula (Garmalo, Karmela, Amaltas)

Purgative, Blood purifier, very good for weight loss, Pitta shamak



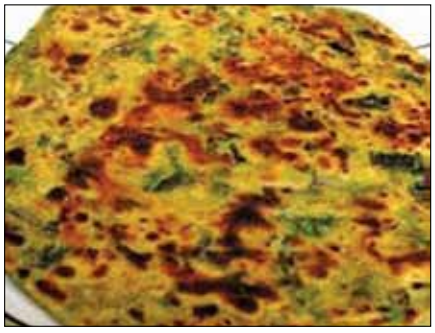
Madhuca indica J.F. Gmel (Mahudo, Mahua)

Flowers are rich source of Sugar, Protein, Vitamins & Minerals



Rivea hypocrateriformis Fangvel

Analgesic, Anti-inflammatory



Aloe barbadensis Mill (Kunvarpatha, Gwarpatha)

Blood purifier, Good for skin, Good for overall health



Madhunashini, Gudmar, *Gymnema sylvestre R. Br.*

Digestive, Anti-inflammatory, diuretic, hypoglycemic (medicine to treat diabetes).

Ceropegia bulbosa

Ceropegia bulbosa, a twiner with underground bulb - The entire plant along with bulb, branches, leaves, flowers, fruits and buds is used for edible purpose. Highly nutritive, energetic



Food Festivals, campaigns, workshops

- Millets and Wild edibles (including edible weeds): the total package of nutrition
- Wild edible plants for food & nutrition security: why hunger burden on Agri fields.
- Ayurved and traditional foods: Food and health security
- Delicious Medicinal plants recipes: we don't need doctor
- Natural Food heritage
- Wild cuisine
- Hamare bhule bisre vyanjan
- Wild delicacies, Healthy drinks: sustainable health is in our hands
- Slow Foods , healthy fields, healthy life
- Our Festivals & related traditional foods : A scientific food system of India

- Recipes for health: solution of malnutrition, diabetes, constipation, etc.
- Sahi Ritucharya aur Sahi Bhojan : Utkrusht Jivan hetu
- Common property resources for food & nutrition security
- Ancient Aahar Vigyan/ Paak Kala: cooking process, science of ingredients, etc.
- Authentic recipes: rare & endangered recipe ingredients, their adulteration in market - chyavanprash, other medicinal recipes.

The nutritional value of rich diversity in food

- Wild foods are important sources of micronutrients, their energy-density is generally low (with the exception of Honey & high-fat organs or in season fat deposits. Samson & Pretty 2006; McMichael *et al.* 2007).
- In the Sahel, several edible desert plants are sources of essential fatty acids, iron, zinc and calcium (Glew *et al.* 1997).
- In the arid Ferlo region of Senegal, some 50 % of all plants have edible parts, and commonly consumed are critical suppliers of vitamins A, B2 & C, especially during seasonal lean periods (Becker 1983).
- Lockett *et al.,* 2000, found that among the plants used by the Fulani in Nigeria, available during the dry season (and important for ensuring year-round nutritional security in the face of possible food shortages) were superior in energy & micro-nutrient content compared with those from the wet season.
- Wild plants & animals form a significant proportion of global food basket
- Almost every ecosystem has been amended so that plants and animals can be used as food, fodder, medicines etc.
- Some indigenous communities use over 200 (Kuhnlein *et al.* 2009); in India, 600 plant species are known to have food value (Rathore 2009); Some 1069 species of wild fungi consumed worldwide are important sources of protein and income (Boa 2004).
- Wild plants have diverse uses - Kachchh, Jessore, Udaipur, Kalpavalli, etc. including food, medicinal, beverage, oil yielding, dye yielding, craft making, hut construction, agriculture tool making & religious (food prog. 1998, 2000, 2002 2003, 2004, 2005, 2007, 2009, 2011, 2014, 2015, 2016.
- Wild foods provide a greater dietary diversity to those who rely on them. Ethnobotanical studies of wild plants indicate more than 7000 species have been used for human food in human history (Grivetti & Ogle 2000; MEA 2005).
- Despite their value (nutritional, medicinal, ecological), wild foods are excluded from official statistics on economic values of natural resources.
- There is substantial evidence that wild foods are an important part of the global food basket. At regional and national level, food balances guide policies on trade, aid and the declaration of food crises. The contribution made by wild edible species is notably absent.
- Local communities in their environments, use many wild plants and animals. Yet, provision of and access to these sources of food declining as natural habitats come under increasing pressure from development, conservation- exclusions and agricultural expansion without ecological-holistic perspective.

Major threats on food supplying resources

- Maximum pressure of food production on agriculture lands.
- Unplanned urbanization & increased demand of needs.
- Development juggernaut: Pressure of unplanned, unbalanced & unstoppable Industrialization.
- Market forced mechanization -ecologically not sound.
- Drastic land use change/ resource over-use (over exploitation).
- Change in market interests, food habits, degrading traditional knowledge deteriorating natural food supply.

Problems of current food & nutrition status

- Agro fields become dump-yard of chemicals
- No living soil, No Soil Nutrients, No soil fertility and No productivity

- Indigenous seed diversity decreasing and maximum species are in endanger
- Food webs and food chains in agro fields are broken
- Eco services of agro fields collapsed (pollinators, Soil engineers, etc.)
- Local edible resources other than agriculture are diminishing from food system
- Current agriculture practices need excessive water and ground water table decreased
- 'Developmental projects' degraded green covers, increased aridity
- Climatic changes affecting overall productivity & production
- Market oriented farming lead to grow cash crops with high inputs, leading crisis of food crop production, killing farmers
- Scientific relevance and values of our food system is gradually disappearing
- Fast foods, junk foods, processed foods, packaged foods are taking place in our festival celebration and adulteration in foods is day by day increasing

Gradually disappearing Diversity

Crop	Varieties	Colour	Remark
Finger Millet	Laal Maal	Red	Less water crop
	Safed Maal	White	Less water crop
Great Millet	Nali Jowar	Dark	Grain small
	Safed Jowar	White	Grain Big
Pumpkin	Bhurkola	Yellow	Sacred
	Chaki	Yellow	Small
	Gol dangar	White	Round
	Lamba dangar	Yellow	Oval shape
Rice	Basmati	White	More water needed
	Dangar	White	Less water crop
	Dhanadi	White	Smallest grain, needs more water
	Dudhmogar	White	Less water crop
	Hegdo	Cream	Less water crop
	Hejni	White	Less water crop
	Hutarhal/ Sustarsal	Cream	Less water crop
	Kajal	White	Less water crop
	Kamod	Cream	Less water crop
	Maudiyu	Yellow	Less water crop
	Tana tondi	White	Less water crop
	Vari	Black coat	Less water crop

Biodiversity to enrich fields

Enhancing biodiversity allows natural agro ecological processes and the ecosystem as a whole to build soil nutrients and natural resistance to pests and diseases; services typically performed by external inputs in mono crops where these natural processes are removed.

Mixing diversity:

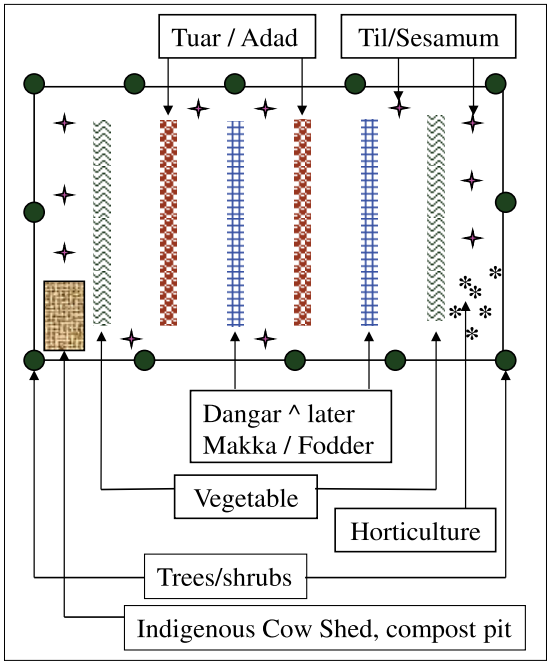
- Multi-purpose trees which give many benefits such as fodder, timber, firewood, medicine, bee forage, and fruit
- Trees with small leaves that don't over shade the land.
- Trees which drop their leaves in winter, such as mulberry, and melia.
- Trees which don't compete with ground crops.
- Trees which have deep roots that aren't damaged by ploughing, such as most legumes, and melia.
- Nitrogen-fixing trees which increase nitrogen in the soil.
- Trees which not require a lot of water, use amounts of water/rain available.

Traditional Mix cropping:

Balancing Eco services Laheriyu Khetar of Tribal region, Gujarat

In this mix cropping method, numbers of beds (*Paliya*) are more and parallel in the field. Each bed is for different crop and hence at the same time, grows more crops (legumes, millets, vegetables) of the season.

If Sesame (Til) is grown in one bed, it cannot grow properly so sesame crops are placed at distance. Different kinds of indigenous trees/shrubs planted on the fence of field (Agro forestry). In this method, in case of severe situation, one or two crop will be harvested and the farmer can earn and save his investment. Also such mix cropping helps to the soil matter balance and productivity.



Model Agro field of Jayesh Patel (Gujarat)

He experienced badly with hybrids & chemicals so he left cultivating hybrid and started cultivating highly nutritious diverse local seeds, millets, vegetables. Cultivating technique is zero cost, and required low carbon inputs. Use of Indigenous floral species & Indian cow products (dung, urine) to make organic manure & biological pest controls in field at zero cost. Organic manure helps soil health (Kankrej Gauvansh-4) and required less water for cropping. More earning by mix cropping-vegetables, millets with good profits.

His father get cured from severe Asthma attacks due to chemicals. Now enjoying the healthy foods. Completely left using of chemical fertilizers & pesticides. and huge savings by reduced cost of inputs. Strong species association of domestic & wild edible plants were developed. Agro forestry was used as ecological fencing. By using ecological fencing NTFP production increased and also protect surrounding habitats of wild edible plant species.

Conservation Issues

- Degradation of grasslands
- Decreasing water regime
- Forest degradation and Biotic loss
- Extreme environment condition-low & erratic rainfall, high rate of evapotranspiration
- Failure of natural regeneration
- Increasing use of forest land in non-forestry works
- Habitat alteration and loss
- Heavy anthropogenic pressure
- Human - Wildlife conflicts
- Indigenous cultures affected by rapid acculturation

Major problems

- Networking problem among NGOs, Govt. bodies., Agri Uni.
- Govt. policy based on Expensive agriculture promotion in villages
- Faulty policies
- No benefits to the remote and poor farmers/ communities

- No market linkage with interior/tribal farmers for direct benefits.

Heads I win, Tails you lose…

- Hybrid promotion… for more production?... For whose benefit?
- Hybrid and BT increase... … GDP of the country?.....OR……. Sick lands, Pollutions, Farmer suicides, Food scarcity, Nutrition crisis, Water scarcity (surface and ground both)!!!!
- Who helps them to destroy our own seeds, grains, millets, BD?

Consumers with access to global supplies of food are less vulnerable to local shortages caused by drought, disease or civil disorder.

-Alan Tennessen, Vice President, Cargill (the giant among grain)

References

Becker B. 1983. The contribution of wild plants to human nutrition in the Ferlo (N Senegal). Econn.Bot.1:257-267.

Boa E.2004. Wild edible fungi A Global overview of their use and importance to people. Non-Wood Forest Products. FAO, Rome, Italy.

Ericksen P.J., Ingram J.S.I. and Liverman D.M. 2009. Food Security and Global Environment Change. Environmental Science Policy 12, 373-377. (doi:10.1016/j.envsci.2009.04.007)

FAO 2009. The State of Food Insecurity in the World, Rome, Italy

Glew R.H., Vander Hagt D.J., Lockett C., Grivetti L.E., Smith G.C., Pastuszyn A. And Millson M. 1997. Amino acid, Fatty acid and mineral composition od 24 indigenous plants of Burkina Faso. Journal of Food Composition Anal. 10:205-217. (doi:10.1006/jfca.1997.0539)

Grivetti L.E. and Ogle B.M. 2000. Value of traditional foods in meeting macro and micronutrient needs: the wild plant connection. Nutrition Research and review.13:31-46.(doi:10.1079/095442200108728990)

https://www.wfp.org/publications/wfp-annual-repor

Jaenicke H. and Hoschle-Zeledon I.(eds).2006. Strategic freamework for underutilized plant species research and development. Rome, Italy: ICUC, Colombo and Global Facilitation Unit for Underutilized Species.

Kuhnlein H., Erasmus B. and Spigelski D. 2009. Indigenous peoples' food systems. Rome, Italy: FAO Centre for Indigenous People's Nutrition and Environment.

Lockett C.T., Calvert C.C. and Grivetti L.E. 2000. Energy and micronutrient composition of dietry and medicinal wild plants consumed during fdrought. Study of rural Fulani, Northeastern Nigeria. International Journal of Food Sciences and Nutrition.51:195-208.

Mcmichael A., Powles J.W., Butler C. D., Uauy R. 2007. Food, Livestock production, energy, climate change and health. Energy and Health 5. Lancet; 3700:1253-63.

Milleniumosystem Assessment (MEA).2005. Current state and trends, Washington, DC.

Rathore M. 2009. Nutrient content of important fruit trees from arid zone of Rajasthan. Journal Horticulture 1:103-108.

Samson C. and Pretty J. 2006. Envrionmental and health benefits of hunting lifestyles and diets for the Innu of Labrador. Food Policy 31, 528-553.(doi:10.1016/j.foodpol.2006.02.001).

Participation of Self Help Groups in Agro Processing Enterprises and their Constraints

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Introduction

"When women moves forward the family moves, the village and the nation moves." These words of Pandit Jawaharlal Nehru are often repeated because it is an accepted fact. Women (especially rural women) are vital development agents who can play a significant role in the economic development of a nation, but they should have an equal access to productive resources, opportunities and public services. It has also been realized in the last few years that the widespread poverty and stunted economic growth can be overcome only by gainful and sustainable economic participation of women. National development will be sluggish, if the economic engine operates only at half power (Santha 2013).

Micro enterprise is an effective instrument of social and economic development The development of micro enterprises in general and particularly for woman would be the appropriate approach to fight against poverty at the grass root and generate income at the household level. This has necessitated the grouping of woman in Self Help Groups and development of entrepreneurship among them.

Areas of Micro-Enterprise Development through SHGs.

- Agriculture and allied agricultural activities.
- Livestock management activities.
- Household based operations

Purpose of Study

The purpose of study was to assess the role of institutions in promotion of SHG entrepreneurship and how effectively SHGs in developed microenterprises and self employment for women's and the efforts that sustain and ensure necessary income to members.

Objectives of Study

- To know the types of enterprises started by the SHG women.
- To investigate the constraints faced by SHG entrepreneur regarding setup, management and marketing.

Methodology

Sample Size and Sample Selection

The study was conducted in Chandrapur district of Maharashtra. Chandrapur district comprises 15 blocks. The women SHGs who are engaged into some income generating entrepreneurial activity from two or more years selected for study.

The purposive random techniques were used to select SHG's. For this purpose the list of SHG's entrepreneurs of each block were collected from District Rural Development Agencies, Mahila Arthik Vikas Mahamandal, Commercial banks of year 2011-12. Out of total number of SHGs started business activities, 150 SHGs, 10 SHG's of each block were chosen by lottery method for the study.

Research design and data collection

A descriptive survey research design was used for study. A pretested structured interview schedule was administered for data collection from the respondents. Statistical analysis of data were carried out by using SPSS (18.0 Software).

Results and Analysis

Participation of SHGs in different entrepreneurial activities

The type of enterprises started by SHG entrepreneurs in particular region reflects their potentiality, interest and demand of the product in the market. Moreover, distribution of the SHGs according to the enterprise undertaken by group is categorized as shown in table.

Table 1: Participation of SHGs in different entrepreneurial activities

Enterprises undertaken	Respondents	Per cent
Agriculture and related activities	31	20.7
Livestock related activities	29	19.3
Agro processing / food processing related	47	31.4
Other non agriculture	43	28.6
Total	**150**	**100.0**

Participation of SHGs in different entrepreneurial activities presented in Table 1. Results show that majority (31.4 per cent) of the SHG are engaged in agro processing / food processing related activities ie. purchasing and selling of farm produce by doing primary processing cleaning, grading, milling manufacturing of processed food items jam, squashes, pickles, papad, snacks items. Value addition of products obtained from forest like making articles of bamboo. Followed by (28.6 per cent) SHGs participated in other types of enterprising activities like the shops, tailoring, pottery making, and operating mess service.

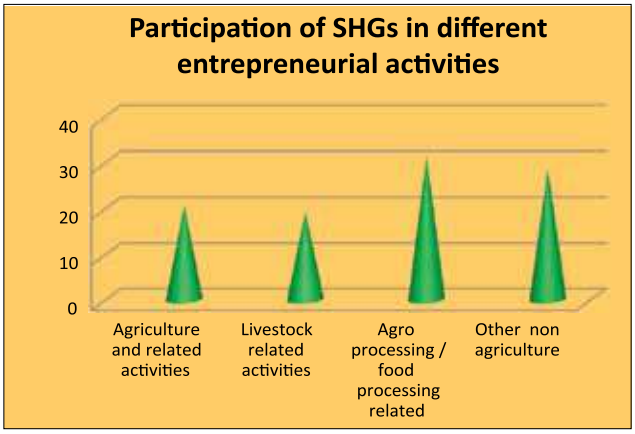

Table 2: Constraints faced by SHG women engaged in agro processing enterprise

S. No.	Constraints	Respondents	Per cent	Degree of constraint
I. Production related constraints				
1.	Difficulty in getting raw material	66	44.0	Moderate
2.	Lack of knowledge about appropriate technology / procedure	39	26.0	Low
3.	Quality control and standardization	37	24.7	Low
II. Infrastructure constraints				
1	Lack of infrastructure facilities like work shed/ electricity / water for selected activity	74	49.3	Moderate
2	Lack of storage facilities	70	46.7	Moderate
3	Lack of required machineries and implements	46	30.7	Low
III. Economic constraint				
1	Difficulty in getting loan on time	51	34.0	Low
2	Delay in getting subsidies	56	37.3	Moderate
3	Repayment period and high interest rates	70	46.7	Moderate
4	Low profit margin	50	33.3	Low
IV. Marketing constraint				
1	Poor marketing linkage	98	65.3	High
2	Lack of market information like appropriate market and distribution network, consumer preference and capacity of market	81	54.0	High
3	Lack of transporting facilities	66	44.0	Moderate
4	Competition from mechanized better quality product of larger and established units	57	38.0	Moderate

S. No.	Constraints	Respondents	Per cent	Degree of constraint
V. Technical constraint				
1	Lack of technical know how about production, storage, quality standards	98	65.3	High
2	Lack of training and up gradation of skill	111	74.0	High
3	Lack of knowledge about account keeping and financial matter	74	49.3	Moderate
4	Lack of knowledge about govt. subsidies, schemes	68	45.3	Moderate
VI. Social constraint				
1	Social attitude towards women entrepreneurs	38	25.3	Low
2	Poor education levels of society	50	33.3	Low
VII. Personal constraints				
1	Work burden of household and farm activities	133	88.7	High
2	Responsibilities of small children and dependent in laws	63	42.0	High
3	Lack of encouragement and support from family members	33	22.0	Low

Table 2, indicates that majority of the SHGs 44.0 per cent face difficulty in getting the raw material as their main production constraint. Most of the SHGs 49.3 per cent reported that lack of infrastructure facilities like work shed/ electricity / water for selected activity etc. leads to main hurdle, 46.7 per cent SHGs reported that repayment period and high interest rates seems to be the basic economic worry. It is seen from the table 2 for 65.3 per cent SHGs had poor marketing linkage is a major marketing constraint. Majority of the SHGs (74.0 per cent) lack of training and up gradation of skill is a major technical constraint. About 33.3 per cent SHGs poor education levels of society is a basic social difficulty. Majority of SHGs 88.7 per cent feel that work burden of household and farm activities is the main personal difficulty.

While comparing from the results the overall constraints faced by the SHG entrepreneurs from the above, it can be concluded that personal, technical and marketing difficulties are the high degree constraints. While infrastructural and economics related difficulties are the moderate degree constraints whereas constraints related to production and social difficulties are the low degree constraints faced by SHG entrepreneurs in the region.

Overall Constraints Faced by SHG Women Entrepreneurs

Degree of Constraint	Constraint Related to
High	Marketing
Moderate	Technical Aspects
Low	Personal Factors
	Infrastructure
	Economics
	Production
	Social Attributes

Conclusion

On the basis of research results, in view of investigator it can be concluded that, majority of enterprises undertaken by SHG women is based on agriculture, agro processing and non agriculture. It is found that only few members of the group are engaged in enterprise activity. SHG women are facing number of constraints while running enterprises. The major constraints are related to personal, technical and marketing which are the main hurdles in the growth of enterprises. Hence more support is needed to sustain the enterprises, in development of marketing skills, account-keeping and information of legal aspects in SHG members by development of more focused and skill oriented training programs. A micro enterprise through women self-help groups gives the socio economic status to women, but it will enhance if they get support from family and society.

Reference

Santha, S. 2013. "Women Entrepreneurship in Kerala: A Comparative Study With Tamil Nadu", pp. 6-7.

Comparision Between Glycemic Index and In-vitro Starch Digestibility of Selected Newly Released Rice Varieties of Northern Telangana Region, India

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Introduction

According to FAOSTAT, 2014 rice is a staple food consumed by more than half of the world population. It provides 20 per cent of the world's dietary energy supply, while wheat supplies 19 per cent and maize 5 per cent (FAO, 2004). Rice has always played a very important role in the food grain category and it is also very necessary for the production of other products for which rice is used as a raw material. India being the second largest producer of rice in the world. (Vijay, 2015). The slogan 'Rice is Life' is more appropriate for India as this crop plays a vital role in our National food security and is a means of livelihood for millions of rural households (Uma, *et al*. 2012).

Diabetic Individuals

Starch is the most common carbohydrate in rice. The basic components of rice starch are amylose and amylopectin. Variation in the glycemic index of rice is due to differences in the proportion of amylose and amylopectin content of starch. Higher the amylose content, lower the glycemic index, hence amylose rich starch is a potential benefit to carbohydrate sensitive or diabetic individuals.

Objectives

- To assess the Glycemic Index of Rice varieties.
- To correlate in vitro starch Digestibility and Glycemic Index.

Materials and Method

Materials: One of the new released rice varieties viz Anjana (JGL-11118) and Pradhyumna (JGL-17004) were procured from Regional Agricultural Research Station, Jagityal, Karimnagar.

Experimental design: Clinically healthy adult subjects (n=20) of age 19 - 25 years were selected for the study of glycemic index of the rice varieties, JGL-11118 and JGL-17004. After an overnight fast, blood glucose was checked for fasting level and then the subjects were fed 50 g of Glucon-D as a reference food and blood glucose was checked at 15, 30, 45, 60, 90 and 120 minutes according to the method of Wolever *et al*., (1991) . The subjects were allowed a normal diet for next three days and then again after an overnight fast, the fasting blood glucose level was taken and then the subjects were fed with 50 g of carbohydrate equaled test food (cooked plain rice). Subjects were given 10 min to complete the given test food portion with drinking water (250 ml) and asked to chew the food thoroughly and then blood glucose was checked at 15, 30, 45, 60, 90 and 120 minutes.

Blood sampling and analysis: Capillary blood was taken from finger tips for blood glucose estimation using Glucometer (One Touch). The blood samples were taken at fasting state (0 min) and at 15, 30, 45, 60, 90 and 120 min interval after ingestion of the reference food as well as test food. The subjects were restricted from performing any physical activity during the 2 hr of study period. The Area Under Curve (AUC) of GI of rice were calculated for each subject. The Incremental Area Under Curve (IAUC) of both reference and test food was used to obtain the Glycemic Index (GI) by the following formula:

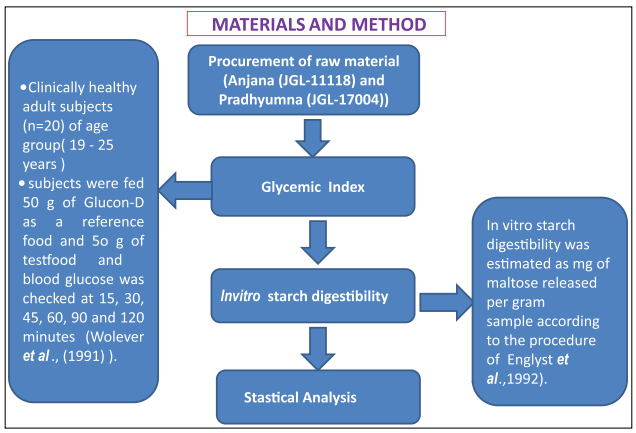
$$GI_{food} = \frac{IAUC \text{ in response to a relevent test food portion}}{IAUC \text{ in response to equal weight of reference food (Glucose)}} \times Amount \text{ of food } (100)$$

In vitro digestibility of starch

Digestibility of starch from rice sample was determined by using the enzymatic method proposed by (Englyst*et al*.,1992).

Stastical Analysis: Data were expressed as mean ± standard deviation. Comparison of the glycemic response of different of varieties of rice with glycemic response of glucose were made by

paired t-test. Correlation of the glycemic index and *Invitro* starch digestibility of selected newly released rice varieties of glucose were made by Pearson correleation.



Results and Discussion

The Glycemic index of two newly released rice (*Oryza sativa*) varieties such as Anjana (JGL-11118) and Pradhyumna (JGL-17004) were determined. Clinically healthy adult subjects (n=20) of age 19 - 25 years were selected for the study of glycemic index of the rice varieties Anjana (JGL-11118) and Pradhyumna (JGL-17004). The blood samples were taken at fasting state (0 min) and at 15, 30, 45, 60, 90, and 120 min interval after ingestion of the reference food and test food.

According to Jenkins *et al*, (1981) Glycemic Index (GI) can be defined as the incremental area under blood glucose response curve of a 50 g carbohydrate dose from a reference food (white bread or glucose) taken by the same subject over a specified period of time. For determining glycemic index, foods are categorised as low (GI value < 55), medium (GI value 56-69) or high GI foods (> 70).

The mean fasting blood glucose level of the participants was 88.9 ± 12.1 mg/dl, and the mean blood glucose level at 30 min and 60 min after the oral administration of 64 g of glucose were 159±25.5 and 125±30.8. Different varieties of cooked rice (Anjana (JGL-11118) and Pradhyumna (JGL-17004) containing 64 g digestible carbohydrate were administered to the participants, and the peak blood glucose response was obtained at 30 min.

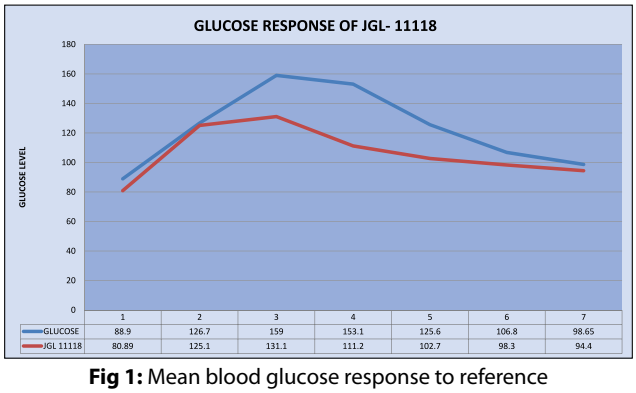


Fig 1: Mean blood glucose response to reference and two test foods (mg/dl)

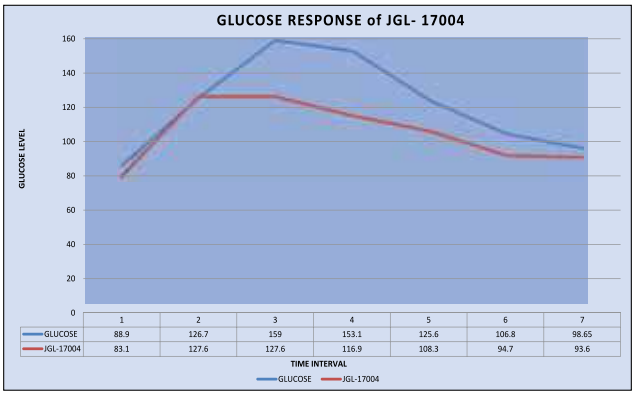


Fig 2 Mean blood glucose response to reference and test food (in mg/dl)

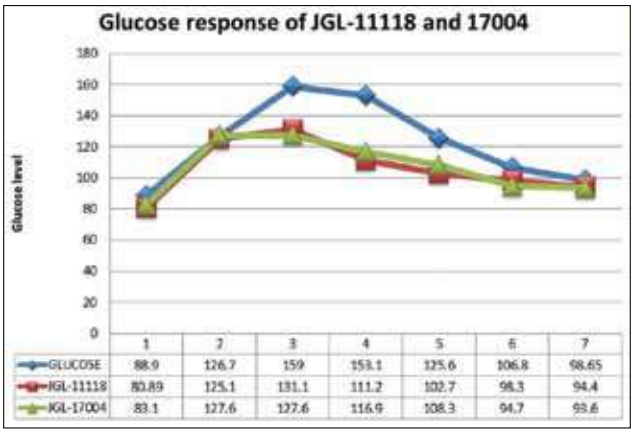


Fig 3: Mean blood glucose response to reference and test food (in mg/dl)

The results indicated that when new released rice variety Anjana (JGL-11118) was orally administered to the selected subjects the test food had a maximum peak levels that is 131±21.3 at 30 minute. Therefore, from the present study, it was observed that reference food (glucose) had a maximum peak level (159±25.5) compared to the test foods (JGL-11118).

When Pradhyumna (JGL-17004) rice was orally administered to the selected subjects, it showed a maximum peak level of 127.6 mg/dl at 30 min and reference food (glucose) showed a maximum peak level of 159 mg/dl at the same time. Shobana, *et al.* (2012) reported GI values for SonaMasuri (72.0 ± 4.5), Ponni (70.2 ± 3.6) and SurtiKolam (77.0 ± 4.0) rice varieties were non-significant and all were classified as high GI varieties of rice.

Results revealed that there was a significant difference ($p<0.050$) between test foods (JGL-11118, JGL-17004) in comparison with reference food (Glucose), but there was no significant difference between the test foods. After estimation, the Glycemic Index value of Pradhyumna (JGL-17004) and Anjana (JGL-11118) varieties of rice was established to be 51.3 and 52.7. Based on these results, it can be concluded that Pradhyumna (JGL-17004) and Anjana (JGL-11118) rice varieties belongto lower GI category.

In vitro Starch Digestibility

Gelatinization or any other treatment that destroy the granular structure of starch increases the digestibility of starch to enzyme action. The in-vitro methods of starch hydrolysis provide useful means of assessing the degree of gelatinization of starch in a product, in predicting bioavailability of starch invivo and selecting starchy foods according to the specific needs of different groups of consumers. Several workers have shown significant correlation in starch availability in-vitro and in-vivo. Hence, invitro method of starch digestibility based on the availability of maltose was used in the present study.

Days	*Invitro* starch digestibility of Anjana (JGL-11118)	*Invitro* starch digestibility of Pradhyumna (JGL-17004)
1	33.5	27.5
2	33.3	27.3
3	34.8	28.2
4	34.6	28.9
5	33.9	28.8
6	34.6	28.9
Mean	34.6	34.6

Correlation of In vitro starch digestibility and glycemic index

Glycemic index values of Anjana (JGL-11118) and Pradhyumna (JGL-17004) was correlated using Pearson correlation with In vitro starch digestibility values of Anjana (JGL-11118) and Pradhyumna (JGL-17004). Statistical analysis on correlation value between Anjana (JGL-11118) and Pradhyumna (JGL-17004) revealed that r value was 0.73363. It was observed that there is a significant correlation between In vitro starch and Glycemic Index at 5% ($p<0.05$) level of significance.

Conclusion

Hence, from the above study it may be inferred that the Rice and legume blends especially high fibre and protein source use as a breakfast product (Idli) should be encouraged for achieving a good glycemic control in diabetes.

References

Englyst H.N., Kingman S.M., and Cummings J.H., 1992. Classification and Measurement of Nutritionally Important starch Fractions European Journal of Clinical Nutrition. 46 (suppl.2):S33-S50.

Food and Agricultural organization of the United Nations. FAOSTAT database. 2014. http://fao.org/site/362.

Food and Agricultural Organization of the United Nations (FAO). 2004. Rice is Life. ftp://ftp.fao.org/docrep/fao/008/y5682e/y5682e00.pdf

Jenkins, D. J., Wolever, T. M., and Taylor, R. H. 1981. Glycemic index of foods: a physiological basis for carbohydrate exchange. *American Journal of Clinical Nutrition.* 34: 362-366.

Uma devi, M., Pushpa, R., Sampathkumar, K. PandDebjit, B. 2012. Rice - Traditional Medicinal Plant in India. *Journal of Pharmacognosy and Phytochemistry*. 1 (1): 6-12.

Vijay Kumar. 2015. Rice Production in India During Pre And Post World Trade Organization. *Asian Journal of Multidisciplinary Studies.* 3(3): 198-212.

Wolever, J. M. S.,Vorster, H. H., and Bjorck, I. 2003. Determination of the glycemic index of foods inter laboratory study. *European Journal of Clinical Nutrition.* 57: 475-482.

SECTION-IV

IMPROVING MATERNAL AND CHILD NUTRITION

भाकृअनुप
ICAR

Give Kids A Good Start

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The first 1,000 days of life from conception to second birthday is a unique period of opportunity when the foundations of optimum health, growth, and neuro development across the life span are established. In developing countries, poverty, malnutrition, weaken this foundation, leading to earlier mortality and significant morbidities, leading to loss of neuro developmental potential. In India, 22% babies born each year have low birth weight (LBW)<2.5 kg, which has been linked to maternal under-nutrition and anemia among other causes. Along with under-nutrition, infectious disease, environmental hazards, all contribute to this loss of potential. Worldwide, obesity has more than doubled since 1980 with an estimate of around 1.5 billion overweight adults. At least 2.8 million adults die each year as a result of being overweight or obese. Under nutrition remains the major challenge worldwide, we are now faced with the negative effects of "over nutrition". Malnutrition from both has been shown to potentially reduce brain development. At least 200 million children living in developing countries fail to meet their developmental potential (Lancet-2007).

The critical or sensitive periods of brain development susceptible to specific nutritional deficiencies are well defined, making prevention of long-term deficits with well-timed nutritional interventions during the fetal period and first years of life critical. Interventions based on the knowledge of these critical windows have the potential to exert a profound global impact. Correction of nutritional deficits alone has been estimated to have the power to increase the world's intelligence quotient by 10 points (Morris *et al*., 2008).

Studies have shown that there is a strong association between birth size and later health. Low birth weight is now known to be associated with increased rates of coronary heart disease and the related disorders, stroke, hypertension and type 2 diabetes. The model proposes that nutrition during fetal life, infancy and early childhood changes gene expression and there by establishes functional capacity, metabolic competence and responses to the later environment (Barker *et al*., 1989).

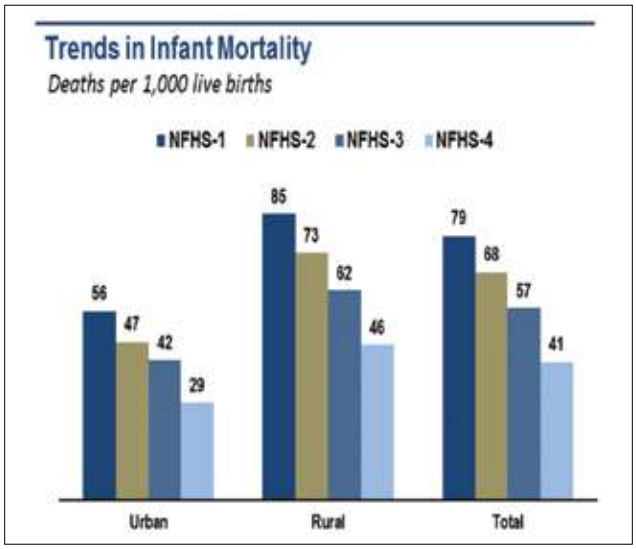
Poor maternal nutritional status are present in women who deliver preterm. These includes a low gravid body mass index, inadequate weight gain for gestation and faltering fetal growth. Recent observations have shown that impaired growth in infancy and rapid childhood weight gain exacerbate the effects of impaired prenatal growth.

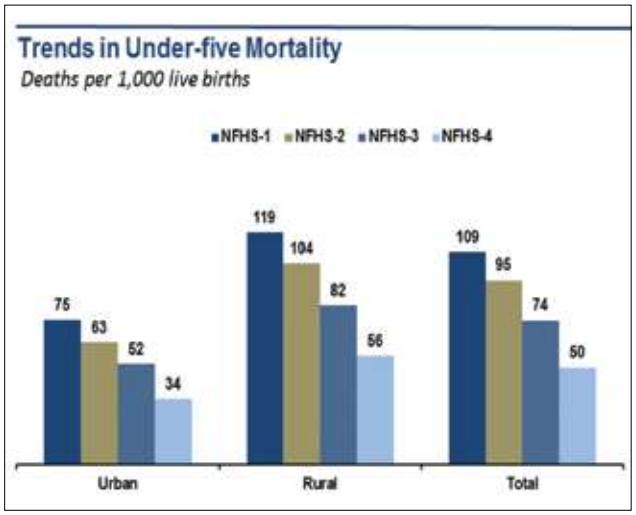
There is growing evidence that maternal nutritional status can alter the epigenetic state (stable alterations of gene expressions through DNA methylation and histone modifications) of the fetal genome. This may provide a molecular mechanism for the impact of maternal nutrition on both fetal programming and genomic imprinting. Just as the damaging effects of malnutrition, pass from one generation to the next, so can benefits of good nutrition passed from one generation to the next (Kulhe *et al*., 2011).

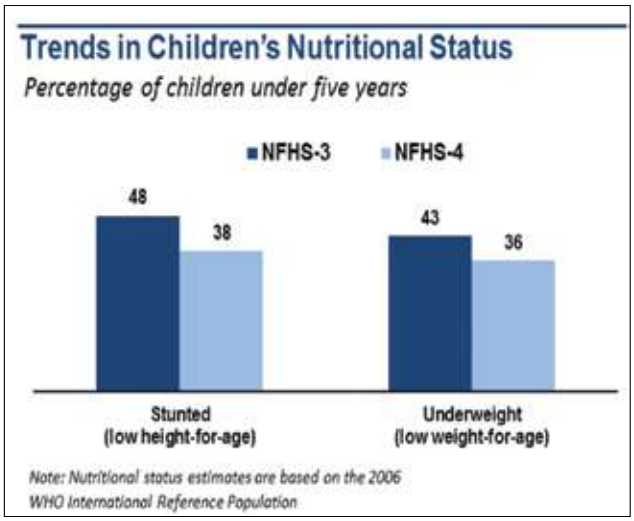
Facts on Infants and Young Child

- The under-five population of India stands at a staggering 112.8 million.
- India also has the highest numbers of children with moderate and severe wasting.
- EBF = 51% at 2-3 months of age & 28% at 4-5 months of age.
- Complementary feeding is introduced in only 53% infants between 6–8 months, with only about 44 % of breastfed children being fed at least the minimum number of times recommended (NFHS-3).
- Overall, only 21% of breastfeeding and non-breastfeeding children are fed in accordance with the infant and young child feeding (IYCF) recommendations.

INDIA - Key Indicators

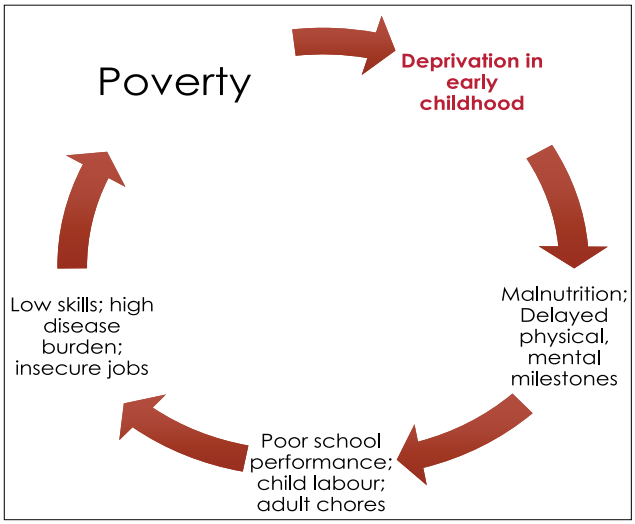






ECCE – breaking the poverty cycle

A pre-emptive strategy; sound economic and scientific basis



Infant and Child Mortality Rates (per 1,000 live births)

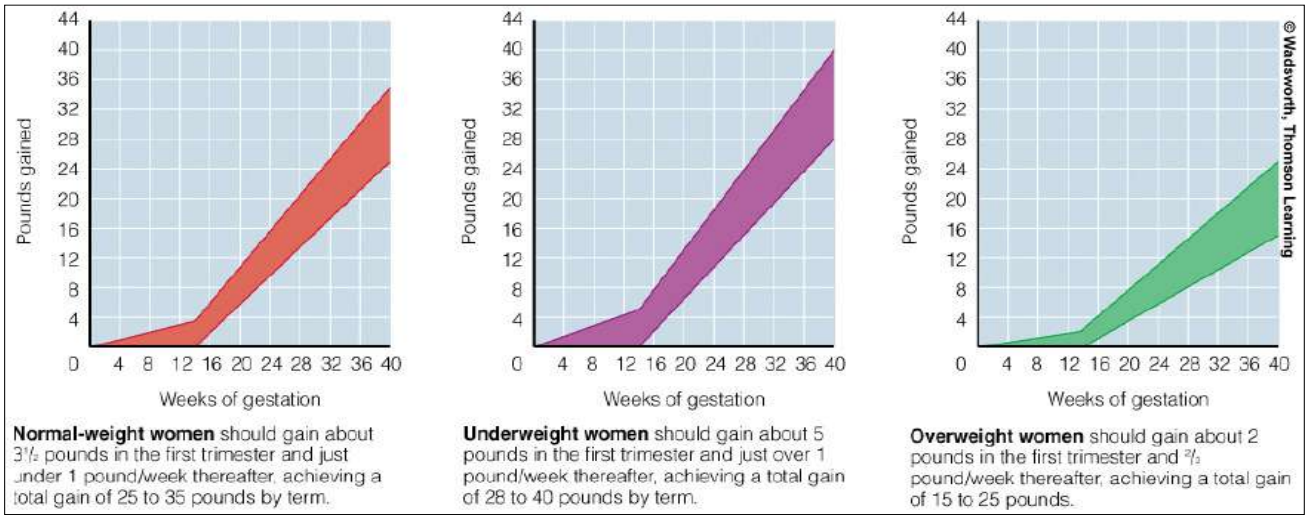
Particular	NFHS-4 (2015-16)			NFHS-3 (2005-06)
	Urban	Rural	Total	Total
Infant and Child Mortality Rates (per 1,000 live births)				
Infant mortality rate (IMR)	29	46	41	57
Under-five mortality rate (U5MR)	34	56	50	74
Anaemia among Children and Adults				
Children age 6-59 months who area anaemic (<11.0 g/dl) (%)	55.9	59.4	58.5	69.4
Non-pregnant women age 15-49 years who are anaemic (<12.0 g/dl) (%)	51.0	54.3	53.1	55.2
Pregnant women age 15-49 years who are anaemic (<11.0 g/dl) (%)	45.7	52.1	50.3	57.9

Particular	NFHS-4 (2015-16)			NFHS-3 (2005-06)
	Urban	Rural	Total	Total
All women age 15-49 years who are anaemic (%)	50.8	54.2	53.0	55.3
Men age 15-49 years who are anaemic (<13.0 g/dl) (%)	18.4	25.2	22.7	24.2
Child feeding practices and nutritional status of Children				
Children under age 3 years breastfed with in one hour of birth (%)	42.8	41.1	41.6	23.4
Children under age 6 months exclusively breastfed	52.1	56.0	54.9	46.4
Children age 6-8 months receiving solid or semi-solid food and breastmilk (%)	50.1	39.9	42.7	52.6
Breastfeeding children age 6-23 months receiving an adequate diet (%)	10.1	8.2	8.7	NA
Non-breastfeeding children age 6-23 months receiving an adequate diet (%)	16.9	12.7	14.3	NA
Total children age 6-23 months receiving an adequate diet (%)	11.6	8.8	9.6	NA
Children under 5 years who are stunted (height-for-age) (%)	31.0	41.2	38.4	48.0
Children under 5 years who are wasted (weight-for-height) (%)	20.0	21.5	21.0	19.8
Children under 5 years who are several wasted (weight-for-height) (%)	7.5	7.4	7.5	6.4
Children under 5 years who are underweight (weight-for-age) (%)	29.1	38.3	35.7	42.5

Source : NFHS 4, 2015-16

Pregnancy is an important phase of life nutritionally - demanding time

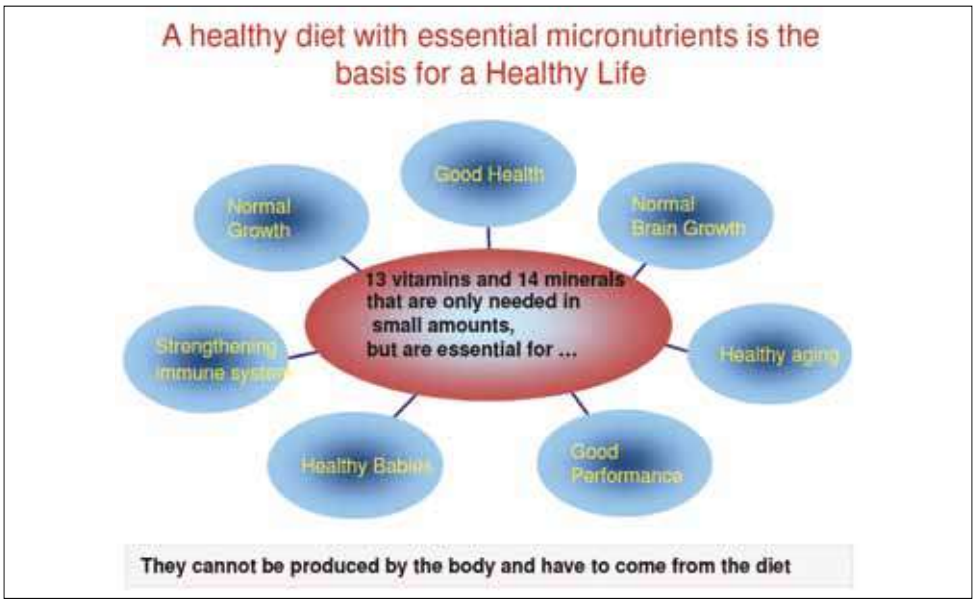
Remember to get sufficient calories for adequate weight gain, eat a variety of foods from each food group to ensure you are getting the nutrients your body needs. Regular meals and snacks, eat a high-fiber diet and drink plenty of liquids. Practice a healthy lifestyle to minimize the discomforts of pregnancy. Do not use harmful substances like tobacco, alcohol or drugs.



Normal-weight women should gain about 3½ pounds in the first trimester and just under 1 pound/week thereafter, achieving a total gain of 25 to 35 pounds by term.

Underweight women should gain about 5 pounds in the first trimester and just over 1 pound/week thereafter, achieving a total gain of 28 to 40 pounds by term.

Overweight women should gain about 2 pounds in the first trimester and ⅔ pound/week thereafter, achieving a total gain of 15 to 25 pounds.



Maternal weight gain, an index of nutrition, strongly influences infant birth weight, and it is the primary indicator of infant health.

Table: Recommended weight gains based on Prepregnancy weight

Prepregnancy weight	Recommended Weight Gain
Underweight (BMI <18.5)	28 to 40 lb (12.5 to 18.0 kg)
Healthy weight (BMI 18.5 to 24.9)	25 to 35 lb (11.5 to 16.0 kg)
Overweight (BMI 25.0 to 29.9)	15 to 25 lb (7.0 to 11.5 kg)
Obese (BMI ≥ 30)	15 lb minimum (6.8 kg minimum)

Balanced Diet

A balanced diet should provide around 50-60% of total calories from carbohydrates, preferably from complex carbohydrates, about 10-15% from proteins and 20-30% from both visible and invisible fat and recommended vitamins and minerals. There's no such thing as bad or good food moderation and balance is the key. A balanced, healthy diet provides a supply of all the essential nutrients in the right quantities for health.

Extra allowances of nutrients during pregnancy

Group	Particulars	Net energy Kcal/d	Protein g/d	Visible Fat g/d	Ca mg/d	Iron mg/d	Zn mg/d
Woman 55 Kg	Moderate work	2230	55.0	25	600	21	10
	Pregnant	+350	+23	30	1200		12
	Lactation 0-6 m	+600	+19	30	1200		
	6-12 m	+520	+13	30			

Vit. A mg/d		Thia mine mg/d	Ribo-flavin mg/d	Niacin equivale nt mg/d	Pyri-doxine mg/d	Ascor-bic Acid mg/d	Folic acid mg/d	Vit.B12 mg/d
Reti-nol	b-caro-tene							
600	4800	1.1	1.3	14	2.0	40	200	1.0
800	6400	+0.2	+0.3	+2	2.5	60	500	1.2

Vit. A mg/d		Thia mine mg/d	Ribo-flavin mg/d	Niacin equivalent mg/d	Pyri-doxine mg/d	Ascor-bic Acid mg/d	Folic acid mg/d	Vit.B12 mg/d
Reti-nol	b-caro-tene							
900	7600	+0.3	+0.4	+4	2.5	80	300	1.5
		+0.2	+0.3	+3	2.5			

Revised RDA, ICMR, 2010

Group	Category	Retinal (µg//day)		B Carotene (µg//day)		Thiamin (mg/day)	
		Revised	Old	Revised	Old	Revised	Old
Man	Sedentary	600	600	4800 ↑	2400	1.2	1.2
	Moderate					1.4	1.4
	Heavy					1.7	1.6
Woman	Sedentary	600	600	4800 ↑	2400	1.0	0.9
	Moderate					1.1	1.1
	Heavy					1.4 ↓	1.2
	Pregnant	800 ↑	600	6400 ↑	2400	+0.2	+0.2
	Lact. <6 Mths	950	950	7600↑	3800	+0.3	+0.3
	Lact. 6-12 Mths					+0.2	+0.2
Infants	0- 6 Mths	350	350	-		0.2	55 µg/kg
	6— 12 Mths			2800 ↑	1200	0.3	50 µg/kg
Children	1 - 3 Yrs	400	400	3200↑	1600	0 5 ↓	0.6
	4- 6 Yrs					0.7 ↓	0.9
	7 - 9 Yrs	600	600	4800 ↑	2400	0.8 ↓	1.0
Boys	10 - 12 Yrs	600	600	4800 ↑	2400	1.1	1.1
Girls	10 - 12 Yrs					1.0	1 0
Boys	13 - 15 Yrs					1.4↑	1.2
Girls	13 - 15 Yrs					1.2↑	1.0
Boys	16 - 17 Yrs					1.5↑	1.3
Girls	16 - 17 Yrs					1.0	1 0

Revised RDA, ICMR, 2010

Group	Category	Vit C (mg/day)		Dietary Folate (µg//day)		Vit. B12 (µg//day)	
		Revised	Old	Revised	Old (FF)	Revised	Old
Man	Sedentary	40	40	200	100	1	1
	Moderate						
	Heavy						
Women	Sedentary	40	40	200	100	1	1
	Moderate						
	Heavy						
	Pregnant	60↑	40	500	400	1.2	1↑
	Lact. <6 mths	80	80	300	150	1.5	1.5
	Lact. 6-12 mths						
Infants	0- 6 mths	25	25	25	25	0.2	0.2
	6 - 12 mths						

Group	Category	Vit C (mg/day)		Dietary Folate (µg//day)		Vit. B12 (µg//day)	
		Revised	Old	Revised	Old (FF)	Revised	Old
Children	1 - 3 Yrs	40	40	80	30	0.2 - 1.0	0.2 -1.0
	4 - 6 Yrs			100	40		
	7 - 9 Yrs			120	60		
Boys	10 - 12 Yrs	40	40	140	70	0.2 -1.0	0.2 - 1.0
Girls	10-12 Yrs						
Boys	13 - 15 Yrs	40	40	150	100	0.2- 1.0	0.2- 1.0
Girls	13-15 Yrs						
Boys	16 - 17 Yrs	40	40	200	100	0.2 - 1.0	0.2 - 1.0

Revised RDA, ICMR, 2010

Micronutrients of special interest during pregnancy

Folate / Folic Acid

RBC formation requires folate. The body uses folate to manufacture new cells and genetic material. Folate plays an important role in preventing neural tube defects. It is recommended to take a daily folate supplement of 500 µg three months prior to conception and should continue through the first three months of the pregnancy.

Food sources include-

- Green leafy vegetables- spinach, asparagus, broccoli
- Dried beans, lentils, cowpeas
- Fresh orange juice
- Organ meats
- Fish
- Eggs

Vitamin A

Vitamin A needs increases by 10% in pregnancy. Its deficiency is linked to an increased risk of low birth weight, intrauterine growth retardation and preterm births.

Excess preformed vitamin A exerts teratogenic effects. Vitamin A is needed to protect the fetus from immune system problems, blindness, infections, and death.

Sources of Vitamin A include:

- Sweet potatoes
- Carrots
- Apricots
- Peaches
- Green leafy vegetables
- Yellow fruits and vegetables
- Organ meats like Liver, kidney
- Egg yolk

Vitamin B12

With increased Folate intake, the pregnant woman needs a greater amount of B12 to assist folate in the manufacture of new cells. People who eat meat, eggs, or dairy products receive all the vitamin B12 they need, even for pregnancy. Those who exclude all animal products from their diet need vitamin B12 fortified foods / supplements.

Vitamin D

Calcium absorption increases during pregnancy to distribute extra calcium for forming the bones of the foetus. To help calcium absorption, adequate Vitamin D is a must. Ensuring regular RDA compliance and exposure to sunlight is sufficient.

Food Sources include:

- Egg yolk
- Organ meat like liver
- Tuna fish and salmon

Calcium

During pregnancy, additional calcium is needed for the growth and development of bones as well as teeth of the fetus. Efforts to ensure an adequate calcium intake during pregnancy are aimed at conserving the mother's bone mass while supplying fetal needs. Most women do not meet the RDA for calcium and should increase their intakes. Deficiency of Calcium can also reduce your risk of preeclampsia.

Sources of Calcium include:

- Milk & milk products,
- Green leafy vegetables, Almonds
- Carrots, Sesame seeds, Ragi, Soy and soy products

Iron

Marked increase in maternal blood supply increases demand for iron. Inadequate consumption leads to poor Hb production and resulting compromised oxygen to uterus, placenta and fetus. Maternal anemia is linked to increased risk and adverse outcomes during pregnancy and LBW and is a major cause of maternal mortality in India.

Iron rich foods include-

- Organ meats like liver, lean meats and poultry
- Eggs
- Cereals-rice flakes, bajra, ragi
- Green leafy vegetables-bathua, methi, palak, sarso, coriander, pudina
- Other vegetables-lotus stem, green mango
- Pulses-kala chana, sprouts, soyabean
- Fruits- apricot, phalsa, watermelon
- Dry fruits-dry dates, walnuts, cashewnuts, til, black currant
- Jaggery

Impairment of iron absorption:

- Tannins (Found in tea and coffee)
- Calcium and phosphorus (Milk)
- Phytates & Oxalates: Found in the fiber of lightly processed legumes and whole-grain cereals + GLVs
- Drink tea between meals, not with food

To enhance iron absorption:

- Heme Iron found in meat, fish and poultry, promotes the absorption of non-heme iron from other foods eaten at the same time.
- Adding a food rich in Vitamin C to a meal containing iron rich foods, can increase non-heme iron absorption up to six times.

Magnesium

Essential for bone and tissue growth. In pregnancy slightly increases the need for magnesium in the diet.

Food sources include

- Whole grains, cereals, tofu, nuts, meat, milk, GLV'S, Legumes.

Zinc

Zinc required for protein synthesis and cell development. It helps in forming organs, skeleton, nerves, and circulatory organs. It is a component of insulin and several enzymes and supports normal growth and important for sexual maturation. Severe deficiency during pregnancy increases the risk of having a low birth weight infant, have shown a higher rate of poor pregnancy outcomes and abnormal deliveries including congenital malformation. Most supplements for pregnancy provide 30 to 60 milligrams zinc / day.

Food sources

- Animal products meat, eggs and milk, beans, cheese, oysters, chicken.

Iodine

Iodine is extremely important for brain development. Lack of iodine could contribute to still birth, birth defects. Iodine deficiency is a preventable cause of mental impairment. Iodine supplementation and fortification programs have been largely successful in decreasing iodine deficiency conditions.

DHA

Docosahexaenoic acid, DHA, is a long chain omega-3 fatty acid that is found throughout the body. More specifically, it is a major structural fat in the brain and the retina of the eye and is a key component of the heart. A growing body of research continues to support the important role that DHA plays for both mother and baby. Specifically, DHA is important for optimal infant brain, eye and nervous system development.

**New food and beverage products with added DHA have emerged in the marketplace because of the mounting evidence of the overall health benefits associated with omega-3 fatty acids.*

Pregnancy (14-18 Yrs)	110 mg total LC n-3 (DHA+ EPA+ DPA)/day
Pregnancy (19-50 Yrs)	115 mg total LC n-3 (DHA+ EPA+ DPA)/day
Lactating (14-18 Yrs)	140 mg LC n-3 (DHA+ EPA+ DPA)/ day

Australian & New Zealand Health Authorities (Department of Health & Ageing National Health & Medical Research Council)

ALA , (LNA) alpha-linolenic acid (18:3 n-3)	Mustard oil, canola oil, walnuts, eggs, Flax seeds, Chia seeds, Pumpkin seeds
EPA, eicosapentaenoic acid (20:5 n-3)	Fish, fish oils, marine sources
DHA, docosahexaenoic acid (22:6 n-3)	Fish, fish oils, specialty egg/dairy products

Common Pregnancy Risk Factors

- **Smoking** –Smoking is not only bad for the mother, but it is worse for the baby. Smoking during pregnancy reduces the amount of oxygen that the baby receives and increases the risk of miscarriage, bleeding, and morning sickness. Pregnant women should also avoid second hand smoke.
- **Alcohol** –Drinking can cause fetal alcohol syndrome, including symptoms like low birth weight, medical problems, and behavior abnormalities.
- **Caffeine** –There are many conflicting studies about caffeine and pregnancy and some believe that caffeine is not as harmful as it was once thought to be. Nevertheless, the FDA warns against caffeine consumption during pregnancy and suggests quitting or reducing consumption at the very least. Caffeine has been shown to affect fetal heart rates and awake time (fetuses grow when sleeping).
- **Drugs and Herbal Remedies** –A pregnant woman needs to be careful about drugs or herbal remedies that are not prescribed by a doctor. These substances may affect the development of the unborn child.
- **Nutrition** – Good nutrition is crucial to a developing child, particularly getting enough folic acid. Lack of folic acid can cause birth defects.
- **Exercise** – Moderate exercise is helpful as it improves the mother's mental state and can increase oxygen flow to the fetus. However, over-exertion can be dangerous.
- **Prenatal Care** – Regular doctor visits are important to the baby's development. The body undergoes many changes during pregnancy. Some side effects may be completely normal, whereas other may not.
- **Multiple sex partners**– Multiple sex partners can increase risk of STD's, which in turn may lead to birth and pregnancy complications, like low birth weight or premature birth.
- **Exposure to chemicals**– During pregnancy, reduce exposure to unnatural chemicals, particularly pesticides in food. The simplest precaution to take before consuming vegetables or fruits is to wash them thoroughly.
- **Other factors** – Many other factors can affect fetal development, including heart disease, the mother's age (less than 15 years and over 35 years is a risk), asthma, excessive stress or depression, etc.

Lactation

It is as if, to provide little ones the best start in life, Mother Nature packed all her love in it.

Golden Hour

For all normal newborns skin-to-skin contact should be initiated in about 5 minutes of birth in order that baby initiates breastfeeding in an hour of birth. The method of 'Breast crawl' can be adopted for early initiation. Skin-to-skin contact between the mother and new born should be encouraged by 'bedding in the mother and baby pair'. The new born should be kept warm by promoting Kangaroo Mother Care. Mothers can breast-feed from as early as 30 minutes after delivery. **Colostrum** should be made available to the infant immediately after birth. Colostrum should not be discarded, as is sometimes practiced.

A baby should be exclusively breast-fed upto 6 months and complementary foods should be introduced thereafter. Breast-feeding can be continued as long as possible, even upto 2 years. Breast-fed infants do not need additional water. Feeding water reduces the breast milk intake and increases the risk of diarrhoea and should, therefore, be avoided. Giving additional water is unnecessary even in hot climate.

Breast-feeding protects against diarrhoea, upper respiratory tract infections and allergic reactions. The bifidus factor in breast-milk promotes the natural gut flora. The gut flora and the low pH of breast-milk inhibit the growth of pathogens. Breast-milk has immunoglobulins (IgA), lactoferrin,

lactoperoxidase which protect the infant from several infections.

Breast Milk Composition

Colostrum

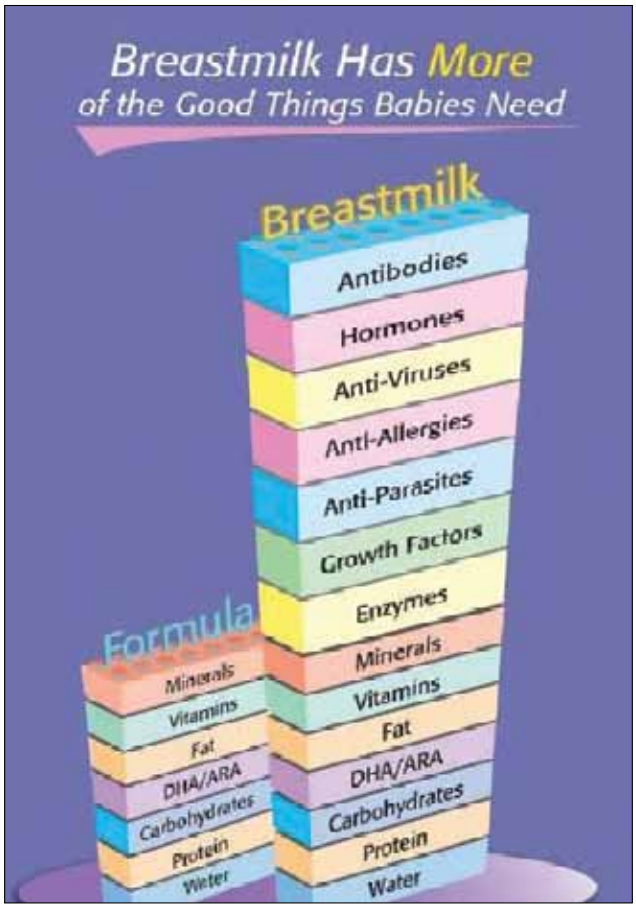
- Milk secreted during the first 3 days after delivery.
- Rich in antibodies, Vit. A,D,E,K.

Transitional Milk

- Milk secreted during the first two weeks.
- Immunoglobulin and protein contents gradually decrease and the fat & sugar contents increases.

Benefits of Breastfeeding

Babies	Moms
Balance of nutrients with high bioavailability.	Contracts the uterus
Good hormones	Delays menstruation
Cognitive development	Conserves iron stores
Less infections	May protect against breast cancer
Less diseases	Convenient
Less food allergies	Bonding time with baby



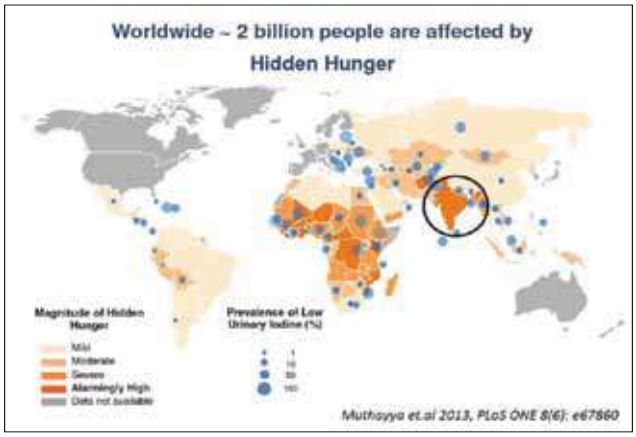
Benefits of breastfeeding for baby:

- **Right nutrients, right balance.** Breast milk has the right proportions of proteins, carbohydrates, fats and other nutrients, baby needs to grow and develop.
- **Easy to digest.** Proteins in breast milk are naturally gentle and easy to digest.
- **Bio-available iron.** Contains iron that's easy for the baby to absorb. The quantity of iron in breast milk may be low, but its bio-availability makes it significant for the baby.
- **Builds tolerance.** Helps protect the baby against early food allergies, protein intolerance and sensitivity.
- **Offers protection.** Provides natural protective antibodies and other immune-related benefits.
- **Helps digestive system.** Fosters a healthy environment in baby's digestive system.
- **Evolves.** Changes to meet the changing needs of your growing baby.
- **Creates bonding.** Provides a perfect opportunity for bonding.
- **Reduces risks.** Reduces the risk of diarrhea and respiratory illnesses.

Complementary Feeding

Appropriately thick homogenous complementary foods home-made from locally available foods should be introduced at six completed months while continuing breastfeeding ad libitum. Foods can be enriched by making a fermented porridge, use of germinated or sprouted flour and toasting of grains before grinding. The food should be a balanced diet consisting of various (as diverse as possible) food groups / components in different combinations. Hygienic practices are essential for food safety during all the involved steps viz feeding during sickness is important for recovery and for prevention of under nutrition.

There is an urgency to find an integrated solution for improving early life environment offers great opportunity to control the chronic non–communicable diseases (NCD) by influencing the susceptibility in a more desirable manner than only controlling lifestyle factors in adulthood.

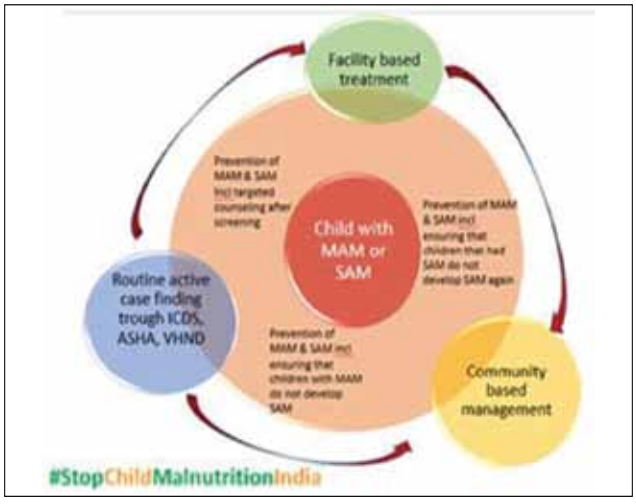


Early detection of malnutrition and intervention:

The longer the developmental delays remain uncorrected, the greater the chance of permanent effects and hence intervention must occur during pregnancy and first three years of life. A well recorded growth chart can detect malnutrition very early. Within a comprehensive approach addressing acute malnutrition there needs to be a specific focus on ensuring that children with Moderately Acute Malnutrition (MAM) do not develop SAM.

Reproductive, Maternal & Child Health and Nutrition

The priority areas in nutrition include multi-stakeholders strategies including community participation to maximize nutritional benefits from locally available foods, food fortification, micronutrient supplementation. The three important public health interventions (i) national iron + initiative NRHM (ii) Universal use of iodine and iron fortified salt and (iii) vitamin A supplementation for children aged 6 to 59 months and improving iron bioavailability from Indian diet and micronutrient status.

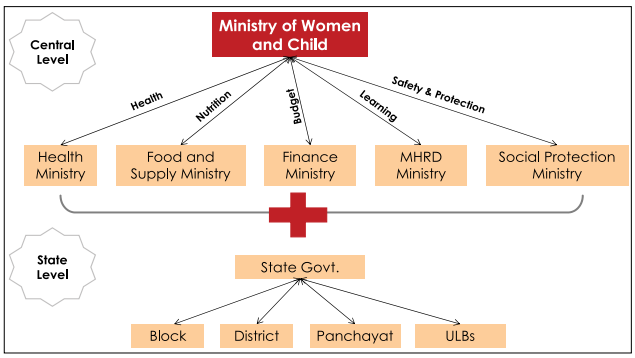


Functional Impact of Food Fortification Strategies and Programmes : Review of data from 36 countries Effect

- 0-1m Neonatal mortality reduced by 65.7% after iodisation
- Infants (1-12m) Infant mortality decreased 56.5% after iodisation .
- Children (12-59m) Improved MN status - (Hb WMD 7.36g/L„ 2.88-11.84)
- Target population: reduction in iron deficiency anemia

Bhutta et al: Lancet 2008, 001:10.1016/S0140-6736(07)61693-6

Child belongs to many Ministries and Dept.



Strategies to prevent malnutrition and improve nutrition

This involves political commitment by the government:

- Nutritional planning involves formulation of a nutrition policy.
- Improve production and supplies of food
- Ensure its equitable distribution and programs to increase the purchasing power of people.
- Land reforms
- Proper guidance in agriculture to help farmers to get better yields from their lands
- Help in proper marketing of farm produce.
- Help increasing the capacity of people to buy nutritious food
- Income generating activities for the weaker sections of the community
- Making available good quality food in affordable prices through proper public distribution system.

Direct nutrition and health interventions

Improved health care system:

- Infections like malaria, measles and diarrhea

are prevalent and they precipitate acute malnutrition among children and infants.

- A good health care system that provides immunization, oral rehydration, periodic deworming, early diagnosis and proper treatment of common illnesses can go a long way in preventing malnutrition in the society.

Nutrition education

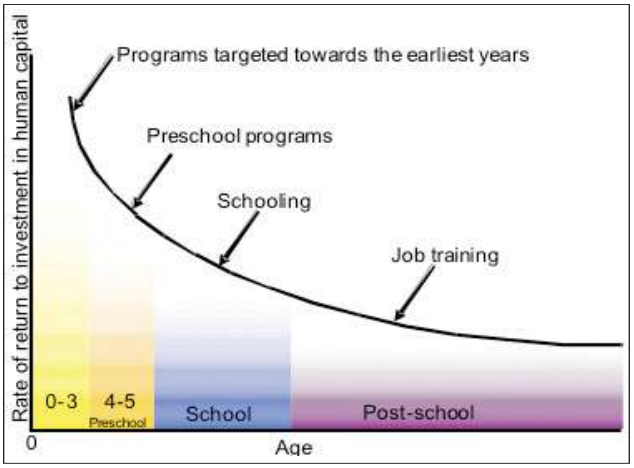
People can be educated on the nutritional quality of common foods**,** importance and nutritional quality of various locally available foods, importance of exclusive breastfeeding for six months and continuing to breast feed up to two years or beyond, by addressing food fads. Education on complementary foods and its preparation helps in creating awareness about nutritious food.

- Importance of including milk, eggs, meat or pulses in sufficient quantities in the diet to enhance the net dietary protein value.
- Importance of feeding children and adults during illness
- Importance and advantages of growing a kitchen garden
- Importance of immunizing their children and following proper sanitation in their day to day life.

Importance of Birth to six years

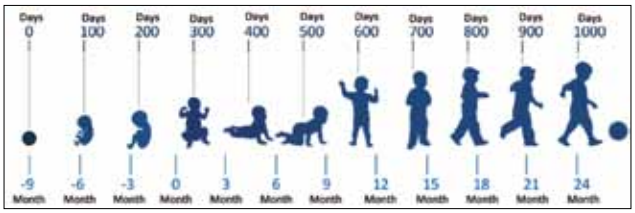
From birth to 6 years are the foundational years of one's life. About 90% of child's brain growth occurs by the time child is of 5 years. It is window of opportunity to develop the child's brain to its full potential.

Rate of Return to Human Capital Investment at different Ages



Various studies have claimed a return in the range of 7-17%

The Important 1000 Days



References

Arnold F, Parasuraman S, Arokiasamy P, Kothari M.Nutrition in India. National Family Health Survey (NFHS-3), India, 2005-06. Mumbai. Available from: hetv.org/india/nfhs/index.html. Accessed September 15, 2015.

Barker D.J, Osmond C. J. et. al: 1989. Growth in utero, blood pressure in childhood and adult life, and mortaalitity from cardiovascular disease. BMJ 1989;298;564-567.

Black R.E., Allen L.H., Bhutta Z.A., Coalfield L.E Onis M.D, Ezzati M, Mathers C and Rivera J. 2008. Maternal and Child Undernutrition: Global and regional Exposures and Health Consequences. Lancet. 371(9608):243-260.

Kuthe A, Shah P.K. Patil V. Bharadva K. Tiwari S, Chaturvedi P. Bang A. Agarwal R.K. 2011. Maternal nutrition and fetus. Feeding Fundamentals. p. 27- 32.

Morris S.S, Cogill B, Uauy R. 2008 Maternal and Child Undernutrition Study Group.,Lancet 16;371(9612):608-21.

Muthayya S, Rah J.H. Sugimoto J.D. Roos F.F. Kraemer K, Black R.E. 2013. The Global Hidden Hunger Indices and Maps: An Advocacy Tool for Action. PLoS ONE 8(6): e67860. https://doi.org/10.1371/journal.pone.0067860

NFHS-4 http://rchiips.org/NFHS/NFHS-4Report.shtml

Revised RDA, ICMR, 2010. http://ninindia.org/Dietary Guidelines for NIN website.

Sally Grantham-McGregon; Lancet, 2007.

Nutrition and Livelihood Interventions in Nutri-SMART Villages of Morena District of Madhya Pradesh

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Food insecurity is an important issue for vulnerable people in India. Macro- and micronutrient malnutrition have lasting and devastating consequences for individual health and national development, as malnutrition early in life often leads to stunted growth (ACC/SCN, 2000), poor cognitive and physical development is associated with increased episodes of infection throughout an individual's lifetime.

Agricultural interventions to improve household food availability and dietary diversity are considered one of the most sustainable solutions to addressing these problems of high household food insecurity and malnutrition by increasing household's access to diverse foods and consumption of micronutrient rich food (HKI, 2007).

Vulnerable groups and malnutrition in villages

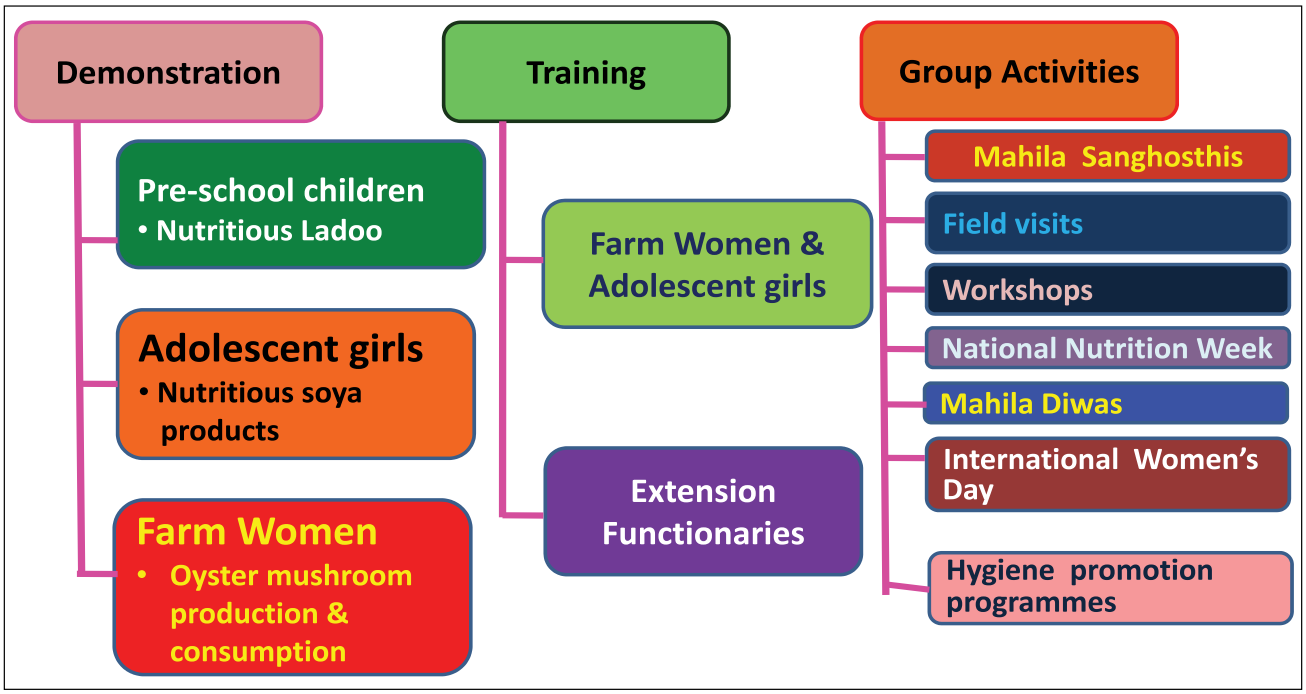
Three vulnerable groups susceptible to malnourishment in rural areas are:

- **Pre-school going children :** Poor cognitive & physical development among pre-school children, their stunted growth susceptible to infection and diseases
- **Adolescent girls :** Nutritional negligence of girls during adolescent period leads stunting, poor health and anemia.
- **Maternal malnutrition :** Lactating mothers & Pregnant women

Five possible approaches

- Improve income generation activities to improve purchase power
- Utilization of existing resources for nutrition garden
- Diversified diets and enhanced intake
- Food fortification and preservation
- Household sanitation

Approach



Skilled training organized for income generation and value addition

Capacity building and skill development of rural farm women and adolescent girls was done through various training programmes conducted by RVSKVV-KVK. (Table 1 & 2) Morena.

Table 1: Training on different enterprises

Theme	Crop / Enterprise	Beneficiaries
Income generation & nutritional security	Mushroom	24
Value addition of seasonal fruits and vegetables	Fruits & vegetables	17

Table 2: Training imparted

Theme	Course	Beneficiaries
Storage grain techniques	2	42
Processing and value addition	4	81
Income generation activities	3	64
High nutrient efficiency diet	4	108
Value addition of locally available food	4	97
Planning and establishment of nutritional kitchen garden	3	64

Important days like International Women's Day, National Nutrition Week and Women in Agriculture Day were also celebrated of the district for creating awareness about food and nutrition security in selected Nutri- Smart Villages of the district (Table 3)

Table 3: Celebration of important days for improving food and nutrition security

Activity	No. of Beneficiaries
Celebration of International Women's Day	44
Celebration of National Nutrition Week	67
Celebration of Women in Agriculture Day	46

Impacts on interventions on pre-school children, adolescent girls and farm women

The capacity building and skill development of farm women, adolescent girls and extension personnel had positive impacts in terms of both attitudes and health outcomes. In particular, nutritional education for farm women and adolescent girls has a positive impact in terms of dietary intake and malnutrition.

Impact on nutritional status of preschool children through poshtikladoo

Ladoos prepared from processed soybean were highly nutritious and can be prepared at low cost for improving the nutritional status (8.91% increase in Body Mass Index) of preschool children (Figure 1).

Impact on nutritional status of adolescent girls through soya products

Nutritional status of adolescent girls was improved through soybean fortified wheat flour and roasted soya namkeen (5.56% increase in BMI) at very low cost (Figure 2).

Impact on nutritional status of adolescent girls through *aonla enriched product*

The inclusion of enriched aonla candy not only gave a new colour and flavor but also enriched the candy with more nutrients. Inclusion of these products in diet helps in improving the nutritional status (Figure 3) as well as these can contributes to the food security of farm women and their family members. As the processed aonla products are highly profitable, there is a potential in generating more employment opportunities for rural women to produce quality products.

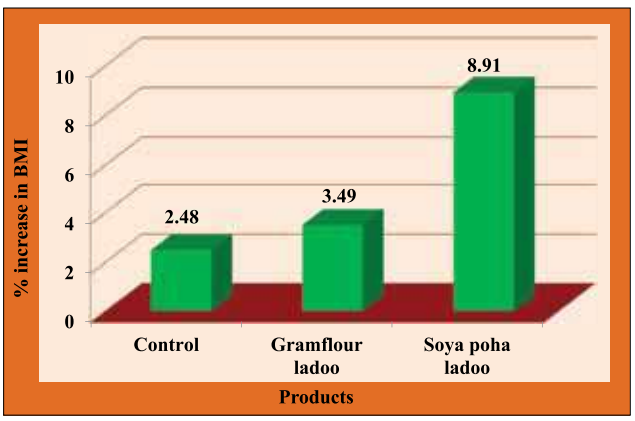


Figure 1 : Impact of nutritious ladoo on preschool children

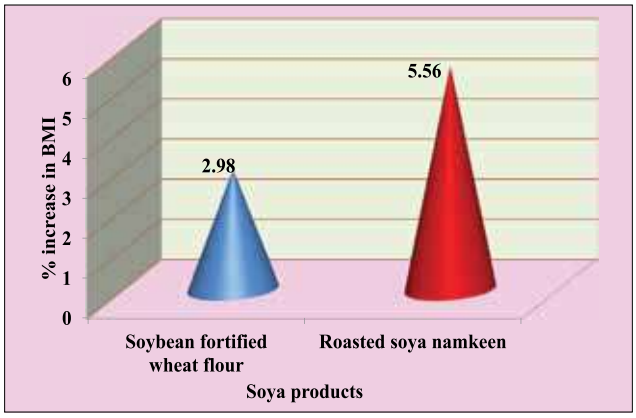


Figure 2 : Children Impact of soya products in their diet on adolescent girls

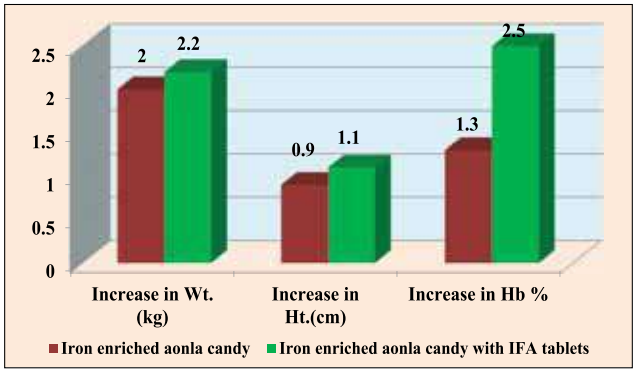


Figure 3 : Impact of enriched aonla on adolescent girls

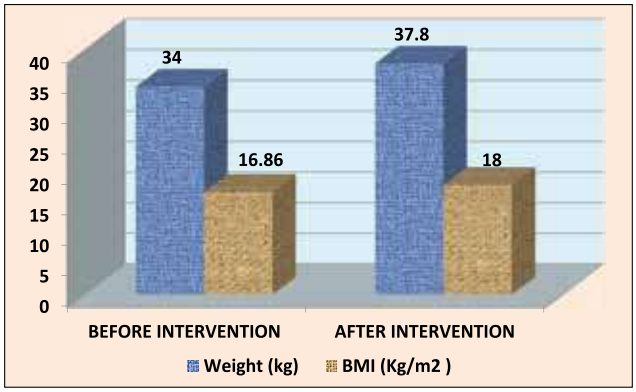


Figure 4 : Impact of oyster mushroom consumption on farm women

Impact of oyster mushroom production on nutritional status of farm women

Oyster mushroom production (Biological Efficiency- 42.55%) in Nutri- Smart Village of Morena district ensures the possibilities of utilizing the locally available substrates (Table 4). Thus the various crop residues can be used in producing oyster mushroom as main substrates in Morena District of Madhya Pradesh for nutritional security (Figure 4) as well as for livelihood security.

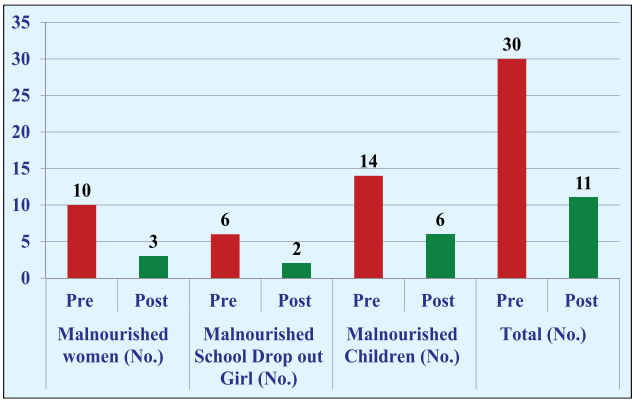


Figure 5 : Nutritional status vulnerable groups before and after interventions in Nutri-Smart Village

Table 4. Performance of oyster mushroom using locally available straw in Nutri-Smart village of Morena district

Initiation of mycelial growth	14 days
Pinhead appearance	20 days
Weight of fruits	22.95 g/10 buds
Production	1.65 kg/bed
Biological efficiency	82.5 %

Conclusion

Improvements in agricultural production alone will not beable to address the problem of malnutrition. Innovative strategies that integrate agriculture and nutrition are essential and such nutrition-sensitive agricultural interventions can focus on how agricultural interventions in the field can be designed to improve nutritional outcomes whilst promoting livelihood security. Strengthening local food systems and promoting education for nutritious food available at low cost, are efforts that encourage balanced diets. Farm women and adolescent girls with better education are more aware of the importance of adequate diets.

References

ACC/SCN 2000. Fourth Report on the World Nutrition Situation: Nutrition Throughout the Life Cycle. ACC/SCN in collaboration with IFPRI, Geneva (online) of Human Biology.1998; 10:529-539.

HKI/Cambodia 2007. Nutrition Bulletin, Homestead food production program improves food and nutrition security by increasing consumption of micronutrient-rich foods and family income in households with HIV/AIDS and other chronic diseases. HKI/Cambodia; 7: 1.

Effect of Consumption of Red Rice on Health of Lactating Mothers and Infants in Tribal Area of Mysuru District, Karnataka

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Introduction

It is important that women should have a good nutritional status because it is through mother that the harmful effects of malnutrition will be passed to future generations. Mothers should eat sufficient amount of nutrients so that they can be healthy and in turn make their children healthy. Rice (Oryza sativa L.) is a major cereal crop in the developing world. It is the main staple food for 2/3rd of the world's population with approximately 95 per cent of production in Asia (Bhathacharjee et al, 2002). Supplementation and fortification are common approaches to combat nutrient deficiencies. Red rice is found to be beneficial in the treatment of several ailments.

It helps in improving the health conditions of the mother and the child in lactation. Red rice is potent source of antioxidants, fiber, Ca, Zn, Fe, Se, Mn, Mg and is promoted as a functional food (Yawadia et al, 2007). Iron contributes to the formation of red blood cells. Manganese has powerful anti-oxidant mineral, which prevents free radical damage from building up and causing cells damage possibly resulting in tumors or other diseases. Being rich in vitamin B6, red rice helps in preventing cardio vascular diseases and Type-2 diabetes due to its powerful anti inflammatory properties. Red rice lowers LDL cholesterol while increasing HDL (good) cholesterol.

Maternal supplementation of essential nutrients has a significant impact on milk composition and output. Traditional red rice varieties have been used to promote lactation in many red rice growing regions in India. Red rice is found to be beneficial in the treatment of several ailments. It is necessary that the traditional resources and wisdoms are scientifically validated, revived and promoted. Hence, the present study was carried out to improve the health status of mother and infants through feeding of red rice among lactating mothers in tribal areas of Mysuru district, Karnataka state.

Objective

To improve the health status of mother and infants through feeding of red rice among lactating mothers in tribal areas of Mysuru district, Karnataka state.

Methodology

For the study 57 lactating mothers and their infants, accessible for the study, were selected from the tribal areas of H.D. Kote taluk (Sollepura C *haadi*, Basavanagiri A & B *haadi*, Metikuppe *haadi* and Sonalli *haadi*) and Hunsur taluk (Shettalli *haadi* and Hebbala *haadi*) of Mysuru district by purposive sampling method. Mothers having infants below 6 months of age were selected for the study as the infants would be introduced supplementary foods after 6 months.

The subjects were selected with the help of Anganwadi centers, Primary Health Centre and NGO (Centre for Wild life Studies) working in H.D. Kote and Hunsur taluks of Mysuru district. All the subjects were briefed in detail about the content of the study and prior consent and willingness of the mothers to participate in the intervention was obtained.

A schedule was developed to elicit information regarding the lactation performance of mothers with intervention of red rice. The schedule included general information of the subject such as demographic and socio-economic data (place, age, type of family, income, type of work). Quantitative observations of the infants during the intervention on the number of feeds/day and time taken/feed were recorded.

Intervention with red rice

Lactating mothers were fed with red rice. *Doddi / dodda battha* (Local) variety of red rice, which was procured and locally used for the intervention. Each subject was suggested to use 200g raw rice per day which yielded around 650g of cooked gruel. Along with red rice it was suggested to consume 200g of locally available fruits and vegetables. Consumption of rice, fruits and vegetables during the course of intervention i.e. 30 days, was ensured and recorded on a day to day basis with the help of Anganawadi worker and NGO (Centre for Wild life Studies).

The results obtained on lactation performance with red rice intervention were quantified, classified, tabulated and expressed in frequencies and percentages.

Person	No.	Parameter used
Lactating mothers	57	Height Weight Haemoglobin
Infants	57	Height Weight Number of Feeds/day Time taken/feed

Study subjects

Measuring weight and height of the infant

Data collection from the subjects

Results

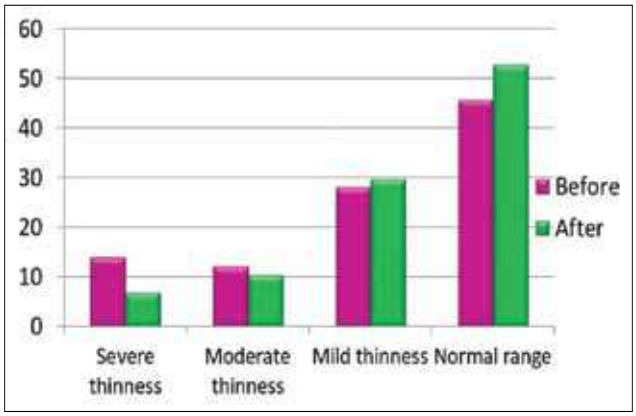

Figure 1 : BMI classification of the subjects

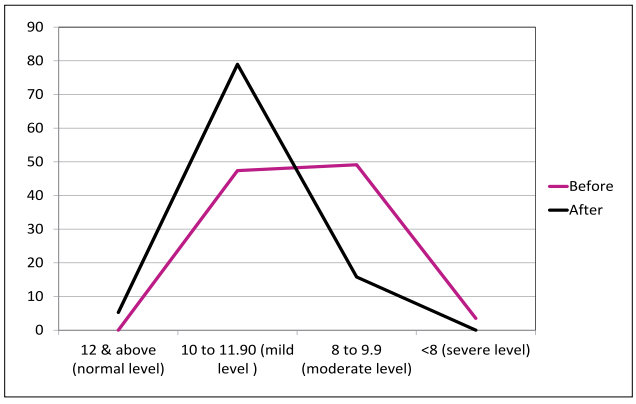

Figure 2 : Hemoglobin level of mothers

Results

Figure 1 depicts the classification of subjects based on Body Mass Index (Anonymous, 2004). After the intervention the per cent of mothers having normal weight was found to increase from 45.61 to 52.63 per cent, which indicated that more than half of the subjects were found to be normal. After feeding of red rice 29.82 per cent of women were recorded in mild thinness category compared to 28.07 per cent before feeding. The per cent of subjects having severe thinness decreased from 14 to 7, and moderate thinness also decreased from 12.28 to 10.53 per cent among lactating mothers.

Figure 2 shows that after the intervention, none of the subjects were found in severe level category and it is interesting to note that the subjects who were in moderate level (49.12 %) decreased significantly to 15.79, and 78.95 per cent of the subjects were in mild level category. However, only 5.26 per cent of the subjects were found to have normal haemoglobin. Red rice is rich in minerals (iron and zinc), poly phenols and antioxidant contents, which help in rapid improvement in the maternal health conditions (Itani and Ogawa, 2004). Results from the study conducted by Hegde and Yanagi (2012), also revealed that haemoglobin status improved with shift from moderate anaemia to mild anaemia with an increase in haemoglobin level by 1.2 per cent after consumption of red rice.

Table 1: Frequency of the feeds and time taken to feed a baby in a day

S. No.	Variables	Intervention		Percent
		Before	After	
1	Frequency of the feeds /day (No.)	18	14	22.22 (decreased)
2	Average time taken per feed (min)	10	15	50.00 (increased)

Table 1 revealed that after the consumption of red rice, the frequency of breast feeding decreased from 18 times to 14 times, in a day indicating that means there was 22.22 per cent reduction in the frequency of feeds and also that there was increase in the time taken to feed a baby from10 to 15 minutes (50%), each time. This is because of the time taken for feeling of fullness of the breast reduced considerably indicating improved milk production and sucking reflex, hence, there was increase in the quantity of milk during feeding, which reduced the

frequency of feeding and increased the time taken to feed a baby (Hegde and Yanagi, 2012).

Table 2: Frequency of the feeds and time taken to feed a baby in a day

Parameters	Before	After	Percent increase
Height (cm)	54.70	60.00	24.83
Weight (kg)	4.59	5.73	9.68

Table 2 showed that the height and weight of the infants increased by 24.83 and 9.68 per cent, respectively. The intake of milk per feed gradually increased day by day there by improving weight and height of the infants.

It is evident that the intervention with red rice in lactating mothers has improved their nutritional status as assessed from their increased BMI, hemoglobin status and milk output. The subjects experienced increased appetite and improvement in the BMI as well as haemoglobin status (Hegde and Yenagi, 2012).

Haemoglobin estimation

Conclusion

It can be concluded here that mothers having normal weight increased from 45.61 to 52.63 per cent. Level of hemoglobin among mothers increased from 10.70 to 13.20g/dl. Height and weight of the infants increased by 9.68, and 24.83 per cent respectively and time taken to feed the baby increased from 10 minutes to 15 minutes, frequency of feeding decreased from 18 to 14 times per day. The subjects perceived good lactation and were fully satisfactory with the milk sufficiency and intake by the child. It was opined that the intervention was very useful and beneficial to lactating mothers and their infants.

Recommendation

To combat mal nutrition, promote consumption of locally available foods like red rice along with fresh fruits and vegetables, which are, helps to get nutrients in turn helps to get good health.

References

Anonymous, 2004. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies.*Lancet*.363 (157-63).

Bhattacharjee P., Singhal R.S. and Kulkarni P.R., 2002. Basmati rice: A review. International J. Food Sci. Technol., 37(1)1–12

Hegde S. and Yenagi N, E.,2012. Evaluation of genetically diversified red rice as functional food with special reference to lactational performance, *Thesis submitted to the University of Agricultural Sciences,* Dharwad.

Itani T. and Ogawa M., 2004.History and recent trends of red rice in Japan.*Jpn J Crop Sci.* 73: 137–147.

Yawadio R, Tanimori S and Morita N, 2007. Identification of phenolic compounds isolated from pigmented rices and their aldose reductase inhibitory activities, Food Chem., 101(4) 1616–1625.

Impact of Iron Supplementation Toward Hemoglobin Levels on Teenage Girls in Jamnagar District

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Introduction

Adolescent girls are the mothers of future generation and they need to be taken care in terms of their balanced nutrition to prevent morbidity and mortality. However, most of the adolescent girls diet are based on stable food with little meal intake which causes iron deficiency. In Indian context, adolescent girls are more prone for nutritional disorders due to ignorance and limit the access to health and leads to nutritional disorder.

According to the World Health Organization (WHO), there are two billion people with anemia in the world and half of the anemia is due to iron deficiency. Anemia is a late indicator of iron deficiency, so it is estimated that the prevalence of iron deficiency is 2.5 times that of anemia.

Anemia is a condition in which blood does not have enough hemoglobin or red blood cells. The normal values of hemoglobin in men are 13.5g/dl and females 12-16g/dl. In India 12 to 14 years women having 46.8 %, 20.8% and 1.1%; and 15 to 17 years women having 47.0%, 20.9% and 1.8% mild, moderate and severe anemia, respectively (Ambika and Vanita Rani, 2015). Anemia has many causes. One of the most common is an inadequate intake of iron in the diet. Iron Deficiency Anemia is a condition where a person has inadequate amounts of iron in the blood to meet body demands. Teenage girls are at the highest risk of anemia during their adolescent growth spurt.

Various studies showed the negative impact of anemia due to iron deficiency of nutrients to the growth and development of children and adolescents. Anemia in children and adolescents will lead to growth and development that are not optimal and reduce learning achievement because easy to get tired, loss of passion and cannot concentrate. Besides that, iron deficiency anemia will also cause low of Intelligent Quotient (IQ) as well as a decrease in the learning ability.

Objective

- To improving the hemoglobin percentage in rural adolescent girls.
- To determine effectiveness of Iron supplementation food on hemoglobin level among adolescent girls.
- To create awareness of adolescent girls/farm women against nutritional diet.

Methodology

The study was conducted at Arikhana and Nathuvadala villages of Jamnagar district whose age group was 18 to 21 years from farming business family. The villages were selected from identified by KVK activity work carried out regularly. It was decided to survey from 30 adolescent girls. The primary survey of the sample adolescent girls was carried out with the help of primary health center of respected villages. To evaluate the adolescent girl information on different aspects were carried out with the help of prefixed questionnaires.

In this study 30 adolescent girls' age between 18 to 21 years were randomly selected and checked hemoglobin level with help of primary health center. According to hemoglobin level of respondents categorized as WHO cut off values for assessing anemia in adolescent girl (1) normal (>12 gm/dl), (2) mild anemia (>11gm/dl to <11.9 gm/dl) and (3) moderate anemia (>8gm/dl and 10.9gm/dl). The criteria used for adolescents was Hbg <12gm/dl then it called anemia. 16 girls under anemia (<12 gm/dl) were selected for the present study.

An experimental study was conducted with roasted Bengal gram, jaggery and aonla to find out the iron availability and prepared nutritional supplement, the ratio of Bengal gram, jaggery and aonla powder in the supplement was 10:5:1 (roasted Bengal gram 50 gm + jaggery 25 gm + aonla 5 gm per day) (Angel *et al*, 2015). All the respondents

were also aware about nutritional diet and anemia through pre training programme.

Assessment of pre test and post test (after six month) levels of hemoglobin among the adolescent girls with anemia. Age, education, food preference, duration of menstruation, menstrual cycle, income of the family per annum etc. Taken and statistical tools were used to analysis the data (Kothari, 1998).

Result and Discussion

Socio-demographic characteristics

The range of age of participants (Table 1) were 18 to 23 years with an average of 19.73 + 1.081 years. All the respondent (30) were adolescent girls (100%). No body were selected for the pre-adolescent and adulthood group.

Table 1. Socio-demographic characters of trainees (n=30)

S. No.	Particulars	Frequency	Per cent	Mean ± S.D.
1	Age group			
	Early-adolescent (10 to 14 Years)	0	0.00	
	adolescent (14 to 21 Years)	30	100	19.73 ± 1.081
	Adulthood (Above 21 Years)	0	0.00	
2	Educational status			
	Graduate	22	73.00	
	Standard 8- to 12	8	27.00	
	Primary	0	0.00	
3	Type of farmers (Family Land)			
	Marginal (<1 ha)	2	1.33	3.64 ± 1.93
	Small (1.1 to 2 ha)	4	2.67	
	Medium (2.1 to 4 ha)	11	7.33	
	Big (>4 ha)	13	8.67	
4	Food Preference			
	Vegetarian	30	100	
	Non-vegetarian	0	0.0	
	Total	30	100	
5	Duration of menstruation			
	2-3 days	3	10.00	4.9 + 1.27
	4-5 days	18	60.00	
	6-7 days	9	30.00	
6	Menstrual cycle			
	21-25 days	9	30.00	28.3 + 3.57
	26-30 days	14	46.67	
	31-35 days	7	23.33	
7	Income of family per annum			
	Below Rs. 50000 per annum	3	10.00	96500 + 38838
	Rs. 50000 to Rs. 100000	13	43.33	
	Above Rs. 100000	14	46.67	

The assessment of the farm women with respect to education status indicted that all the 30 participants were literate having education standard 8 to 12 (27 %), graduate level (73%) and nobody were educate only up to primary education or illiterate (0%).

The average size of land holding marginal farmers having less than 1 hectare land were 1.33 (2 farm women), small farmers having 1.1. to 2 ha land 2.67 (4 farm women), medium size having 2.1 to 4 ha land 7.33 (11 farm women) and big farmers having more than 4 ha land were 8.67 (13 farm women) per cent (frequency). The average size of land holding is 3.64 + 1.93 ha land with the farm women family.

The food preference under the study ware take 100 per cent vegetarian diet adolescent girls. However, no body take eggs, meat or non-vegetarian diet. They are holistic in nature and having only take food from grown by own field.

Regarding the duration of menstruation 3 (10%) adolescent girls had menstruation (2-3 days), 18 (60%) were had 4-5 days, 9 (30%) were had 6-7 days. The average duration of menstruation 4.9 + 1.27 days to the adolescent girls.

Regarding the duration of menstrual cycle 9 (30%) adolescent girls had menstrual cycle 21 to 25 days, 14 (46.67%) were had 26 to 30 days, 7 (23.33%) were had 31 to 35 days. The average menstrual cycle found 28.3 + 3.57 days.

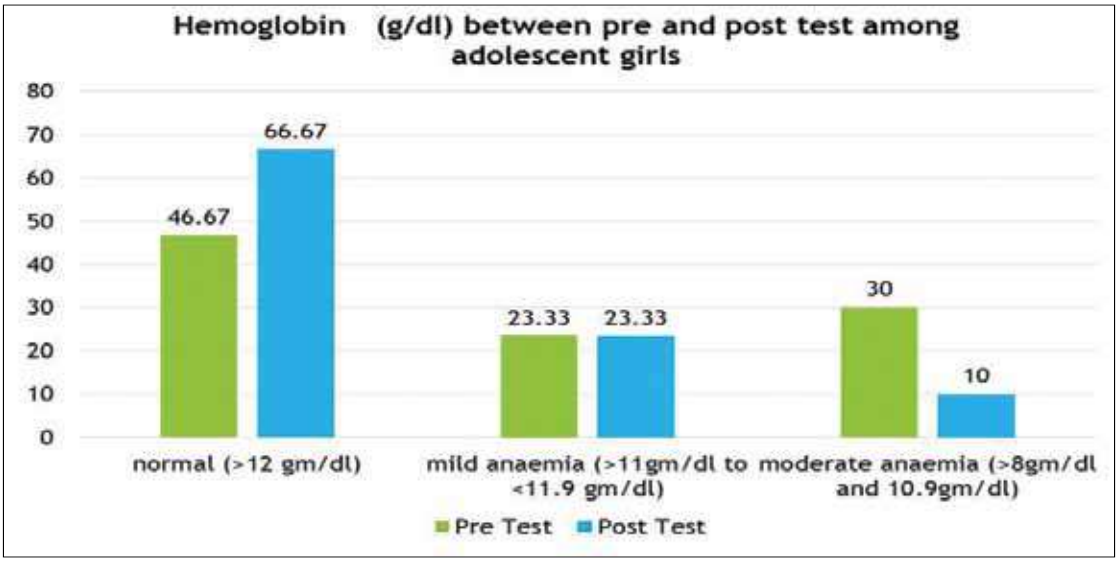
The average income of the farm family shows that 3 (10%) adolescent girls family found less than Rs. 50000/- per annum, 13 (43.33%) having Rs. 50000/- to Rs. 100000/- and 14 (46.67%) have more than Rs. 100000/- income per annum with an average of Rs. 96500 + 38838 per annum.

Table 2, showed that in pre test level of hemoglobin 14 (46.67%) had normal anaemia , 7(23.33%) had mid anaemia and 9 (30.00%) had severe anaemia . The post test level of hemoglobin revealed that normal hemoglobin 20 (66.67%), had mild anaemia 7 (23.33%) had moderate anaemia 3(10.00%). It also represents that the mean hemoglobin level was found pre and post 11.80+ 1.47 and 12.42 + 0.91 gm/dl, respectively. The present research were support with the work carried out by M. Angel and K. P. Vasantha Devi, et al.,(2015). Iron supplementation daily consecutive six months decrease the prevalence of anaemia in teenager girls as much as 20 per cent with an increase level in hemoglobin level 0.5 to 2.0 g/dl. Statistically, showed that the iron supplementation had a significant impact on the reduction of anaemia incidence in teenage girls. The level of hemoglobin increase in after treatment in normal condition by 46.67 to 66.67 per cent, same trend was also found with research carried out by Francisco et al., (2010).

Table 2. Represents the comparison of the level of the Hemoglobin (g/dl) between pre and post test among adolescent girls with anaemia

(n=30)

S. No.	Level of hemoglobin	Pre test			Post test		
		Frequency	Per cent	Mean ± S.D.	Frequency	Per cent	Mean ± S.D.
1	normal (>12 gm/dl)	14	46.67	11.80± 1.47	20	66.67	12.42 ± 0.91
2	mild anaemia (>11gm/dl to <11.9 gm/dl)	7	23.33		7	23.33	
3	moderate anaemia (>8gm/dl and 10.9gm/dl)	9	30.00		3	10.00	



Conclusion

The main objective of the study was to determine effectiveness of Iron supplementation food on hemoglobin level among adolescent girls with anaemia. The result showed that there was a significant difference between pre and post test level of hemoglobin. Iron supplementation daily consecutive six months decrease the prevalence of anaemia in teenage girls as much as 20 per cent with an increase level in hemoglobin level 0.5 to 2.0 g/dl. Statistically, showed that the iron supplementation had a significant impact on the reduction of anaemia incidence in teenage girls. Thus, improve the hemoglobin level in rural adolescent girls along with awareness about nutrition diet and anaemia.

References

Francesco L, Pedro A., Bernard C., Adrian C., Angel D. F., Iain C. M., Andrzej W., Raymond V. and On behalf of the Anaemia Working Group of European Renal Best Practice (ERBP). 2010. Target haemoglobin to aim for with erythropoiesis-stimulating agents: a position statement by ERBP following publication of the Trial to Reduce Cardiovascular Events with Aranesp® Therapy (TREAT) Study. Nephrology Dialysis Transplantation. 25: 2846–2850

Kothari. S. 1998. Research methodology methods and techniques. Wilerestern limited.

M. Angel and K.P. Vasantha Devi. 2015. Therapeutic impact of garden cress seeds incorporated ladoo among the selected anaemic adolescent girls (12-15 years). 3 (25). 18-22.

Technological Intervention for Food and Nutritional Security

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The Sustainable Development Goals (SDGs), otherwise known as the Global Goals, are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity.

Sustainable Development Goals

- End Poverty
- End Hunger
- Ensure Healthy Lives
- Ensure Gender equality
- Sustainable Management
- Combat climate Change
- Revitalize the Global partnership
- Protect,restore & promote Ecosystem
- Ensure accesses energy to all (International Solar Alliance 11th March at Delhi)
- Conserve oceans, seas and marine resources

End to Malnutrition in all its forms

Malnutrition is an outcome of poverty and inequality. Under nutrition leading to stunting causes irreversible damage to both individuals and society. Now a days obesity in childhood is a growing problem in all regions. Ensuring universal access to nutritious food in the 1000-day window of opportunity between the start of pregnancy and a child's second birthday is essential to tackling stunting. This should be supported by a multi-sect oral approach includes nutrition-sensitive health care, water, sanitation, education, agriculture, social protection and specific nutrition interventions, coupled with initiatives that enable empowerment of women.

Access Adequate Food and Healthy Diets, for all People, all Year Round

- Addressing poverty and inequality
- Access to food that forms the basis of healthy and diverse diets Equity and women's rights

India operates one of the largest food safety nets in the world

National Food Security Act 2013. India's department of food and public distribution, in collaboration with World Food Program, is implementing this scheme which provides a whopping 800 million people each year. Yet the results of the program have been largely a hit and miss affair, with experts blaming the country's entrenched corruption in the distribution chain for its inefficacy.

Growing food in a sustainable way means

- It also means reducing food losses before the final product or retail stage through a number of initiatives
- Including better harvesting, storage, packing, transport, infrastructure, market mechanisms,
- As well as institutional and legal frameworks.

(67% of the country's population or 10% of the world's) with subsidized monthly household rations

Hunger

Worldwide 1,02 billion people or one in 11 of the world total population are suffering from hunger. The reason for hunger is severe weather, food crises and severe drought.

Food Technology for Rural Setting

The annual wastage of agricultural produce is almost 30% and equivalent to Rs. 58000 Crore (Due to inadequate storage and processing facilities). The wasted food could feed almost 232 million people. Food technology can directly contribute to food security through enhancement of nutrient density. Establishment of tiny and cottage – scale industry for processing industries in rural areas would help to empower rural women which contribute livelihood security.

Most vulnerable sections:

- Adolescent girls
- Pregnant and lactating mothers
- Under weight children under five

Women and Agriculture

Concentrated efforts should be made to ensure that food will reach them in proportion to their numbers.

There is need to articulate four T's, make agriculture an attractive option for securing livelihood and sustainable development

- Tradition
- Technology
- Talent
- Trade

Micronutrient malnutrition is a serious public health problem globally :

- More than 250 million children in developing countries are at risk of Vitamin A deficiency
- More than 2000 million women & children are at the risk of iron deficiency
- More than 1500 million people in the World are at risk of iodine deficiency

Poverty is persistent

- People in 33 countries consume less calories than required (840 million peopleas per FAO)
- 799 million live in developing countries
- Food insecurity – access and distribution

Child Nutrition (Below 5years)

India has not achieved acceptable child nutrition levels. According to India's 3rd National family health survey 48% child - Stunted, 20% - Wasted, 43% - Under weight, 70% - Anemia, 50% - Vitamin A deficiency and 75% - Iodine deficiency.

Noble Lau rate Amaritya Sen said that "Food depravation is the result more of distribution inequalities rather than lack of food".

Anaemia in different states

Preschool Children	
M.P.	68.4%
West Bengal	81.2%
Orissa	92.4%
Maharastra	583%
A.P.	70.8%
Tamil Nadu	623%
Karnataka	68.0%
Kerala	33.7%
6 -14 years girls	
Kolkatta	95.0%
Hyderabad	67.0%
New Delhi	73.0%

Malnourished children

- Tend to have low IQ
- Impaired cognitive ability affecting their school performance and
- productivity in their later life

Cost of treating malnutrition is 27 times more than the investment required for its prevention.

Research carried by Dr. Vijaya Khader on on Food, Health, Livelihood and Nutrition Security and discussed under the following aspects:

- Diversification of Agricultural ; Horticulture
- Mushrooms; Dairy; Fisheries; Value addition
- Nutrition education
- Welfare Programs
- Economic empowerment of women
- Unexploited biodiversity.

Agricultural Diversification:

Crop diversification / cropping systems

- Intercropping of ragi and red gram in 8:2 ratio is found to give additional income of Rs.5,500/ha compared to sole crop of ragi.
- Ground nut intercropped with either red gram

(4151 kg / ha) or castor (4238 kg/ha) in 7:1 ration recorded maximum yield

- Red gram based cropping systems, red gram+ cluster bean (3263 kg /ha) in 1:7 ration gave highest red gram yield

Home based low cost energy protein rich preparations using Horse gram (Dolichos Biflorus) for vulnerable groups

- Financial Support : ICAR
- Ragina - (Germinate rags flour 40 g+ puffed horse gram flour + jaggery 35g +Crude red palm oil 5 g)
- EPRF - (Dehusked roasted horse gram flour 40 g+ Dehusked roasted soya flour 20 g + jaggery 35 g + crude red paloil 5 g

The horse gram which is commonly used for cattle feed can be diversified for human consumption with less investment.

Horticulture intervention:

- Promotion of home gardening: Supply of micronutrients
- Horticulture intervention will involve the Ministry of Agriculture for the supply of seeds, extension, and storage support.
- Horticulture crops and dairy farming in East Godavari district of A.P. showed very significant improvement in their nutritional status vulnerable group mainly Vitamin A & Iron
- Food & Nutrient intake of Pre School Children, Pregnant & Lactating women revealed vegetable & fruit consumption is significantly more in the families with Horticulture

Transfer of home level preservative techniques of selective fruits and vegetables to rural women in Guntur district. There was positive correlation of socio economic variables such as educational status, family income, and land holding (Vijaya Khader and Bharti, 1994).

Operational feasibility of RPO supplementation to pre-school children in Anganwadi centers of ICDs Project (Vijaya Khader and Aruna, 2008) shows decrease in Grade 11 and Grade 111 malnutrition was observed in respect of sex.

Rural Women as Entrepreneurs in Mushroom Cultivation (Vijaya Khader, 1994)

- Financial Support : ANGRAU & ICAR
- Every women is an entrepreneur as she manages, organizes and assures responsibility of running her house

Mushroom cultivation can be taken up at household level by illiterate and landless women for income generation. Simple house level technologies to preserve mushrooms help the women to market them.

Impact of dairy programme on the nutritional status of women and preschool children in Vihiga District, Kenya Africa (Many Khakoni Walingo and Vijaya Khader, 2000)

- Financial Support: ANGRAU & Kenya
- Women participated in the dairy programme showed significantly higher income

Dairy cooperative societies had

- Significant effect on household income
- Intake of protective foods increased (Consumption of milk & milk products)
- Improved the nutritional status of women.

Patent received

- Low Cost Ice Cream Freezer
- License the technology (to women entrepreneur):
- Smt. G.Varalakshmi, W/o. Sri SatyaKiran, M/s. Yogi Industries, Secunderabad
- Mrs. Lakshmi Bhuvaneswa, W/o Devi Hanprasad, D.No.23/321, Bachupeta, Hindu College Road , Machlmatnam - 527 001

Technologies Development Ready for Commercialization

- **Entrepreneurship Technologies:** Sorghum food Enterprise/Geriatric foods/ Malted Infant Food/High Fifer Vermicelli/ Preservation of Palmyra Fruit/Mushroom Cultivation.
- **Knowledge Empowerment Technologies:** Multipurpose Fresh Fish Vending & Display Table/Low cost Ice-Cream Freezer.
- **Value Addition technologies:** Value Addition to Fruits /Value Addition to Red Palm Oil / Fruit Powders / Horse Gram Products & Soya Products.

Success Stories

- Mrs. Amalorphavan- An enterprising fish vendor

at Poovar in Thiruvananthpuram district (Kerala)- Rs. 3,000-15,000

- Mrs. Bhageerathy - Fishing cum-marketing as a family enterprise (Kerala) She feels that fish trade always from the easiest and alternative employment avenue for fisher women of coastal region. Rs. 15000-20000
- Smt Banumati - From fresh fish vending to ice plant ownership (Karnataka) - Rs. 30,000
- Mrs. Thressia - A successful calm processor cum-vendor at Thekkumbhamin Kollam District (Kerala)- Rs. 10,000.
- Smt. Hemavathy Puthran (Karnataka) - Following the footsteps of her mother in dried fish marketing. Rs. 40,000
- Smt. P. Roopavathy, Kovalam fishing village, Kanchipuram (Tamilnadu) Yet it is very much fitting here to quate her as one of the role mofel for the fisher women. Rs. 12000-15000.
- Srimathi Gopala Pentamma. Ampadu of Uppada hamlet of Kakinada (Andhra Pradesh) - Rs. 20000.
- With the financial assistance obtained she started a small net making unit in her hut by employing three fisher women at a wage rate 40 per day.

Major Thrust

- Health
- Nutritional status
- Economic Empowerment
- Entrepreneur Development
- Education (Awareness programs through T.V, Technology on Value addition , Education Material on Child Care, Food & Health)

To study the effect of feeding malted food on the nutritional status of vulnerable groups (Vijaya Khader and Vina Maheshwari, 2012)

- Financial Support : *Department of Biotechnology (DBT)*
- Amylase rich malted mixes (ARMM) are two types namely using ragi / wheat
- Preschool children – 400
- Pregnant women -- 100
- Lactating women -- 100

} 3 months

- Promotion of malt based Small Scale Food Industry not only provides opportunities for rural women to develop entrepreneurship and employment but also provides food and nutritional security through income generation.

Promotion of Malt based small scale Food Industry provides

- Entrepreneurship
- Employment
- Food and nutrition security through income generation

Therapeutic food Supplementation in ICDS projects of Andhra Pradesh (Yasoda Devi and Vijaya Khader, 2004)

Financial Support : World Bank

3 types
- Sweet Ready Mix (SRM)
- Therapeutic Food
- Therapeutic Food with Amylase rich flour

} **To reduce grade III and grade IV Malnutrition in preschool children in rural and tribal areas**

Supplementary food of 70 g (Cereal, pulse and oilseed combination) meet the nutritional requirements of preschool child.

Feeding carried out on 2267 Children of age Range of 1 to 3 years

100 gm of supplement provides :- 400 to 480 Kcal. , 12.5 to 13.8 protein

Economic Empowerment of women:

Family income and nutritional status of pre-scholars' in rural areas of Tenali division (Vijaya Khader and Kavitha, 1993)

- The increase in the annual per capita income of the family increased slightly the nutritional status of pre-scholars

In spite of having high purchasing power

- lower educational status of the mothers
- low nutritional awareness,
- Majority of the children are in Grade 1 degree malnutrition.

Impact of women's supplementary income on families' nutritional status (Vijaya Khader 1999)

The study was carried in 4 villages of Rajendarnagar Mandal & Ranga Reddy District on vegetable venders, Shop Keepers, Washers, Fruit venders, Tea & Snack Venders

The results reveal that the supplementary income of women has a positive impact on food & nutrient intake of the family.

Un exploited biodiversity

2,50,000-3,00,000 species of plants exist, 10,000-50,000 are edible, 150-200 are useds as animal food. Three species viz, rice, maize and wheat supply almost 60% of the calories and protein humane drive from plants.

Diversification must entail management and generation of resources :

- Small livestock and poultry keeping
- Fish farming
- Integrated crop/livestock/fish management
- Promoting diversification of diets

Economic growth in India has failed nutrition

- China has reduced child under nutrition by more than half (from 25% to 8%).
- Brazil has reduced child under nutrition by 60% (from 18% to 7%).
- Thailand has reduced child under nutrition by more than half (from 50% to 25%)
- Vietnam has reduced child under nutrition by 40% (from 45% to 27%).

Reducing malnutrition is not just about health, agriculture and economics but it also accounts for politics, Governance and power.

As per the 2014 UNDP Human Development Report

- India Human Development Index Rank : 135 of 187 countries. (The Human Development Index is a composite Index that measures Income, Education and health.
- Gender Development Index Rank : 132
- Multi – Dimensional Poverty Index : 55.30 %

(Economic Crises, Social unrest, Conflict & climate change.)

Several Programs

- National Nutrition Policy (1993)
- National Nutrition Plan of Action (1995)
- National Nutrition Mission (2001)

Not at achieved nutrition goals

Reasons : Nutrition is a poor cousin even in health and agriculture planning and execution, Nutrition improvement is not a stated goal with measurable parameters in National Food Security Mission, National Horticulture Mission and National Rural Health Mission.

Low spending on Health Care

- Inadequate medical research,
- Absence of indigenous drug development and low spending on health
- India spends only 1% of its GDP on health while other countries spend more. Eg. Thailand and other countries spend 7-8% of the GDP.
- Further shortage of Doctors, mainly in rural areas,
- Lack of integration of traditional & modern Medicine.
- Non communicable diseases including hypertension, diabetes, cardiovascular disease, cancer, and chronic lung disorders are seeing arise in number, attributable to change in life style.

Gender wage disparity

- India had among the worst levels of gender wage disparity. Men earning more than women in similar Jobs, As per the Global Wage Report 2016-2017 released by the International Labour Organization(ILO).
- In India ,Women formed 60% of the lowest paid wage labour. Gender Pay gap at the bottom is also very wide in India.
- At the same time care work is undervalued because it may be seen as a natural female attribute rather than a skill attribute (22nd Dec.2016 –Hindu News Paper).

Emerging areas of concern

Due To Globalization & Trade Liberalization Women In India are linked to the Global economy to a very Significant extent as :

- Producers
- Entrepreneurs
- Service Providers
- Consumers
- Citizens

Education Programme & Material Developed

Co-Investigator explaining about the importance of malted mix

Meeting with Officials, village leaders a Women of a meeting conducted on 2nd April 2005

References

Mary Khakoni Walingo and Vijaya khader .2000. Impact of Dairy programme on the Nutritional status of women and pre-school children in Vihiga district (Ph.D. thesis)

Vijaya Khader and Aruna. 2008. Operational feasibility of RPO supplementation to pre-school children in Anganwadi centers of ICDs Project, Natural Product Radiance, and Vol.7 (4) pp 310-313

Vijaya Khader. 1994. Rural Women as Entrepreneurs in Mushroom Cultivation, Indian Farming, March, pp. 18-21

Vijaya Khader and Kavitha. 1993. Anthropometric measurements of pre-school children in the rural areas of Tenali division. Asian Journal of Psychology and Education. Vol. 26 No.1-2, PP. 35-40

Vijaya Khader. 1999. Impact of Women's supplementary incomes as families' Nutritional status. The Indian Journal Social Work, vol. 60(3) pp. 368-378

Vijaya Khader & Umamaheswari. 2012. to study the effect of feeding malted food on the nutritional status of vulnerable groups: accepted for publication in the International Journal for Biotechnology and Molecular Biology Research. Vol. 4 (4) pp.35-36

Yasoda Devi & Vijaya khader. 2004. Therapeutic food supplementation in ICDS projects of Andhra Pradesh, Every man's science Vol. 39(3) pp. 160-167

SECTION-V

STRATEGIES TO IMPROVE COMPLEMENTARY FOOD AND FEEDING

भाकृअनुप
ICAR

Investing in 1000 Days Nutrition in Madhya Pradesh : To Get Impact Ensure C²IQ Coverage, Continuity, Intensity & Quality

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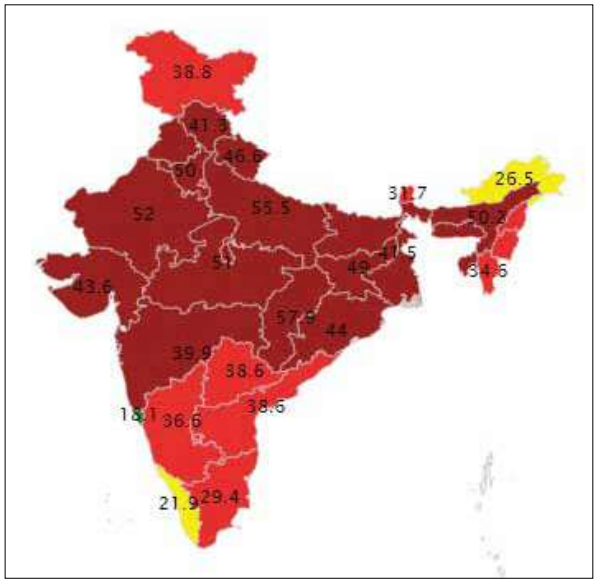
Globally, undernutrition directly or indirectly contributes to almost half of the under-five mortality. Persistent nutrition deprivation for a chronic period of time leads to stunting (characterized by low height for age) which jeopardizes child's survival and development by contributing to impaired or non-optimal physical growth and cognitive development. It is clearer from the evidences that poor foetal growth or stunting in the first 2 years of life leads to irreversible damage, including shorter adult height, lower attained schooling, reduced adult income, and decreased off spring birthweight. Moreover, if the children who are undernourished in the first 2 years of life put on weight rapidly later in childhood and in adolescence, they are at high risk of chronic diseases related to nutrition

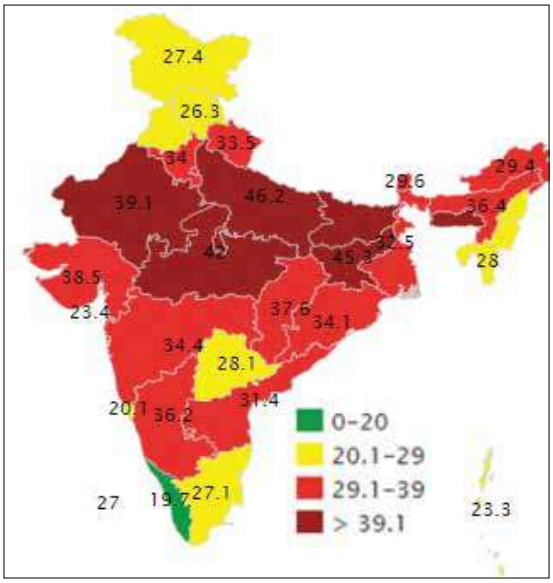
In early 2017, the Government of India released the NHFS-4 (2015-16). The results confirmed the declining trend of child stunting (from 48% in 2006 to 38% in 2016), stagnating levels of child wasting (20% in 2006; 21% in 2016) and increased levels of severe wasting in children (6% in 2006 to 8% in 2016). The survey also showed proportion of undernourished women (body mass index less than 18.5 kg/m2) declined from 36% to 23% and those who are overweight or obese (BMI >=25 kg/m2) increased from 13% to 21% in the same period indicating increasing dual burden of adult malnutrition. Anaemia among women and children has remained persistently high, with children 6-59 months who are anaemic being 58% in 2016 (compared to 58% in 2006) and proportion of women 15-49 years who are anaemic remaining high at 53% in 2016 (compared to 55% in 2006). The survey also points out at inter-state and inter-district variation in these indicators with larger load being shared by few states in central and northern India, due to sheer size of the population and issues pertaining to access to quality service delivery.

The state of Madhya Pradesh bears larger burden with 42% children are being stunted and 26% children are wasted. This means 3.3 million children in MP are stunted and it contributes to 7% of the stunted children in the country.

INDIA: Child stunting



NFHS2 1999



NFHS4 2016

However, there has been a declining trend with 29% reduction in children underweight (from 60% to 42.8%), 16% decrease in stunted children (from 50% to 42%) and 27% decrease in children with severe wasting (from 12.6% to 9.2%). The decline in stunting is slower than the national average (20%) however it is much better for other indicators. Madhya Pradesh also exhibits coexisting burdens of micronutrient deficiency (anemia), low BMI among adolescents and pregnant women. The trend shows very marginal decline in anemia among all the age-groups and the prevalence among women / girls remains above 50% for all the age-group with children under five years of age having prevalence as high as 68%.

Why focus on stunting reduction in MP?

- Reflects chronic undernutrition during the most critical periods of growth and development in early life –
- **Marker of multiple deprivations**
- Under developed brain
  - Diminished mental ability and learning capacity
  - Reduced earnings in later life
  - Increased risk of diabetes, hypertension and obesity in later life
- Stunted children are denied the opportunity to grow up to be skilled.

Stunting is defined as % of children aged 0 to 59 months whose height for age is below minus two standard deviations from the median of the WHO Child Growth Standards. 45 % of all child deaths in MP from poor nutrition.

26 months old 52 months old

Source: www.globalnutritionreport.org

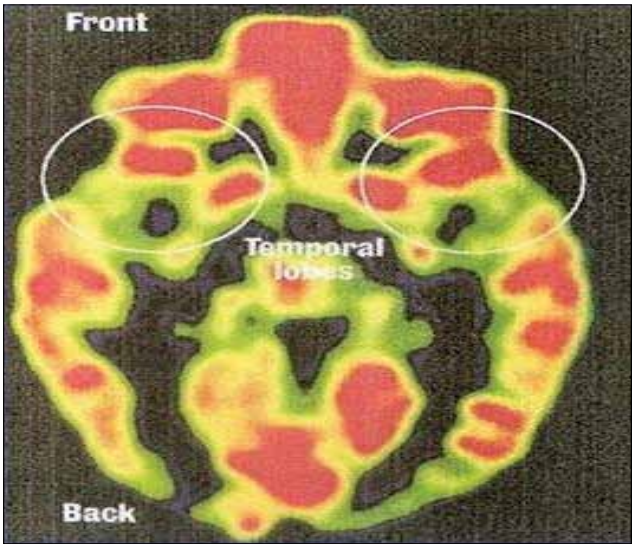
The cycle of poverty begins in the early years

The early years set the life-long foundation for human capital

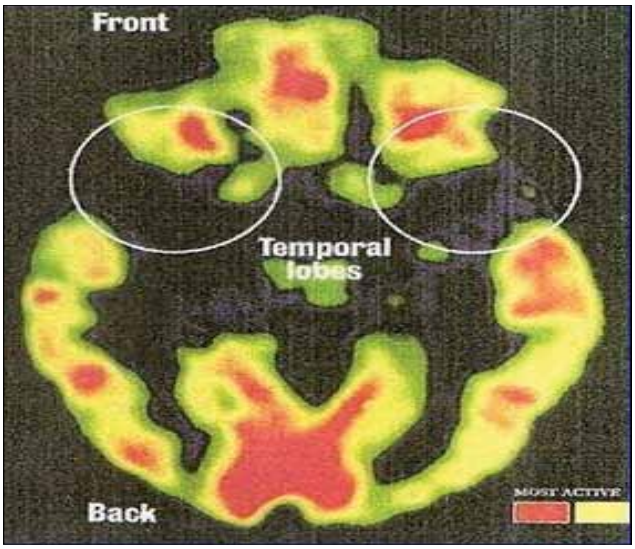
1. Socio-emotional skills predict future success and productivity
2. A well-nourished, healthy workforce is a pre-condition for sustainable development.

Source: Cordero E, D'Acuna E, Benveniste S et al. 1993

Essential Nutrition Actions



Healthy child



Child with stunted brain development

Source: Cordero E, D'Acuna E, Benveniste S et al. 1993

Care for women before and during pregnancy	Infant and young child feeding practices	Access to healthy services and healthy environment
• Improved food and nutrient intake for adolescent girls particularly to prevent anemia • Adequate food, nutrition and health services for newly wed, pregnant women and breastfeeding mothers	• Initiation of breastfeeding with in 1 hour of birth • Exclusive breastfeeding during the first six months of life. • Timely introduction of complementary foods at six months. • Age-appropriate foods for children six months to two years (quality, quantity an frequency and hygiene)	• Immunization and bi-annual Vitamin A supplementation with deworming • Appropriate feeding for children during and after illness. • Therapeutic feeding for children with severe acute malnutrition in facility and community • Improve access to safe drinking water and sanitation commodities.

Institutional Delivery

- 82.6 % more than 8 out of 10 women had an institutional

Early initiation of breastfeeding (0-23 mo)

- 34.6 % more than 3 out of 10 children were breastfed with in one hour

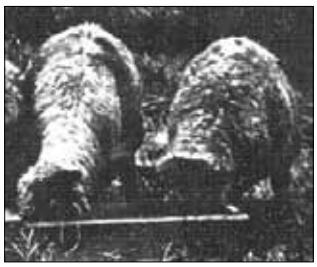
Vitamin A supplementation (9-59 mo)

- 60.4% 6 out of 10 children received VAS

Children (0-59 mo) with diarrhea given Zinc along with ORS

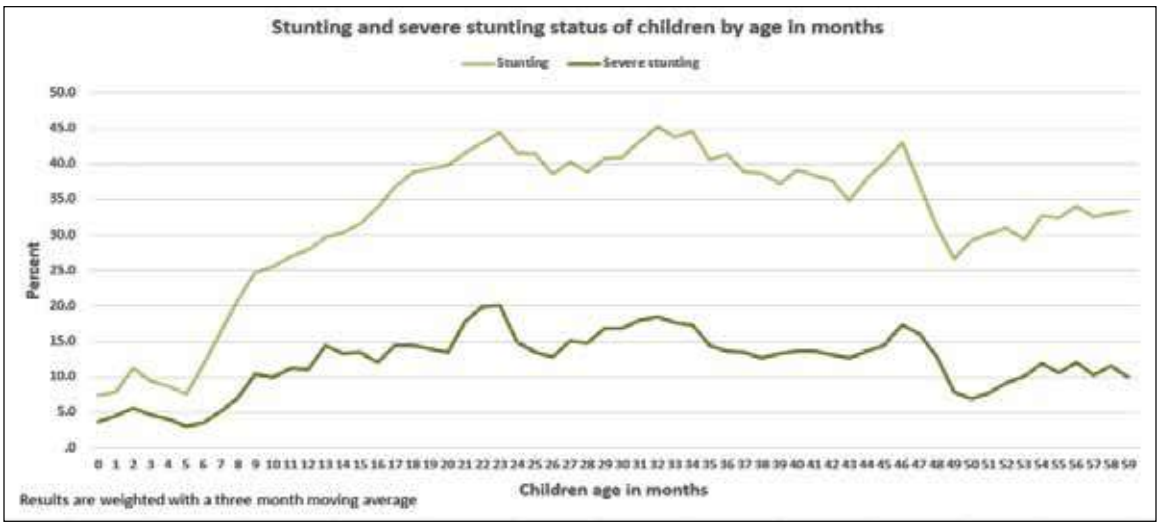
- 12.7% more than 1 out of 10 children with diarrhea were given Zinc & ORS

Periodically dewormed

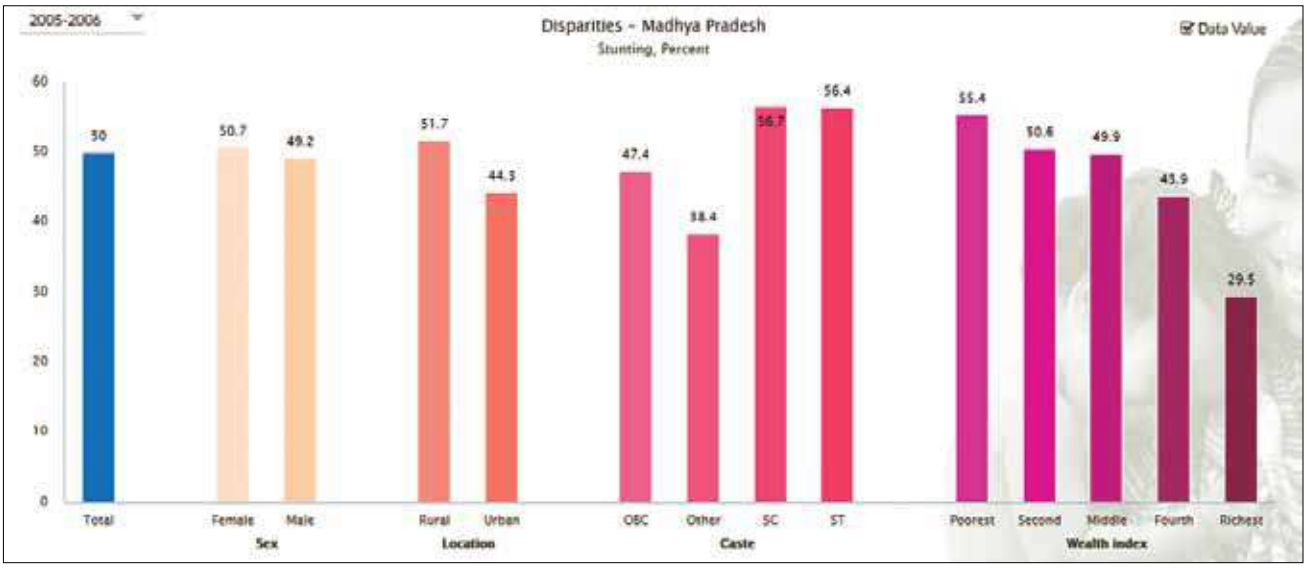


Not receiving deworming

Malnutrition in India rapidly increases from 6 months onwards



Stunting disparities poverty is a factor but does not explain malnutrition (NFHS3)



Intervention – Deworming

These animals are of the same specie, sex and age

What do we know: Foods and Feeding

- Poor social expectations on appropriate feeding
- Primary driver for feeding appeasement of hunger
- Children can eat anything
- Start complementary feeding without knowing when, how, what, how much, how many times, how many types
- Poor growth in child 'can be seen' but 'is not seen'
- Handwashing at all critical times not practiced
- Families spend money on convenience food
- Diets do not meet recommended nutrition intakes
- No time to prepare and give several feeds / day

Baby's stomach is small- Several meals with nutrient dense food needed

Baby's Age	1-2 days	3-6 days	1 week – 6 months	6 months -1 year	Adult
Tummy Capacity	Size of a cooked chickpea	Size of a grape	Size of a strawberry	Size of a grapefruit	Small Cantaloupe
	7-13 ml	1-2 oz	2-3 oz	3 oz-2 cups	4 cups (1 quart)

Note: Key:- 1 oz = 30 ml; 1 cup = 240 ml

Stop Child Malnutrition MP

- Govt can provide policies, funding, implement programs e.g. vitamins, CMAM, iron/folate, food provision
- Private sector can ensure good and affordable food products and marketing
- But much has to do with behavior – the BIG 4 :
- Exclusive Breastfeeding with no drinking water is need during first 6 months
- Dietary Diversity - Prepare nutrient rich foods from 6 months
- Meal Frequency - 3-4 meals and 1-2 snacks
- Hygiene - Wash hands and utensils
- Nutrition is too important to leave it to others -
- We need A Social Movement / Poshan Jan Andolan- #Stop Child Malnutrition MP
- Now implement high nutrition impact programmes across MP with: C^2IQ (Coverage, Continuity, Intensity & Quality)
- The 10-90 Commitment:

The impact of investing in nutrition in MP

One of the greatest opportunities for social and economic change

- Boost GNP by 11% in Africa and Asia
- Prevent nearly half of child mortality
- Increase school attainment by at least one year
- Boost wage rates by 5-50%
- Make children 33% more likely to escape poverty as adults

Ten high impact interventions to be implemented with C^{2}IQ

Out of total ANC registered, 90% of pregnant women registered within 1st trimester (within 12 weeks)	90% mothers with children between 4-24 months who were visited by ASHA at least once every two months to promote timely and appropriate complementary feeding (dietary diversity, frequent feeding, feeding hygiene and early stimulation)
90% of pregnant women have at least 4 ANC visits	90% of the villages where last month a VHND was held where a comprehensive set of interventions was provided.
90% children below one year fully immunized	90% of children 1-19 years covered with albendazole in the first round in February and in August
90% children and women receiving Iron/folate, vitamin A and calcium supplementation as per national guidelines	90% of children 0-60 months with diarrhoea who received ORS
90% of mothers that deliver in health facilities also start breastfeeding within 1 hour	90% children 6-36 months registered who received Supplementary Nutrition (THR) for 21 days in the last month

One World – No Hunger : Food and Nutrition Security, Enhanced Resilience Programme

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Food & Nutrition Security, Enhanced Resilience (FaNS-India)
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E-learning in ICDS

- Educational level of these AWWs are varied with huge no. are illiterate and less educated.

	5th standard or less	6-8 classes	9-10 classes	11-12 classes	Graduate
AWW	7434	16799	17356	26464	25204
AWH	25730	24087	9327	5635	1425

- To match the level of understanding and in lesser time, DWCD collaborated with GIZ for the development of online training platform
- Also Up-skilling in the near future is easy with less distribution and implementation costs

Benefits of e-learning platform

- Large target audience base
- Cost effective and time saving
- Self-paced
- Higher knowledge retention
- Easy course tracking
- Room for discretion
- Encourages sharing

Process Adopted:

- GIZ after getting request from the department:
  - Desk review
  - Short study on IT solutions
  - ToR developed
  - Initiated tender process- hiring of National Company
  - CnK Management Services, Hyderabad on board for 2 years till end of 2019
- The assignment will be completed by CnK in two phases (up to 24 Months)
  - Phase 1: Development of e-learning modules, launching and rollout of e-modules
  - Phase 2: Maintenance and technical support
- Formation of Steering committee with members of DWCD and GIZ

Scope of Work – CnK

Content	Technology	Services
E-Learning (40 hours) Assessment Qs	Portal / LMS Android App	10 – 6 Help Desk Maintenance of portal Ph 2 = next 18 months

Visually Rich-Engaging Learning Content

Multiple instructional and multimedia elements are used to create engaging, interactive learning content

- Visuals in form of animation to concretize the concepts clearly, supported by audio narration
- Interactivities and graphic elements (diagrams/ infographics, illustrations etc.)
- Interactive & attractive
- Video/games/quiz
- Local scenario considering ground reality
- Updated information
- Exercise for practice
- Questions/Answers to check knowledge retention

E-learning platform – Benefits to Department

- Uniform updated information
- Last mile worker approach
- Wide reach
- At a time, multi user platform
- Better service delivery
- Effectiveness in existing training technique
- In future, replacement of refresher training by this certificate e- course

Course Overview

Total time of course: 40 hours

Number of modules in the course: 7

Each module is divided into chapters.

LMS (Learning Management System): Functionality

- Login, Access to e-learning modules, Online assessments, evaluation and publication of results
- Dashboards to track user progress
- Uses HTML 5 – Supports Mobile Platforms
- Maintenance phase- 10 AM - 6 PM helpline for 18 months (Ph 2)
  - For assisting experts and learners to solve any difficulty
- Instructions User Manual for using the e-learning system
  - For Learners and Teachers/Experts/Trainers

LMS: Certification & Other Features

- **Certification**
  - Assessments with Randomized Qs
  - Design of Q Paper with desired number of Qs by Module and marks for each Qs
  - Set a pass in percentage
  - Auto-issue certificate
- **Other functionalities**
  - Discussions forums and feedback mechanisms with a pool of volunteer mentors deployed by DWCD

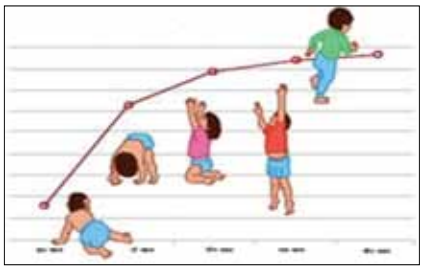
Monitoring Mechanism

DPO/CDPO can Track Learners Progress

Monitor feedbacks received on each module

Topics covered in the CASCAD program

Pilot Training- 4 Modules



Monitoring of Growth

Malnutrition management

Community involvement

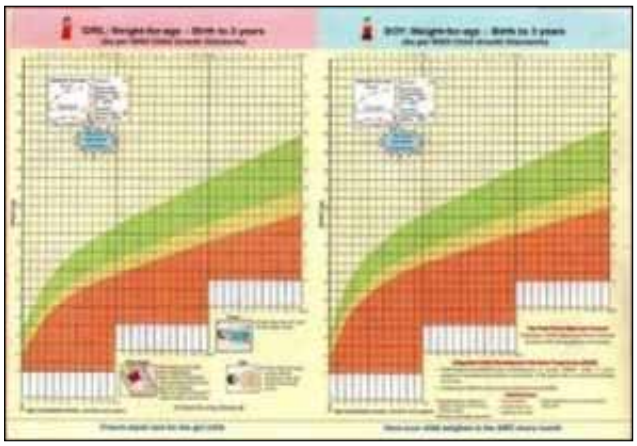
Sector management

Dissemination of information education

Major and minor nutrient

Module: Increase Monitoring

- Evaluation of child development
- The process of filling the growth chart properly
- Steps to follow to evaluate development using tools like Soller machine, MUAC tape
- Increase surveillance and support in advising parents and family

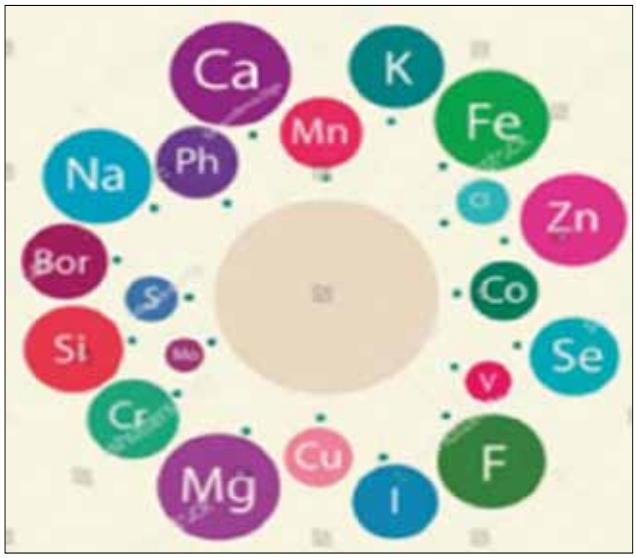


Module: Malnutrition Management

- Importance of breastfeeding
- Importance of weaning diet and the right time to start it
- Understand about NRC and learn the features provided by it
- Understanding malnutrition, its type and side effects
- Identification of malnutrition in children

Module: Macro and Micro Nutrients

- Essential nutrients and their importance



Types of nutrients

Various nutrients and their functions

Diseases due to deficiency of nutrients

Prepare a plan to reduce nutrient deficiency

Module: Information, Education and Communication (IEC)

Objectives of ICDS

- Use of counseling Techniques during their home visit
- Communication skills and their need
- Will help to Anganwadi workers in effective communication in groups
- Transformational transformation of communication and Its process

Module: Community Interaction

- Learning the importance of creating an identity for you
- Ways to motivate the community
- Understanding the community and collecting information from them
- Anganwadi workers will learn how to increase community participation

Module: Early Childhood Care and Education (ECCE)

- Understanding the growth of a child and the development
- Helping Anganwadi workers to make a better plan of their routine
- The concept of Child Choupal and the process of organizing it
- Learning about activities that children can do
- Use of P.S.E Kit
- Time management skills
- Know the concept of Vibrant ECE Center
- Understanding the ECCC and Its Importance

Module: Sector Management

- Will learn effective supervision of sectors
- Information collected in Skeeter
- Organizing an effective sector meeting
- Process of filling
- Importance of A.M.P.R and verification of information
- Calculation of important indices like malnutrition rate

About the Pilot Training

The key objective of the pilot run was to:

- Get feedback from learners on the 4 modules
- Improvise based on the learner feedback
- The pilot run was initiated on 25th January 2018

Implementation – Roll out plan

Target Learners	How	Where	By whom
JDs/DPOs/ CDPOs	VC	NIC	CnK team and GIZ
AWTC Instructors/ CDPOs/ Supervisors	1 day orientation	Directorate of ICDS – 6th and 7th April 2018	CnK team and GIZ
Supervisors	Orientation about e-platform	Divisional level	DPO/CDPO/ trained Master trainer
AWWs	Orientation about e-platform	Sector level	CDPO/ Supervisors

Expectations from DPOs/CDPOs

- Ensure 100% orientation of Supervisors/AWWs about the e- learning platform
- Ensure 100% completion of course by all AWWs
- Support in infrastructure availability especially computers/laptop/tablet with internet connectivity, if case online, else offline course
- Provide feedback on comment box (e- learning) if any

Alive & Thrive: Impact and Scale for Improvements in Complementary Feeding Nutrition

Sebanti Ghosh
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Scaling up maternal, infant and young child nutrition

Multi year (2008-2022) initiative, managed by FHI Solutions, funded by Bill & Melinda Gates Foundation, Irish Aid and Government of Canada. In 1st phase started in Bangladesh, Ethiopia, Vietnam and now also started in Burkina Faso, India (National, Bihar & UP), Nigeria. A regional 6-country policy initiative started in SE Asia.

Goal

To reduce under nutrition, disability and death caused by sub-optimal maternal nutrition and infant and young child feeding (MIYCN) practices.

Alive & Thrive INDIA

MIYCN Knowledge partner of the Bill & Melinda Gates Foundation, 2015 – 2020

Scope : National level, priority states of Uttar Pradesh & Bihar and Diffusion States

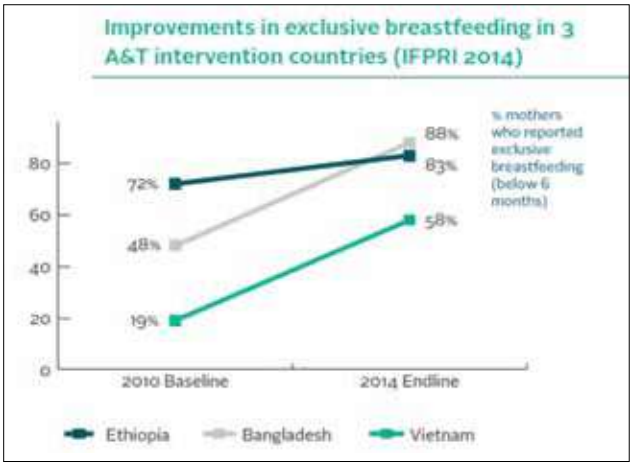
Program Platforms: Health, ICDS, Rural Livelihoods Mission; Medical colleges & Professional associations

Procedure

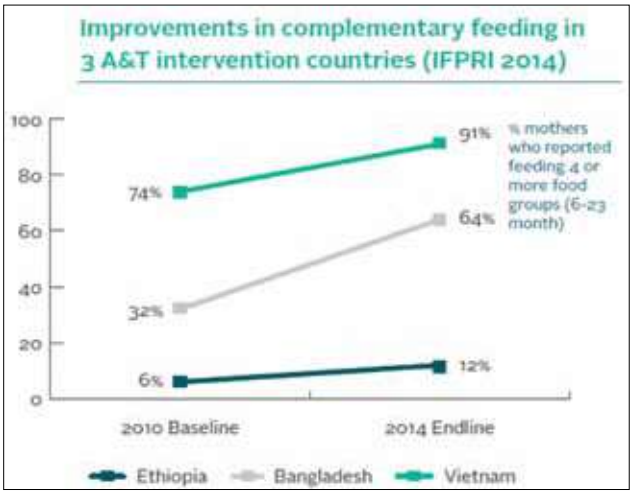
It undertake advocacy & provide technical assistance (Health systems strengthening & SBC), generate and share knowledge/evidence and fosters strategic partnerships for scale and sustainability.

Alive & Thrive results in Phase 1 demonstrated that rapid improvements in IYCF including Complementary Feeding are feasible at large scale.

Exclusive breastfeeding improved

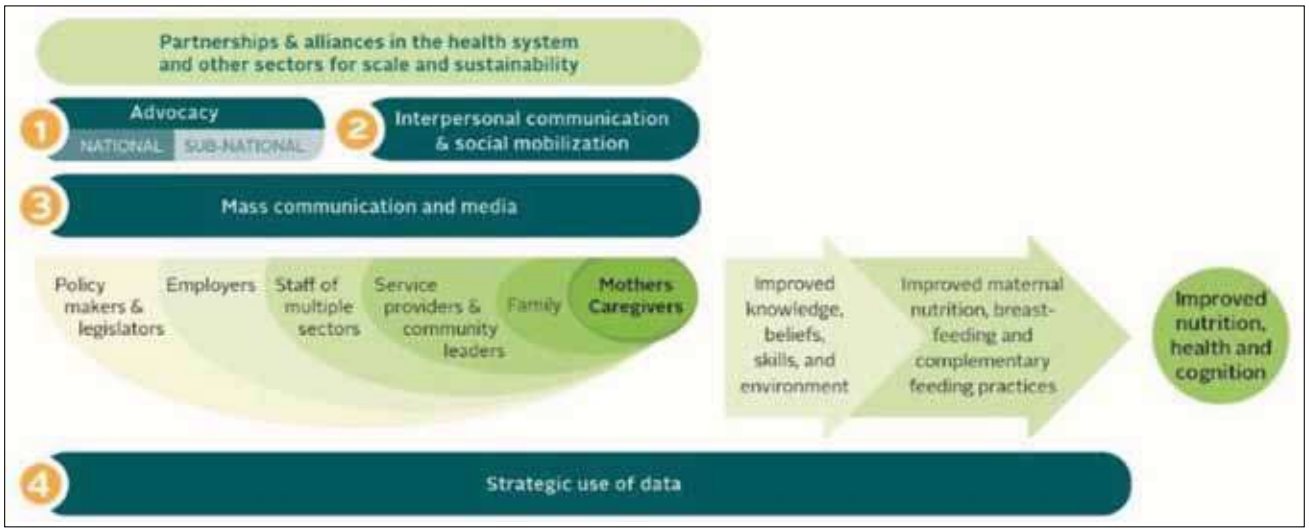


Improvements in diversity of complementary foods



Scaling up infant and young child feeding programs

Implementation framework emerged for at scale results : Changing social norms, engaging people throughout society

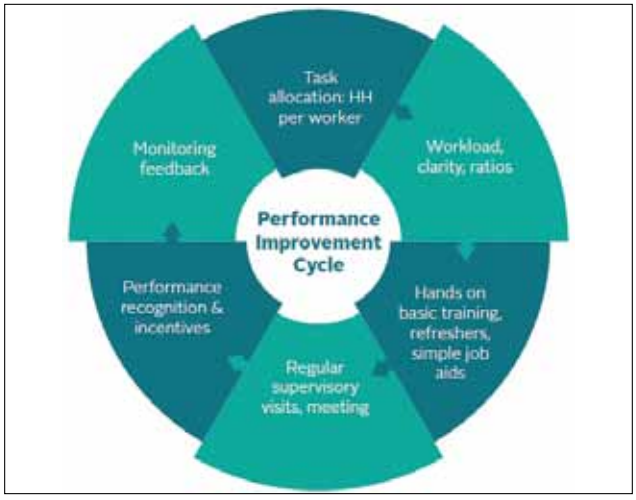


Framework for Implementing Maternal, Infant and Young Child Nutrition Programs at Scale

IPC at Health Facility Level : Vietnam

Integration of breast feeding into Early essential newborn care. Innovative social franchise model of IYCF Counselling Center in government health facilities with good quality counselling and support and 9-15 contacts over 27 month period from pregnancy to 24 months.

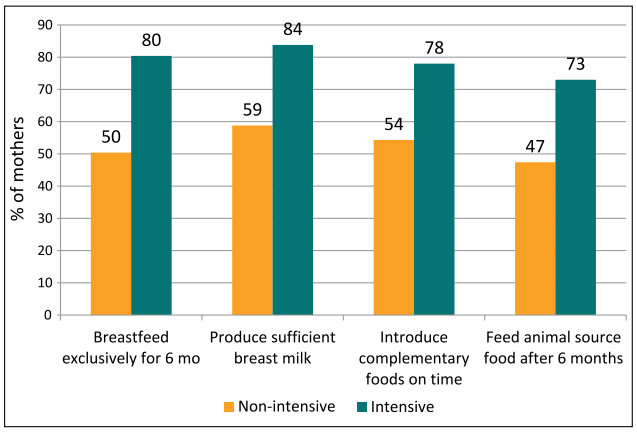
Performance of frontline workers, not only training



Performance improvement cycle for FLWs (A&T, Bangladesh)

Use of multiple platforms and intensity of exposure

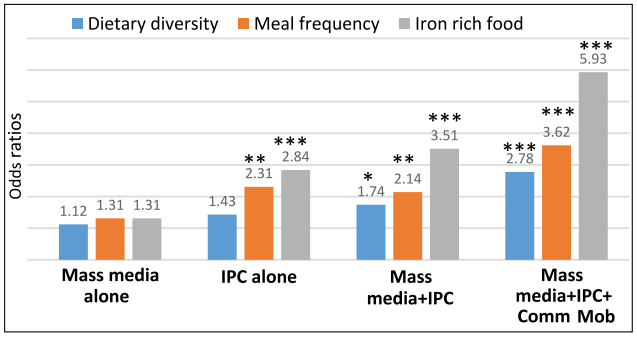
More mothers felt confident about following IYCF practices where home visits and community mobilization were combined with mass media



All results above significant for double difference at p<0.05

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

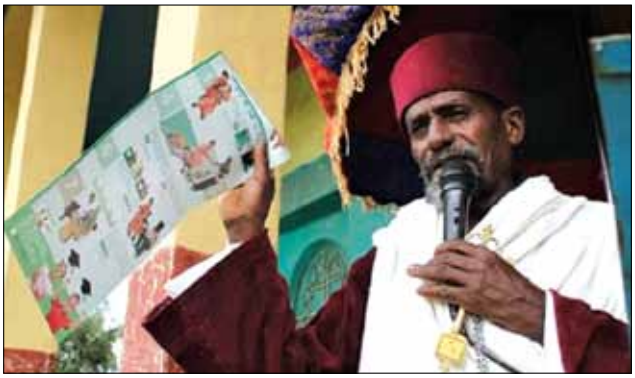
Greater behavior change from multiple program platforms



Source: Menon 2016, J. Nutr. in press. Intensive and non-intensive groups combined, endline survey (2014). Adjusted for maternal, child, HH characteristics. Children 6 to 23.9 months

Reaching the key influentials in family & community with the same behavior change objective

Traditional networks



Religious leaders

Multiple layers including Mass Media: Touching audiences through creative media

Regular Monitoring

Three-layered monitoring

- Routine service records
- Internal validation
- External concurrent

What we learned about how to be Effective

- Identify priority behaviours
- Unpacking behavior into small doable action for mothers
- Intensity matters
- Listen to mothers and engage more than mothers
- Specific actions for influential
- Focus on drivers of behavior
- "LESS GUESS" -Let data be the guide

Key operational elements for strengthening India IYCF programming

1. Improve coverage & its content(quality) through front line workers (FLWs) : quality interpersonal communication
2. Reach out to fathers, and grandmothers
3. Investing in behavior change & performance of FLWs
4. Use of multiple platforms and high intensity of exposure through many different channels
5. Rigorous monitoring & data driven review for program improvements

"Success in breastfeeding is not the sole responsibility of a woman – the promotion of breastfeeding is a collective societal responsibility."

Lancet 2016 Breastfeeding Series

(https://www.thelancet.com/series/breastfeeding)

Programme Opportunities for India's Food Based Safety Nets

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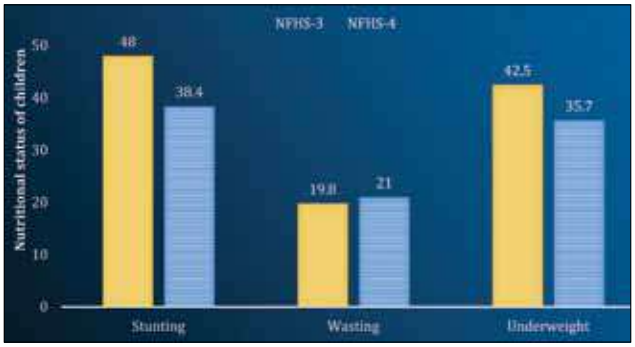
An overview of the anaemia prevalence among children, women and men in India

Anaemia causes 20% of maternal deaths in India and was the associate cause in 50% of maternal deaths, IndiaSpend reported in October 2016. It causes low birth weight among babies, putting them at risk for lifelong issues involving cognitive development and physical growth. Anaemic children go on to earn 2.5% less as adults than their healthier peers.

In India about 58.5% children were anaemic having age between 6 – 59 months, 53.0% Women aged 15-49 yrs and 22.7% men aged 15 – 49 yrs: were anaemic *(NFHS-4, factsheets)*.

An overview of the nutritional status of children in India

Nutritional Status of children



India's food safety net schemes:

Scheme	Target Beneficiaries	Objective	Remarks
Targeted Public Distribution System (TPDS)	Antodaya Anna Yojana (AAY) and Priority households	Ensure food delivery	Required: Nutrition Interventions with SBCC
Mid-Day Meal	School children aged 6 - 14 years	Improve nutrition	
Integrated Child Development Services (ICDS)	Children up to 6 years of age, Pregnant and Lactating women		

Strategies to address micronutrient deficiencies and anaemia:

- Dietary Diversification
- Supplementation
- Food Fortification
- Public Health Measures
- Nutrition and Health Education

What is food fortification?

"Food fortification is the practice of deliberately increasing the micronutrient content of a food, i.e. addition of vitamins and minerals (including trace elements) to a food, so as to improve the nutritional quality of the food supply and thereby provide a public health benefit with minimal risk to health (WHO)"

- Maintain body stores of nutrients more efficiently and effectively
- Does not require changes in existing food patterns
- Better addresses multiple micronutrient deficiencies
- Cost-effective

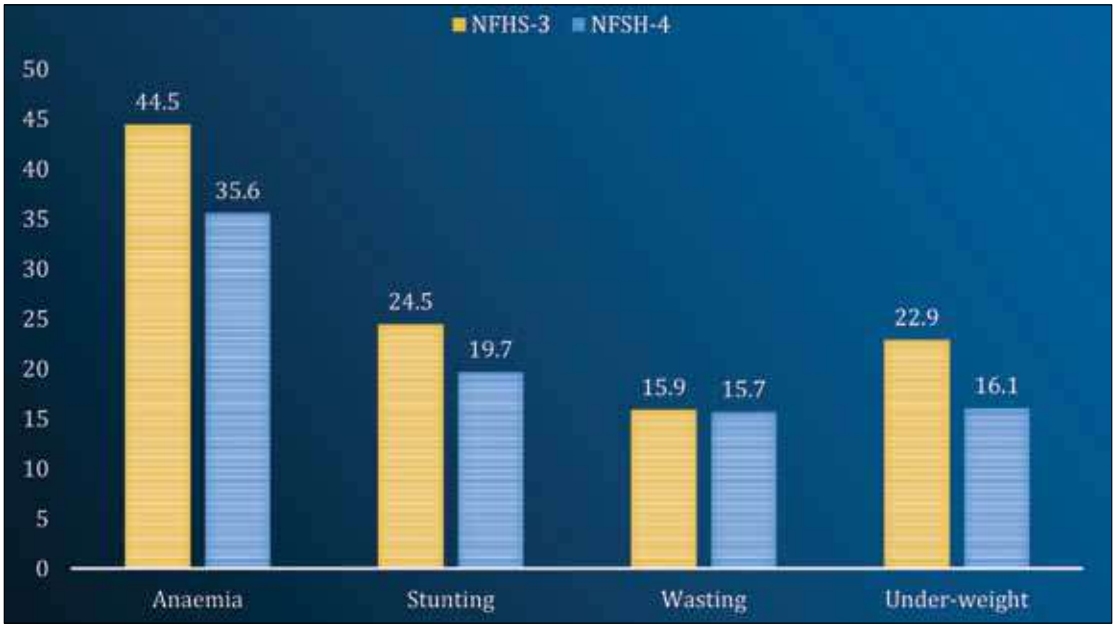
Commodities which can be fortified:

Source: WHO

Integrated Child Development Services (ICDS)

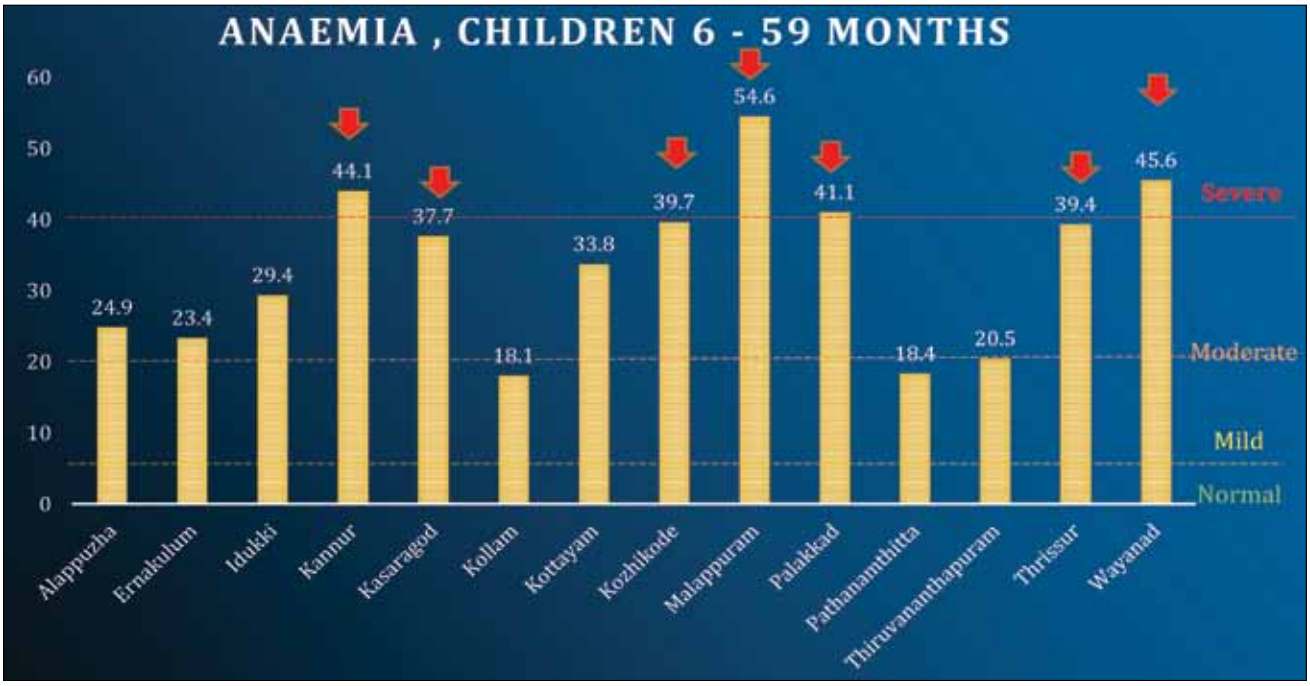
The programme was launched on 2nd October, 1975, the Integrated Child Development Services (ICDS) Scheme is one of the flagship programmes of the Government of India and represents one of the world's largest and unique programmes for early childhood care and development. It is the foremost symbol of country's commitment to its children and nursing mothers, as a response to the challenge of providing pre-school non-formal education on one hand and breaking the vicious cycle of malnutrition, morbidity, reduced learning capacity and mortality on the other. The beneficiaries under the Scheme are children in the age group of 0-6 years, pregnant women and lactating mothers.

Nutritional status and Prevalence of anaemia among children in Kerala



Source: NFHS-4, factsheets

District-wise prevalence of anaemia in Kerala



Source: NFHS-4, factsheets

Average daily intake of micronutrients vs RDA*Children aged 1 – 3 years

States	Protein (gm)	Total fat (gm)	Energy (kcal)	Calcium (mg)	Iron (mg)	Vit A (mcg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vit C (mg)	Dietary folate (mcg)
Kerala	14.6	10.4	524	165	2.5	61	0.3	0.3	3.1	8	22.0
Other states	19.7	11.8	733	166	4.7	61	0.5	0.3	4.8	9	48.1
Recommended dietary allowance (RDA)	16.7	27.0	1060	600	9	400	0.5	0.6	6	40	80

As per the NNMB survey, average intake of children (1-3 years) for recommended micronutrients is much lower than required, resulting in consequent malnutrition and micronutrient deficiencies.

Source: NNMB, 2012

Integrated Child Development Services (ICDS) – Kerala

The Govt. of Kerala, under the ICDS provides a locally prepared blended food known as 'amrutham nutrimix' to children aged 6–36 months as supplementary nutrition / take-home rations.

'Amrutham nutrimix' is a mixture prepared from:

- Wheat (45%),
- Texturized Soya Chunks (10%),
- Sugar (20%),
- Roasted Bengal Gram (15%) and
- Roasted Groundnut (10%).

Each child aged 6 – 36 months is entitled for 135 gm/daily of 'amrutham nutrimix' as it approx, provides 3.77 kcal/gm energy. Amrutham Nutrimix is a non-fortified product, though it meets the caloric and protein content norms laid by the GoI.

'According to the WHO guiding principles for infant and young child feeding, children in this age group should receive foods which provide sufficient energy, protein and micronutrients to cover a child's energy and nutrient gaps. The Government of India in its 'revised nutritional and feeding norms for supplementary nutrition' under ICDS Scheme have requested all states and UTs to provide micronutrient fortified supplementary nutrition to children below six years of age and pregnant and lactating mothers

Fortification of take home rations in Wayanad, Kerala

Mission: To ensure delivery of fortified blended foods as THR to children between 6-36 months of age through the ICDS in Kerala.

Modality: Multi-micronutrient premix consisting of Calcium, Iron, Zinc, Vitamin A, Vitamin C, Thiamine, Riboflavin, Niacin, Pyridoxine, Vitamin B12, Folic acid

Duration: 12 months of implementation

Coverage: 3152 children through 148 anganwadis in the project location

The Kudumbashree unit member - demonstrates the process of fortification of Take Home Rations at the project location in Wayanad district of Kerala

- Setting-up the fortification demonstration unit
- Developing Standard Operating Protocols (SoPs) for fortification
- Capacity building of unit staff
- Quality assurance and control
- Capacity building of field workers
- Gap analysis and scoping study

For implementation and roll-out of the project, a three phased approach has been envisaged:

1. **Initial phase:** This was a phase of directly implementation and support by WFP, wherein a fortification demonstration unit was setup in Manathavady block of Wayanad district. While simultaneously conducting gap analysis and outlining scale-up plan for fortification.
2. **Support phase:** During the support phase, WFP will conduct capacity building of officials on THR fortification while the Government is expected to fill gaps identified by WFP at its own cost towards fortification with technical support from WFP
3. **Final Phase**: WFP support would be largely facilitatory in nature, and the state will take the lead in ensuring that fortified foods reach young children in anganwadi centers

Baseline Findings

It was found that there is high prevalence of anaemia (58.5%), boys more than girls; and tribal populations; Vitamin A Deficiency @ 72%. Quantity of nutrimix consumed per child was 58.6 g which was much less than required 135 g. The baseline also suggested that scope to improve the knowledge and awareness levels regarding the anaemia, vitamin A deficiency, nutrition and feeding practices among the caregivers/parents of children. The anganwadi workers had limited tools for counselling of mothers.

Fortification of take home rations in Wayanad, Kerala; Information, Education and Communication (IEC) activities

1. Importance of the first 1000 days of life
2. Types of malnutrition and its causes,
3. Micronutrient deficiencies
4. Breastfeeding – importance

5. Age-appropriate complementary feeding (for children 6 – 8 months, 9 – 11 months, 12 – 24 months and 24-36 months)
6. Feeding during illness and after recovery
7. Safe and hygienic preparation of complementary foods

Flyers:

Four types of flyers were developed depending upon the age of the child. (6 – 8 months, 9 – 11 months, 12 – 23 months or feeding during illness). The importance of timely, frequent and age-appropriate complementary feeding while stressing on fortified foods was conveyed through the flyers.

Folk media shows

The importance of timely, frequent and age-appropriate complementary feeding while stressing on fortified foods was reiterated through the folk media campaigns

Current status of the project:

Project has completed its 12th month of implementation. An endline evaluation for project for the benchmarked indicators is being done. Project monitoring activities suggest, no acceptability issues among children regarding the taste for fortified amrutham nutrimix. The utilization and consumption of fortified amrutham nutrimix has increased (3152 à 3648 children regularly consuming fortified nutrimix each month). Improved awareness regarding age-appropriate complementary feeding, and feeding during illness. Fortified amrutham is consumed at least once a day at homes along with other foods prepared at home. The project is being scaled-up by Govt. of Kerala to the other units in Wayanad district and gradually to the other districts in the state. The IEC materials developed by the project are being scaled-up to other districts.

Mid-Day Meals (MDM) Scheme

Evidence on rice fortification from Gajapati district, Odisha

Goal: Operationalizing rice fortification through the platform of the mid-day meal

Coverage: 99,231 school children across 1473 schools in Gajapati

Duration: 40 months (duration of intervention was 31 months)

Intervention: Every 100 grams of rice provided 10 mg of iron. The form of Fe used is ferric pyrophosphate. The daily ration for rice is 100 gm and 150 gm respectively for children between 6-10 yrs. and 11-14 yrs. respectively.

A school girl in Gajapati district of Odisha, with a plate of cooked fortified rice: the World Food Programme (WFP) in collaboration with the Govt. of Odisha plans to scale-up of rice fortification in the state

Gajapati rice fortification project - Strategy

Key Components

- Capacity building of teachers and cooks
- Information, Education & Communication (IEC) materials
- Monitoring
- Implementing Partners

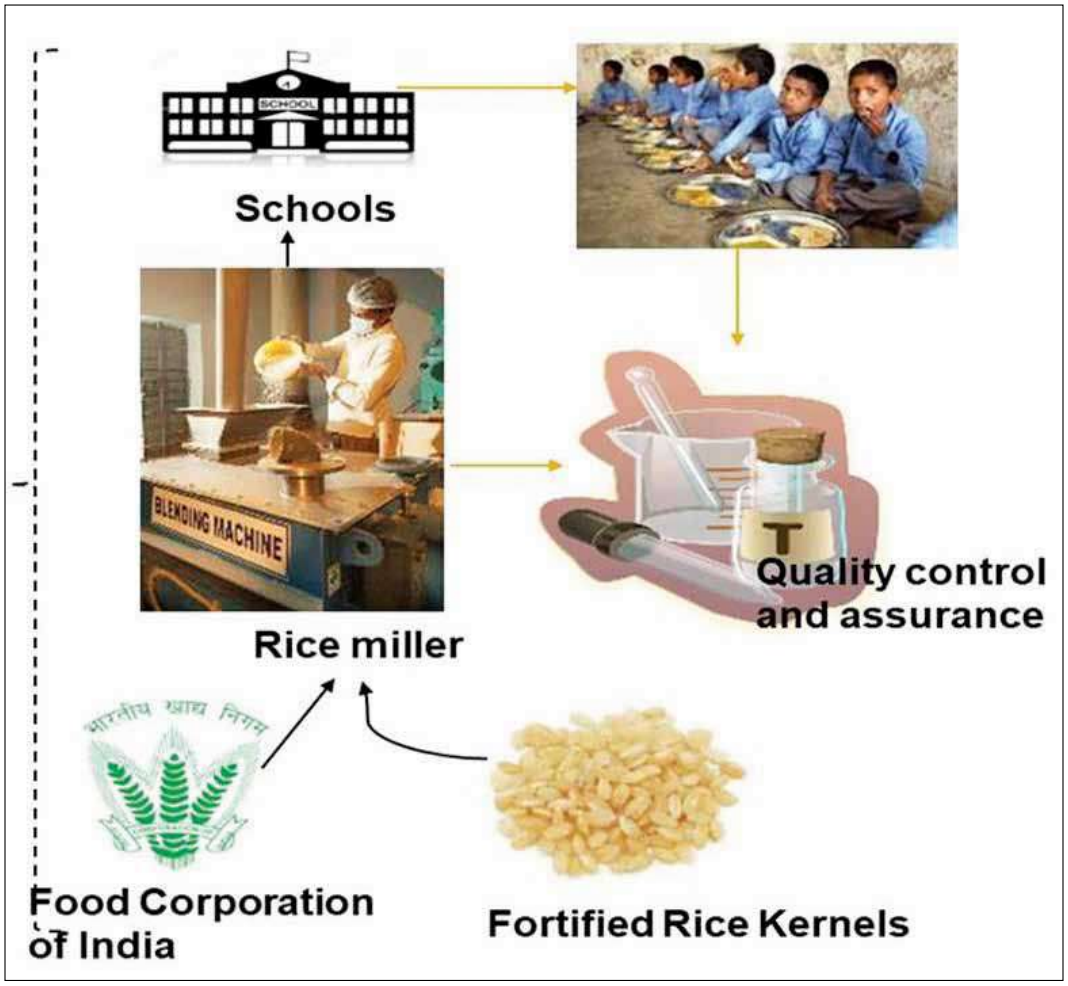
Gajapati rice fortification project

Awareness, sensitization and regular communication with programme implementers, school teachers, cooks of MDM, the school children and the community. Importance of handwashing before meals, after using toilet. Folk media and cultural activities organized to raise awareness among the community on fortified meals. Regular NHED sessions with school children, teachers on cause and consequences of anaemia, how to address the same. Cooks were trained to adopt efficient ways of cooking rice.

Results

Rice fortification reinforces, complements and supports the ongoing Govt. run nutrition

Technical Advisory Group (TAG) for review & monitoring the implementation, Meet on a Bi-annual basis



improvement programmes. Rice fortification is also technically effective (decrease in prevalence of anaemia) and operationally feasible to implement in the Govt. social safety nets.

Conclusion

Fortification is cost-effective if implemented at scale. (THR Fortification: INR 0.18 per child per day, Rice fortification: 0.40/kg fortified rice). India's food based safety nets offer a huge opportunity for nutritional improvement through fortification. Food fortification can lead to rapid improvements in micronutrient status of children, and does not require any behaviour change on part of the consumer. Nutrition interventions coupled with nutrition education and awareness can play a big role in improving nutritional outcomes.

Support for food fortification from the Government

FSSAI has operationalized standards of fortification for rice, milk, wheat, oil, salt and other processed foods. The Food Fortification Resource Centre has been setup as a body that acts as a resource and support centre to promote large-scale fortification of food across India.

References

http://ffrc.fssai.gov.in/ffrc/home
NFHS-4 http://rchiips.org/NFHS/NFHS-4Report.shtml
NNMB, 2012 http://nnmbindia.org

Addressing Infant and Young Child Feeding in Madhya Pradesh: Connecting Global Evidence to State-level Data

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Global evidence on improving complementary feeding

From the small scale studies (Lancet, 2016) two things was evidence that close information and knowledge gaps can be fill through counselling, support, nutrition education and close resource gaps through food supplements or cash. Now it should be do at large scale.

Bangladesh: Engaging frontline workers for delivering counseling through a large-scale NGO platform implemented by BRAC + Mass media + Social mobilization



Counseling by health workers and social mobilization

Mass Media Campaign

Vietnam: A social franchise model for delivering IYCF counseling at government health facilities + Mass media

Counseling by frontline workers, food demonstrations

Counseling at social franchise

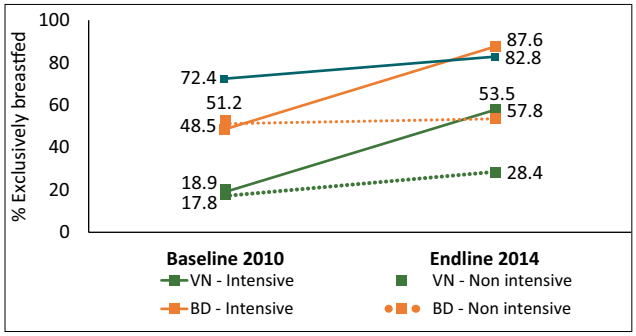
Materials and mass media campaign

Ethiopia: Nutrition counseling through government health extension platforms in Ethiopia + Radio

2010-2014: first phase study

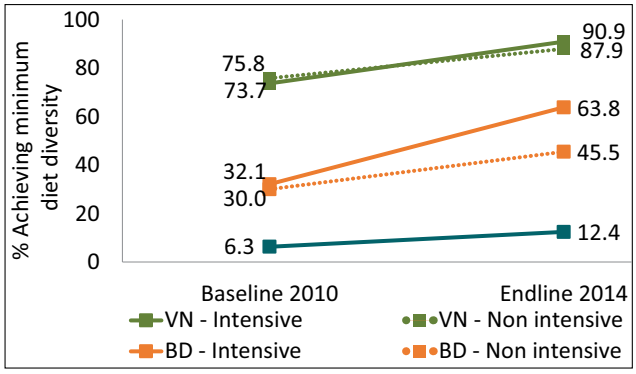
2015-2017 study: also uses agricultural extension workers for nutrition education

Fig. 1: Impacts on exclusive breastfeeding in Bangladesh, Ethiopia and Vietnam (children 0-5 months)



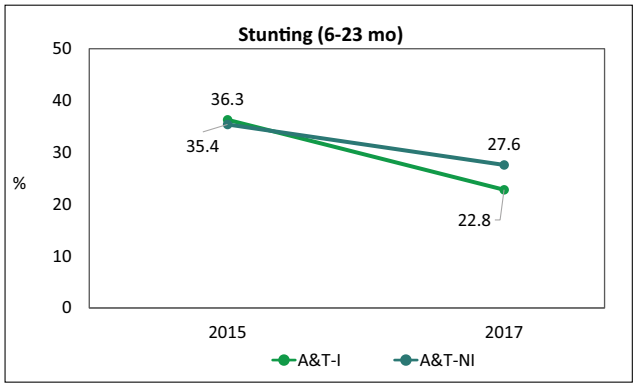
Menon et al., PloS Medicine, 2017; Kim et al., PLoS One, 2016

Fig. 2: Impacts on complementary feeding in Bangladesh, Ethiopia and Vietnam (children 6-23 months)



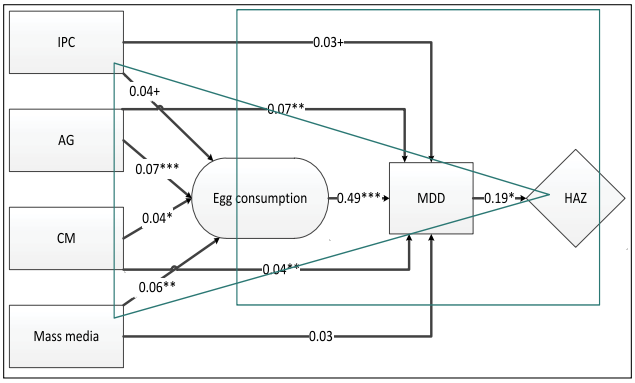
Menon et al., J Nutr, 2016; Rawat et al., J Nutr 2017; Kim et al, PLoS One 2016

Fig. 3: In Ethiopia, combined nutrition and agriculture BCC improved stunting



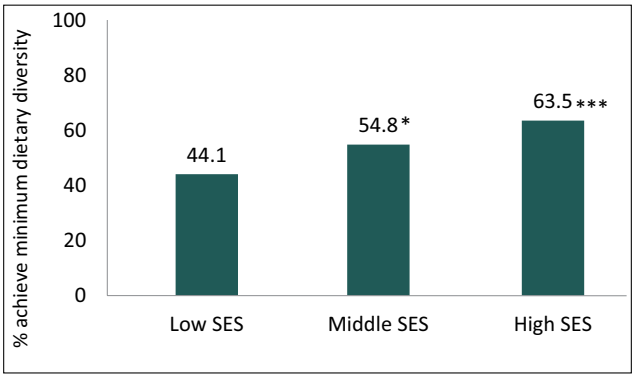
*Kim et al, under review (201) +p<0.1, *p<0.0, **p<0.01*

In Ethiopia, exposure to interventions are associated with child growth through dietary diversity, directly or via egg consumption



+p<0.1, *p<0.05, **p<0.01, ***p<0.001

Context matters: Household economic status affects adoption of minimum dietary diversity in Bangladesh



*p<0.05, **p<0.01, ***p<0.001

Ethnographic research showed integration of program messages into existing social norms but challenges remain - cheap snack foods, tinned milks

Improving infant and young child feeding practices

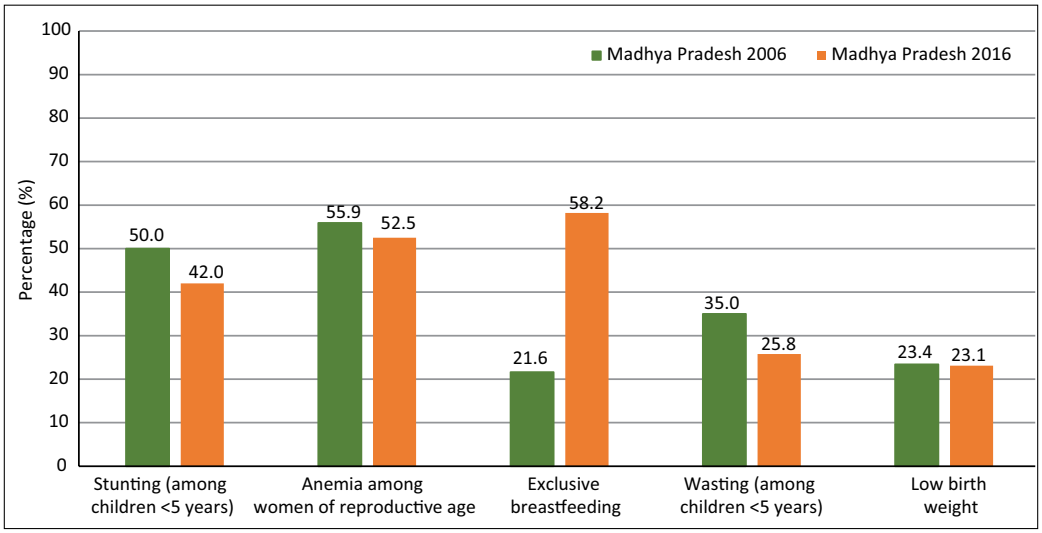
In multiple evaluations of Alive & Thrive's efforts in Bangladesh, Ethiopia and Vietnam, we showed that:

1. It is possible to achieve substantial impacts, at scale, on nutrition-related behaviors in multiple contexts
2. Context, and pathways to impact, affect reach and adoption of practices

What does the evidence say for India?

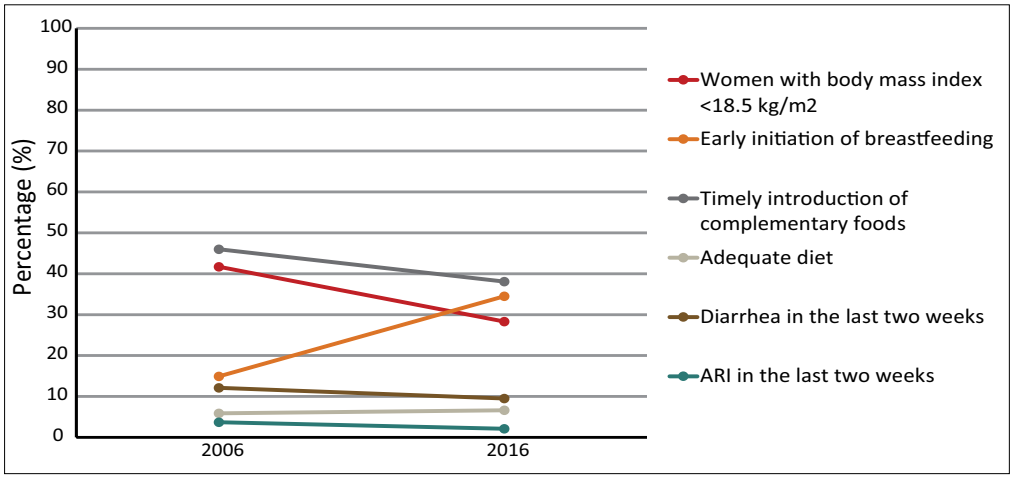
India has a vision for impact and a supportive policy environment. Multiple operational platforms to deliver counselling and complementary food supplements. Indian policies are well aligned with global evidence that current guidelines for complementary food supplements need to be re-examined but capacity, finance, and governance gaps are the primary limiting factors and gaps in research evidence base & program experience base in improving diet diversity and combined effects of food supplements and counselling.

Stunting, wasting and exclusive breastfeeding have improved in the last decade in MP



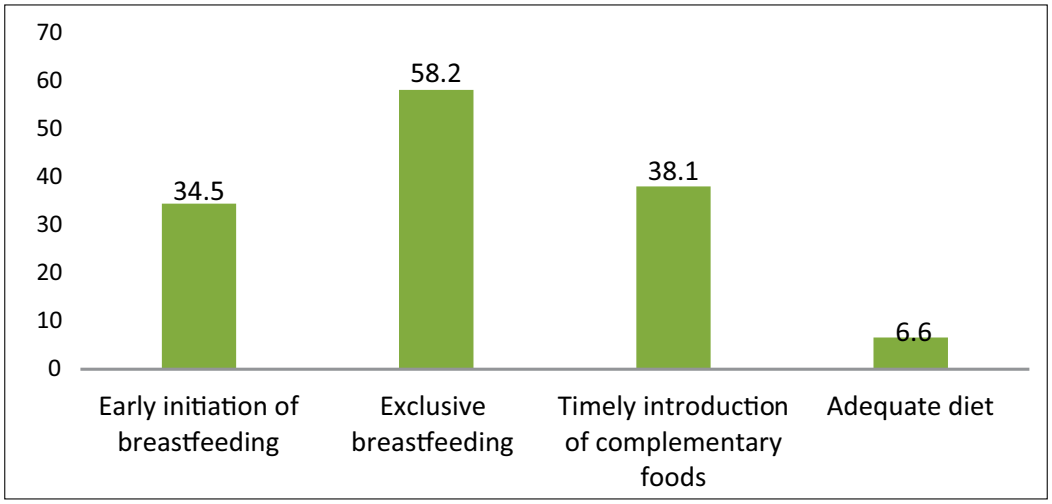
Source: NFHS-3; NFHS-4 and RSOC for low birth weight

Immediate determinants (2006 to 2016): Women with lower body mass index reduced; early initiation of breastfeeding doubled; decline in complementary feeding



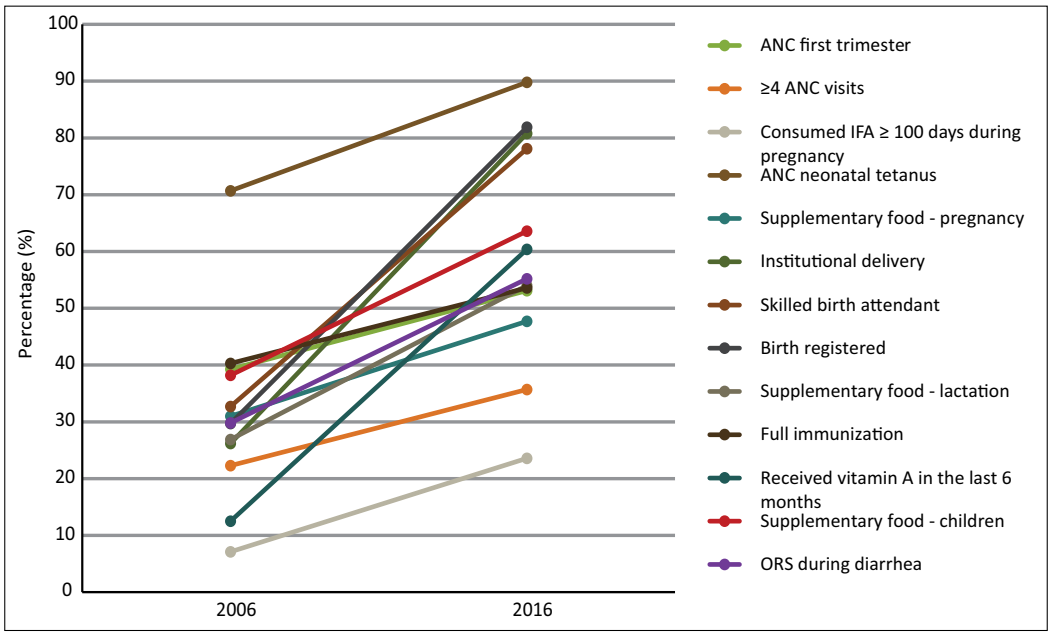
Sources: NFHS-3 and NFHS-4

Taking a closer look (2016): Big gaps in feeding practices



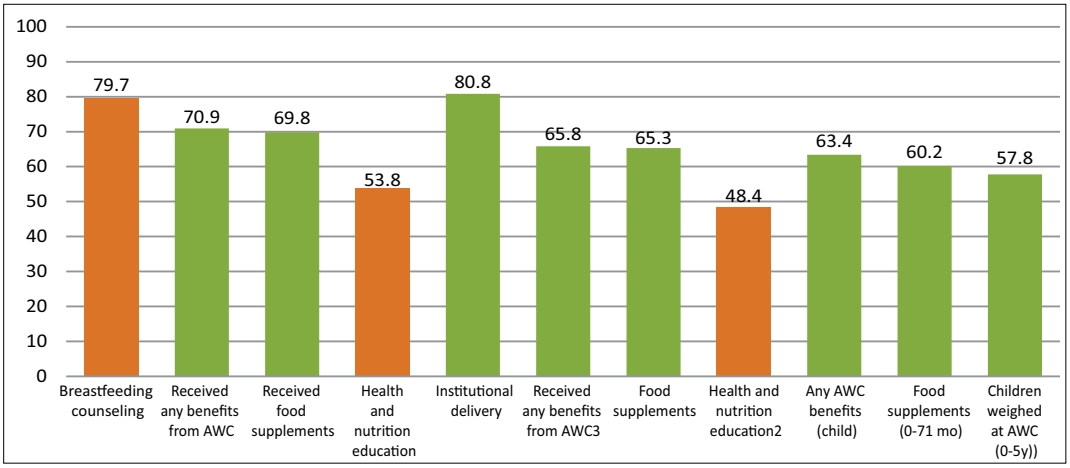
Sources: NFHS-4

Nutrition-specific interventions in the first 1000 days in Madhya Pradesh: Making progress but gaps to close

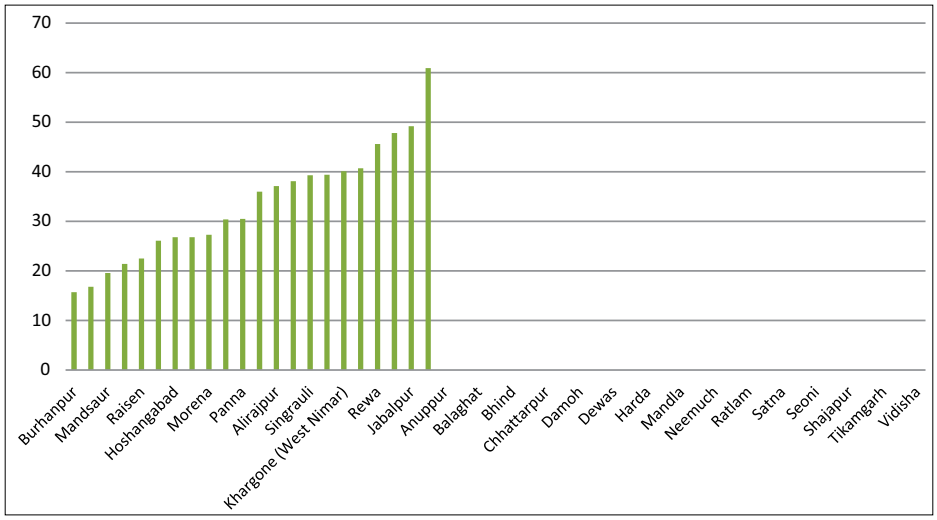


Sources: NFHS-3, NFHS-4

Opportunities for counselling on complementary feeding – MP (NFHS-4)



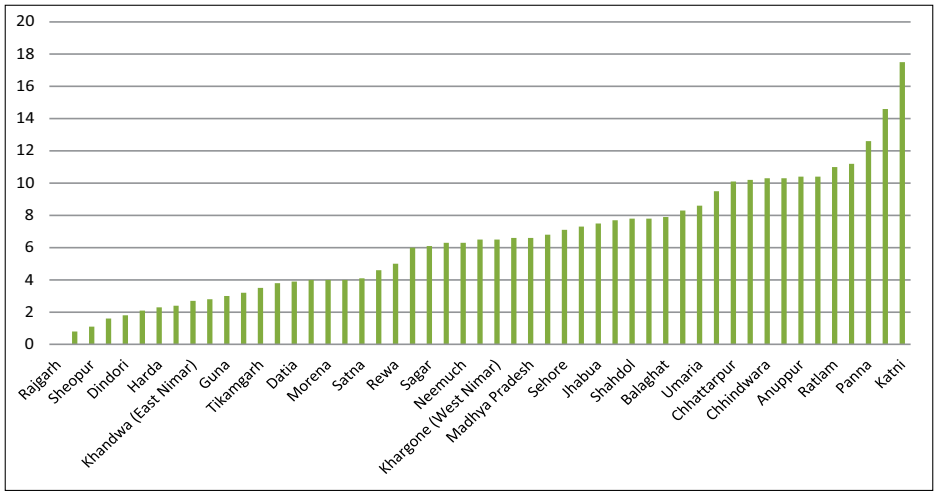
Timely complementary feeding, by district, in Madhya Pradesh, 2016



Sample sizes too small to create indicator

Sources: NFHS 4, IFPRI Analysis

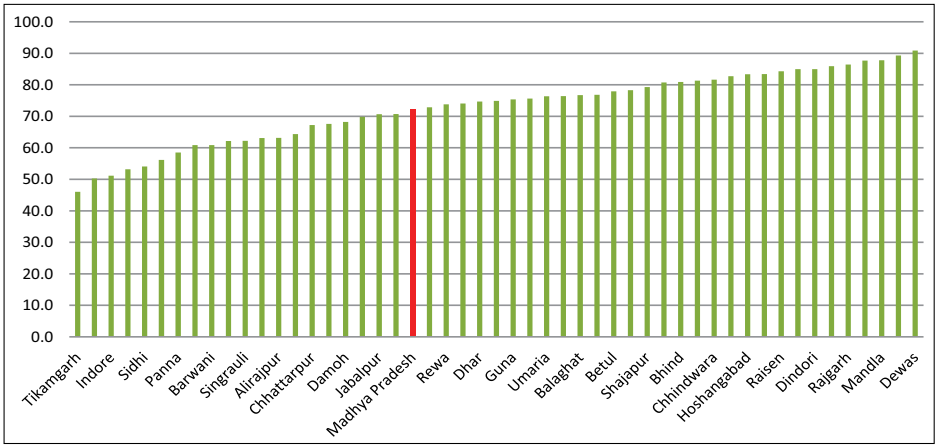
Adequacy of complementary feeding, by district, in Madhya Pradesh, 2016



Source: NFHS 4, IFPRI Analysis

Food supplements: Uptake of ICDS supplementary nutrition in the complementary feeding age (6-23.9 months): 45% to 90% in Madhya Pradesh

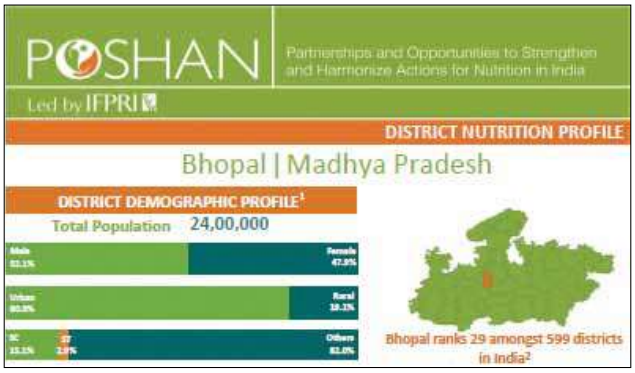
Coverage of THR for children 6-23.9 mo

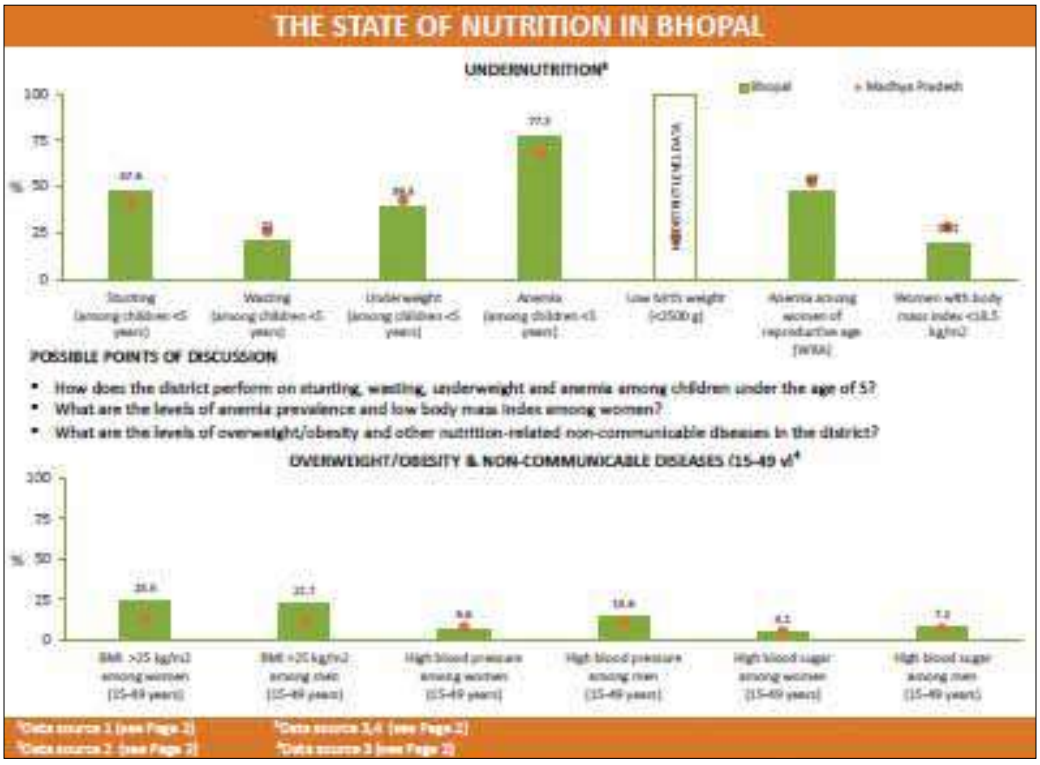


Source: NFHS 4, IFPRI Analysis

District-focused action to close gaps in interventions and determinants is essential

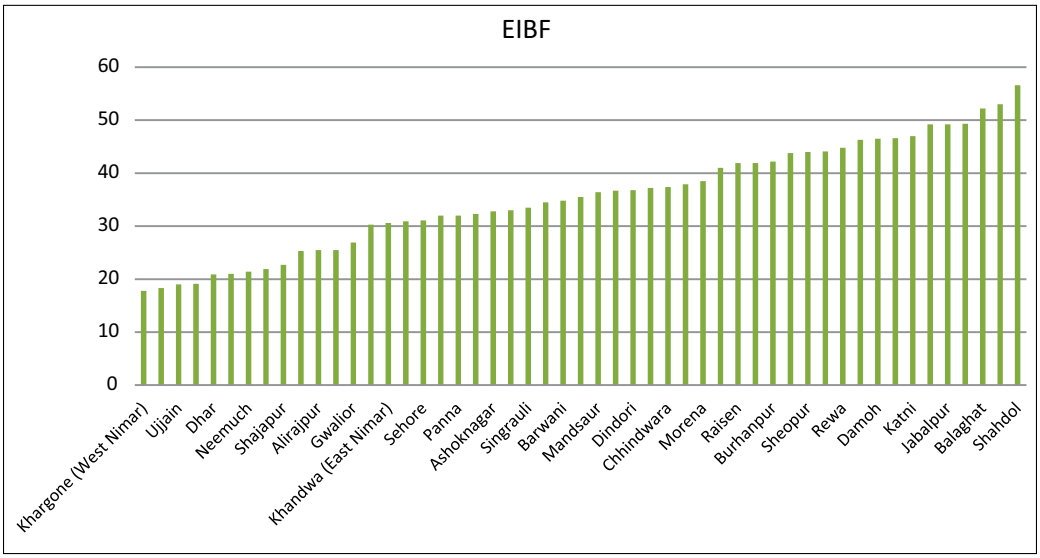
- State averages mask district variability
- Undernutrition can only change if the determinants and intervention coverage change
- District-specific gap identification and gap-closing efforts needed





District Nutrition Profile

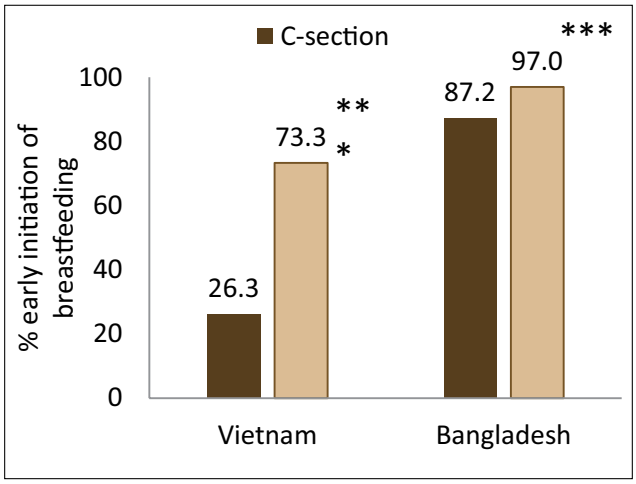
Early initiation of breastfeeding, by district, in Madhya Pradesh (2016)



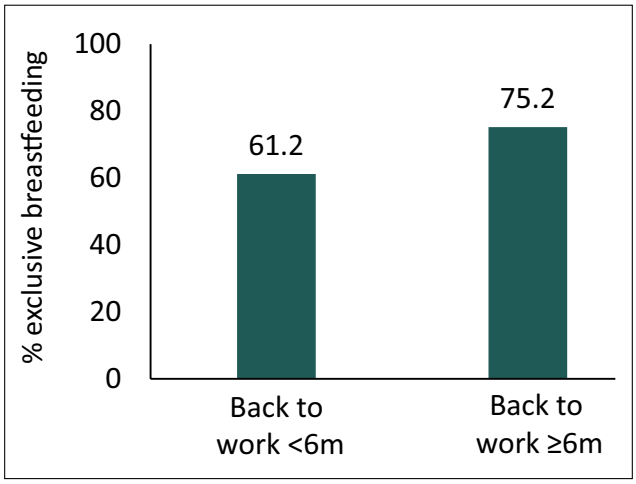
Source: NFHS 4, IFPRI Analysis

Utilization context affects ability to adopt breastfeeding practices (Vietnam)

Cesarean-section births and early breastfeeding



Maternal work force participation and exclusive breastfeeding



*p<0.05, **p<0.01, ***p<0.001

In closing: what are we trying to support for complementary feeding?

A child is fed about 3000 times in the first two years. We need to make every feeding episode count as quality and safety of foods to child, frequently available, good amounts of diet and avoiding unhealthy foods. Information, resoureces and social support to supporting families to do the best on feeding children must be a central goal.

References

Kim S.S., Rawat R., Mwangi E.M., Tesfaye R., Abebe Y., Baker J., Frongillo E.A., Ruel M.T., and Menon P. 2016. Exposure to Large-Scale Social and Behavior Change Communication Interventions Is Associated with Improvements in Infant and Young Child Feeding Practices in Ethiopia. PLoSOne. 11(10):e0164800. doi: 10.1371/journal.pone.0164800.

Menon P., Nguyen P.H., Saha K.K., Khaled A., Kennedy A., and Tran L.M., 2016. Impacts on Breastfeeding Practices of At-Scale Strategies That Combine Intensive Interpersonal Counseling, Mass Media, and Community Mobilization: Results of Cluster-Randomized Program Evaluations in Bangladesh and Viet Nam. PLoS Med 13(10): e1002159. doi:10.1371/journal. pmed. 1002159

Menon P., Nguyen P.H., Saha K.K., Khaled A., Sanghvi T., Baker J., Afsana K., Haque R., Frongillo E.A., Ruel M.T., and Rawat R. 2016. Combining Intensive Counseling by Frontline Workers with a Nationwide Mass Media Campaign Has Large Differential Impacts on Complementary Feeding Practices but Not on Child Growth: Results of a Cluster-Randomized Program Evaluation in Bangladesh. J Nutr. 146(10):2075-2084.

Rawat R., Nguyen P.H., Tran L.M., Hajeebhoy N., Nguyen H.V., Baker J., Frongillo E.A., Ruel M.T., and Menon P. 2017. Social Franchising and a Nationwide Mass Media Campaign Increased the Prevalence of Adequate Complementary Feeding in Vietnam: A Cluster-Randomized Program Evaluation. J Nutr. Apr;147(4):670-679. doi: 10.3945/jn.116.243907.

NFHS-3 http://rchiips.org/NFHS/report.shtml

NFHS-4 http://rchiips.org/NFHS/NFHS-4Report.shtml

Nutrition Literacy through Participatory Women's Group

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Nutrition literacy is the degree to which individuals have the capacity to obtain, process, and understand nutrition information and skills needed in order to make appropriate nutrition decisions. It can be achieve by participatory learning activities effectively.

In 2010, the Ekjut trial showed that PLA through women's groups could reduce neonatal mortality by around a third in rural, underserved areas of Jharkhand and Odisha. In 2015, the JOHAR study found that ASHAs could do PLA and achieve the same results. (Tripathy et al. *Lancet 2010* and Tripathy et al. *Lancet Global Health 2016)*

Participatory Learning & Action (PLA)

Participatory Learning & Action (PLA) Cycle

Participatory Learning and Action [PLA]: A change in mindset

'A student is an empty vessel to be filled with a teacher's knowledge.'

'People are experts in their own world. They require more than just information: respect and a space to develop their own solutions.'

Phase-I : Identifying & Prioritising Problems

In first phase groups was strengthed, understand the inequities in the area, identified undernutrition problems in the area and after that the problems were prioritized.

Phase-II:Analysing problems & Exploring solutions

In second phase causes and effects of problems were identified by bridge game.

Phase-III: Taking Action

Understanding causes and effects with pictorial stories and 'but why?' game

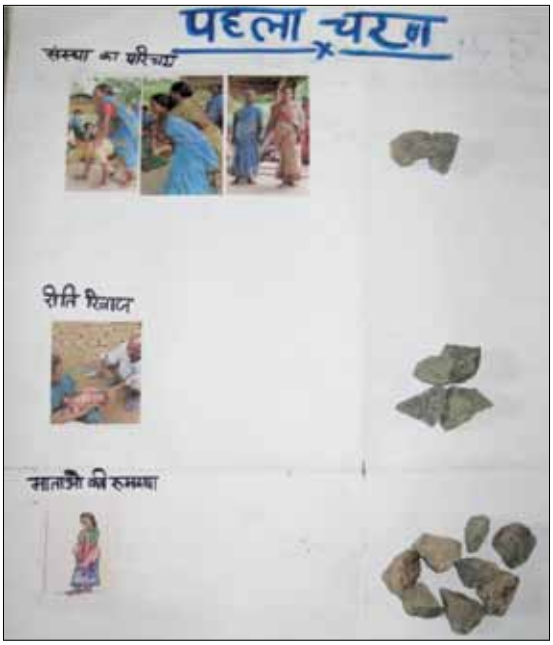
Identifying strategies-'bridge' game

Community interface meeting sharing strategies

In third phase action was taken. Dry food mix using local ingredients was prepared and Learning about safe food handling, early childhood development and food diversity.

Phase- IV: Evaluating Progress

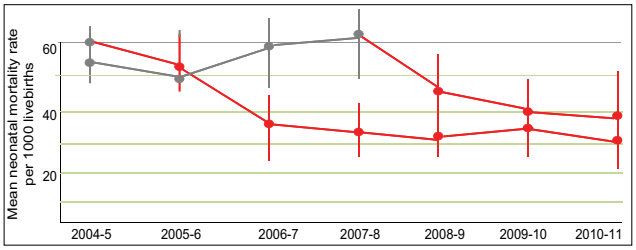
Evidence on Maternal & Newborn Health



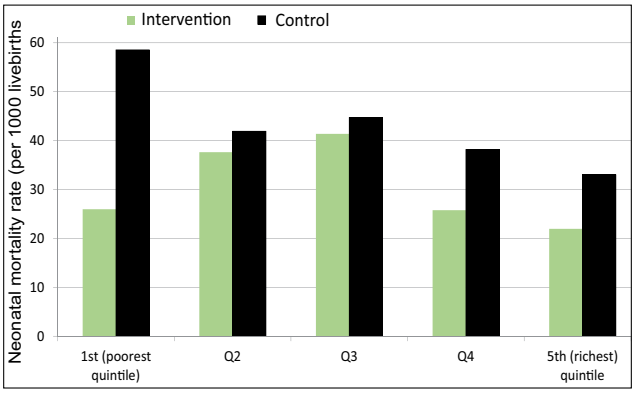
Participatory evaluation

Community Interface meeting

Ekjut Trial: 244 Groups	Replication in control areas: 274 Groups
18775 births: 32% reduction in neonatal mortality in the 3 years of the intervention (OR: 0.68, 95%CI: 0.58-0.78)	17725 births: 31% reduction in neonatal mortality after introduction of PLA (OR: 0.69, 95%CI: 0.57-0.83)

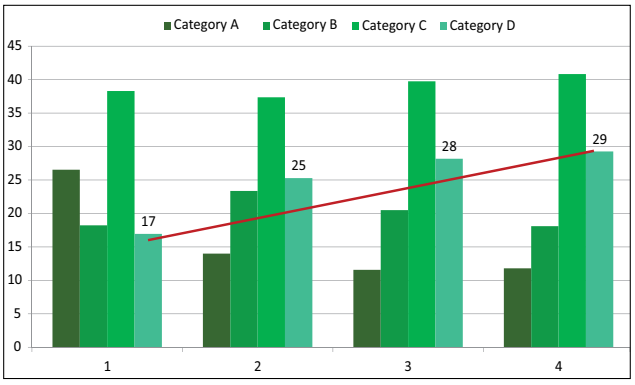


Impact on neonatal mortality among the poorest (Johar Trial)



Source: Tripathy et al. Lancet Global Health 2016

Groups attract the poorest in Madhya Pradesh



A to D: Economic status of households as categorised by Madhya Pradesh Rural Livelihood Programme. A = wealthiest households; D= poorest households.

Initiatives in Madhya Pradesh on Nutrition- by Ekjut

In 2010-2011 Nutrition was started as pilot study with MPRLP - MPTAST, 2013 - 2016 Nutrition + wash was started by joint effort of Sanjhi Sehat and MPTAST and in 2015 - 2017 food + nutrition security was started by WHH.

'Food and nutrition security and enhanced resilience amongst vulnerable communities in Sheopur and Chhattarpur districts of Madhya Pradesh'

Objective

1. Increased Dietary Diversity among women 15-49
2. Improved Minimum Acceptable Diet for children 6 -23 months (Pilot in 100 villages, Scale up in 1619 villages)

Output

In the programme about 58 master trainers were trained, 5614 anganwadi workers trained to facilitate PLA meetings, 84000 women reached through PLA and around 665000 community members reached through interface meetings.

Initiative on Maternal and Newborn health

It was started in 41 blocks of 17 districts by 659 ASHA Sahayogi in 6926 Villages.

EKJUT	17 NGOs
• NGO selection • Master training & Quality assurance of training • Resource material development • Overall coordination	• ASHA Sahayogi training • Quality assurance in the community • Support in MIS

Two tested models to address Undernutrition

1. Participatory Learning & Action (PLA) with Home visits
2. Participatory Learning & Action (PLA), Home visits and Crèches

Home Visits & Counselling

Participatory Group Meetings

Participatory group meetings

Reinforce changes in immediate causes and begin to address underlying causes such as Birth spacing, nutrition in pregnancy, WASH, indoor pollution, women's empowerment, family planning, etc.

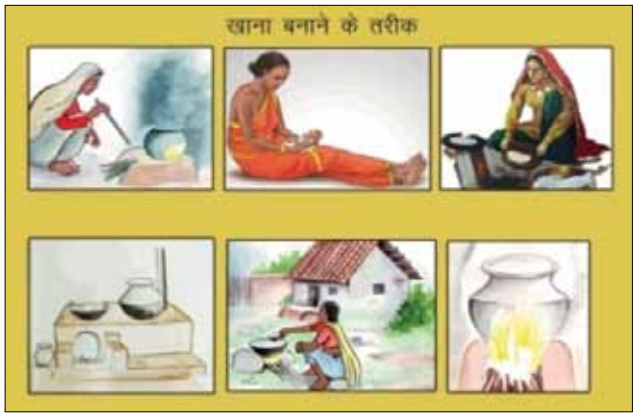
Home visits & Counseling

To address immediate causes of undernutrition, counseling for IYCF, illness prevention and support for referrals, Use of MUAC in children > 6 months to screen for MAM and SAM

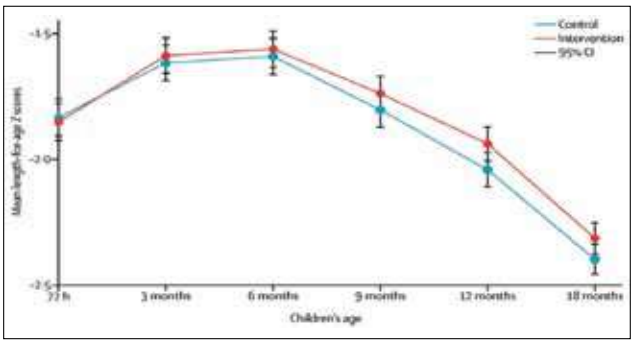
- One home visit to pregnant women in the third trimester and monthly home visits all children under 2 years
- MUAC to identify children <12.5mm, sick children referred to AWW/ANM as required
- Demonstration on hand washing technique, food enrichment, food hygiene, feeding of children and food handling
- Picture cards for age-appropriate counselling on IYCF practices, reducing indoor air pollution, immunization, ECCD and family planning

Additional visits were also made to children who were discharged from Malnutrition Treatment Centre/Nutrition Rehabilitation Centre, sick during the last visit, have MUAC between 11.5-12.5mm, MUAC < 11.5 mm and refusing to visit MTC and low birth weight babies

Picture cards used during Home visits



Findings – Participatory Learning & Action and Home Visits



0.11 SD Change in Length for Age; p=0.08

Source: Nair et al., Lancet Global Health, 2017

Women's Nutrition in Pregnancy

More pregnant women received minimum dietary diversity (p=0.03).

At 12 and 18 months, more children received minimum dietary diversity (p=0.01) and minimum meal frequency (p=0.03).

Source: Nair et al. *Lancet Global Health 2017*

Infection control

- More caregivers washed their hands before feeding children (p<0.001).
- More infants survived till 12 months
- (IMR Intervention: 51 - IMR Control: 64, p=0.05.)
- Fewer children were underweight at 18 months (p=0.04).

We still need more work on underlying and immediate determinants to reduce stunting substantially.

Findings from Action Against Malnutrition

Crèches + PLA Vs Control

The findings shows that 29% reduction in the odds of wasting ($P = 0.018$) and 38% reduction in odds of underweight ($P < 0.001$). Effect on stunting in the right direction but not significant at 0.05 level ($P = 0.06$)

Participatory Learning Action(PLA) Vs Control

The result shows that 28% reduction in the odds of wasting ($P = 0.022$) and 26% reduction in odds of underweight ($P = 0.014$). Stunting was not significant at($P = 0.640$).

Findings – PLA, HV and Crèches

Changes in wasting

Particulars	% Change	Or (95%% CI)	P value
Creches, PLA and home visits			
All children	-29%	0.71 (0.54-0.94)	0.018
Most marginalised	-55%	0.45 (0.29-0.71)	<0.001
PLA and home visits			
All children	-28%	0.72 (0.54-0.95)	0.022
Most marginalised	-46%	0.54 (0.35-0.85)	0.007

Changes in underweight

Particulars	% Change	Or (95%% CI)	P value
ARM 3 (Creches, PLA and Home visits)			
All children	-38%	0.62 (0.49-0.79)	p<0.001
Most marginalised	-47%	0.53 (0.36-0.78)	0.001
ARM 2 (PLA and home visits)			
All children	-26%	0.74 (0.58-0.94)	0.014
Most marginalised	-36%	0.64 (0.44-0.95)	0.027

***Most marginalized :** belonging to Schedule Tribes and to the two poorest wealth quintiles

References

Nair N., Tripathy P., Pradhan H., Bhattacharyya S., Gope R., Gagrai S., Rath S., Rath Suchitra, Sinha R., Sarbani S., Shewales S., Singh V., Srivastava A., Costello A., Copas a., Skordis-Worrall J., Haghparast H., Saville N. and Prost A. 2017. Effect of Participatory Women's Groups and Counseling Through Home Visits on Children's Linear growth in rural eastern India (CARING Trial): A Cluster Randomized Controlled Trial. *The Lancet Global Health*. 5(10):E1004-E1016.

Tripathy P., Nair N., Barnett S., Mahapatra R., Borghi J., Rath S., RathSuchitra, Gope R., Mahto D., Sinha R., Lakshminarayan R., Patel V., Pagel C., Prost A and Costello A. 2010. Effect of participatory Intervention with Women's Group on Birth Outcomes and Maternal Depression in Jharkhand and Orissa, India: A Cluster Randomized Controlled Trial. *The Lancet*. 375(9721): 1182-1192.

Tripathy P., Nair N., Sinha R., Rath S., Goper.K., Rath S., Sarbani S., Bajpai A., Singh V., Nath V., Ali S., Kundu A.K., Choudhry D., Ghosh S.K., Kumar S., Mahapatra R., Costello A., Fottrell E., Floaweling T.A.J. and Prost A. 2016. Effect of Participatory Women's Groups Facilitated by Accredited Social health Activists on Birth Outcomes in Rural Eastern India: A Cluster Randomized Controlled Trial. *The Lancet Global Health*. 4(2):E119-E128.

SECTION-VI

NUTRITION LITERACY

भाकृअनुप
ICAR

Promoting Nutrition Literacy for Nutri-SMART Villages in India

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Introduction

Agriculture as a source of food pathway when practiced in a holistic manner is the farming system for nutrition approach and is defined by M.S. Swaminathan as: The introduction of agricultural remedies to the nutritional maladies prevailing in an area through mainstreaming nutritional criteria in the selection of the components of a farming system involving crops, farm animals and wherever feasible, fish cultivation (Nagarajan *et al*., 2014).

Nutrition sensitive agriculture advocating that 'grow the food which we eat & eat the food which we grow' for the household level so that seasonal scarcity and micro-nutrient deficiency could be addressed particularly among the rural folks. Scaling out the nutrition-smart agricultural technologies vis-à-vis practices using community based adaptation strategies is a potential solution to food security and nutrition challenges. NSA ensures food production in adequate quantity and quality to meet the dietary requirements of populations in a sustainable manner.

Access of food is more imperative for a child for proper mental growth. In India poverty, hunger and malnutrition being the main problem. Green revolution reduced poverty and hunger and food production is increased to five fold. But still 250 million people live in poverty and about 47 million children below five year malnourished. Food security and improved nutrition is now major issues to the growing population. Food systems must deliver more nutritious food to populations. It can be possible by strengthening of value chains for micronutrient-rich foods and food availability at affordable to consumers. Despite of having food security in India, nutritional security is still challenging due to low access of the healthy foods coupled with lack of nutritional literacy affecting intake, quantity, timing and hygienic condition. Nutrition sensitive agriculture could be a better option and it is timely initiation by ICAR, New Delhi.

Nutrition security is a prime concern of our country today, as the number of people suffering from lifestyle related diseases and specific nutrient deficiencies are on the steep rise. India needs a lot more to be done to tackle the menace of malnutrition and agriculture could be more nutrition-sensitive for plugging the gaps in the nutrition-led government schemes.

Empirical evidences shown that efforts aimed solely at increasing production, raising income and increasing energy intake hardly help in ensuring household nutritional security as effectively as programmes that also recognize the importance of diet quality and diversity. Achieving success in nutritional security as well as food security also requires narrowing the 'nutrition gap" which requires increasing availability and access to the food necessary for a healthy diet and ensuring the intake of those food at recommended quantity. The structure and policies of institutions that contribute and influence agricultural development need to be reshaped with the values, behaviours, gender relations, and social norms of the societies in which they are situated.

In India, there is missing link between agriculture and nutrition (Sangeetha, 2018) evidenced by the fact that despite production of 277.49 million tonnes of food grains, 314.67 million tonnes of fruits and vegetables, milk production of 176.4 million tonnes (Anonymous, 2018). During 2015-16, 38.4% of India's children below the age of five were stunted, 35.8% are underweight; one-fifth of women in the reproductive age group were suffering from chronic energy deficiency while another one-fifth were obese (IIPS & ICF 2017). In fact initial 1000 days of any children are the most crucial period of life for mental and physical development. Not only children, vulnerable groups of the society like adolescent girls, pregnant and lactating women and adults are also malnourished.

In such situation, there is need to promote the locally available food crops with proper recipe preparation among the rural women to secure the intake of healthy diets. Nutri-Smart village establishment and its promotion would be a denting step in the promotion and sustaining the nutrition sensitive agriculture and nutritional literacy.

Nutri-SMART Village Concept

For making agriculture pro-nutrition, a food-based approach is required to promote nutrition literacy and fine tuning of the production plan in fields, farms as well as in backyards through nutritional gardens for overcoming malnutrition and micronutrient deficiencies at household level. Multiple benefits derived from enjoying a variety of foods, recognizing the nutritional value of food for supporting rural livelihoods to make the global food system better equipped to produce good nutritional outcomes.

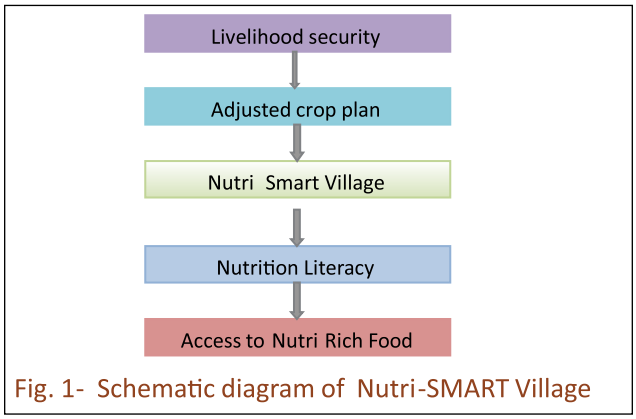


Fig. 1- Schematic diagram of Nutri-SMART Village

To tackle the nutritional sensitivity problem, a new initiative has been taken by the ICAR-ATARI, Jabalpur in collaboration with Women and Children Development Department, (WCD), Govt. of Madhya Pradesh to establish Nutri-SMART Villages (NSV) at each block to showcase the technology & methodology suited for nutritional security at the grass-root level through availability of healthy foods and wide scale nutritional literacy to overcome challenges of nutritional imbalances.

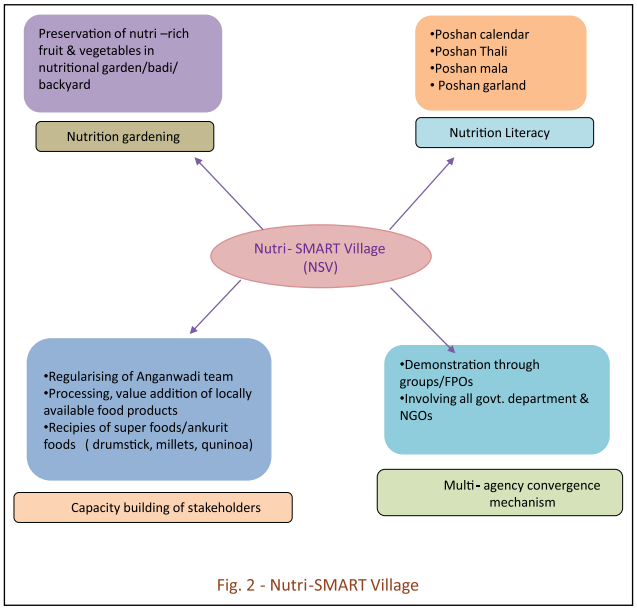
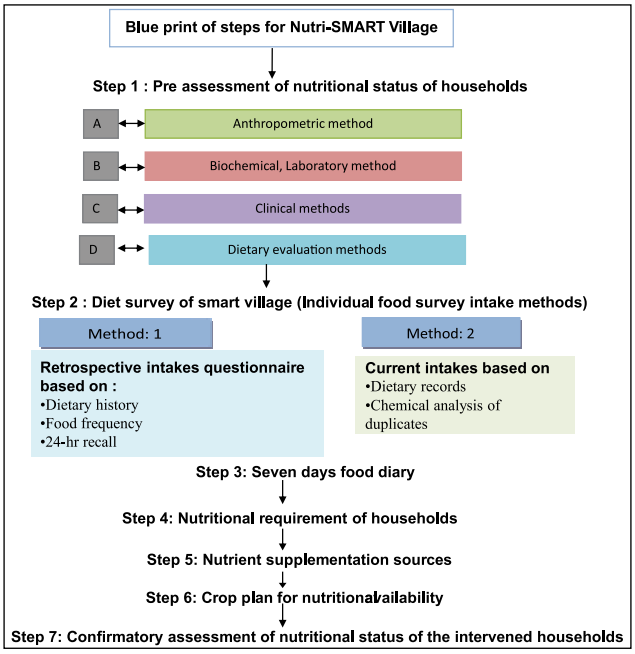


Fig. 2 - Nutri-SMART Village

- Nutri-SMART village having planned for secured food availability, meeting nutrient requirement of all households of different age and physical condition for making them nutrition sufficient and healthy citizen.
- This is a scientific approach based on the concept "You grow what you eat".
- NSV is a crop plan-led nutritional security concept so that the nutritional gap could be reduced by minor adjustment in the dietary plan.
- It advocates the traditional recipe based "Poshan Thali" which will not only remove the deficiency rather will address the social health from chronic diseases.
- NSV is the unique architect for nutrition-sensitive agriculture which could be practiced in Kitchen garden, roof garden for nutrition supplementation. It nutshell, NSV could be considered a "minilab" for showcasing precise nutritional security through using available resources by proper motivation, nutritional literacy & attitudinal change.



Promoting strategies for nutrition literacy

Poshan Mala

Protein Power of Pulses

Iron & Calcium Rich Vegetable Garland

Alsi (Flax) Mahua Poshan Mala

Poshan Thali

Food is basis for good health. Our health is basically depend on what we eat, and how much we eat. Poshan thali is source of healthy diet in contains all colours of food. It is a source of balanced diet, full of fruits, vegetables, whole grain and supply protein for healthy diet.

Exhibits

It provides platform for discussion on new techniques and methods to promote nutrition literacy and can be a medium to demonstrate nutri rich products. Exhibits can advance the multidisciplinary field of nutrition science through immersive education and networking experience.

Poster/Banner

Posters on nutrition literacy not only catches the attention of people but also brings awareness about the importance of balanced diet with full of nutrition for healthy life. Poster/banner should be prepared on local language helpful in disseminating nutrition literacy.

Radio talks

Radio talks are most effective in dissemination of information on nutrition and nutrition sensitive agriculture. Interactive radio programme and talk show promote nutrition-related messages through live interviews with influential community members, health workers and representatives from agriculture sector. Local people can show their experiences and success with the other peoples. and audience can engage their self with the stories. Radio programmes in local language will communicate nutrition related messages to more number of people.

A number of videos related to nutrition, Scientists-Farmers' interface; Nutrition awareness and promotion of nutri-rich varieties, traditional crops with biofortified fruits and vegetables cultivation Fodder crop cultivation, kitchen gardens, e-agri-nutri centres, Agri-Nutri videos, Nutri Forum: discussion forums, training on food processing/ value addition, products/food fortification and follow up on preparation of low cost nutritious foods for self and commercial purpose , Education on nutrition sensitive agriculture, campaigns, Exposure visit of farmers and farm women to Nutri-SMART villages will promote nutrition literacy among rural people and educate them to reach sufficient, diverse, nutritious and safe food for healthy life.

Conclusion

In view of the sluggish nutritional performance, it demands reshaping and reconnecting the modern agriculture and food systems to nutrition-sensitive programs and policies. Agricultural advances are mainly measured in terms of how successfully they narrow the gap between current and potential production yields. Achieving success in nutritional security as well as food security also requires narrowing the "nutrition gap". Narrowing this gap first requires increasing availability and access to the foods necessary for a healthy diet and ensuring that intake of those foods increases by enhancing nutrition literacy. As we know that agriculture has great potential to alleviate poverty and improve the food and nutrition situation in vulnerable rural communities. Moreover, it is the nutritional security which can guarantee the quality and diversity of food necessary for good health and higher nutritional status.

References

Anonymous. 2018. http//:www.pib.gov.in

IIPS and ICF. 2012. National Family Health Survey, 2015-16-India, Mumbai:IIPS. http://rchiips.org/NFHS/NFHS-4repaorts/India.pdf.

Nagarajan S., Bhavani R.V. and Swaminathan M.S., 2014. Operationalizing the concept of farming system for nutrition through the promotion of nutrition-sensitive agriculture. *Current Science* 107(6): 959-964.

Sangeetha V., Singh, Premlata, Satyapriya, Lenin, V. Paul, Sudipta, Barua, Sukanya Murlikrishnan, L. and Sitaram. 2018. An Agri-Nutri (A2N) Smart Village Model for Food and Nutrition Security. Division of Agricultural Extension, ICAR-Indian Agricultural Research Institute, New Delhi-110012.

Promoting Nutritional Literacy Among Farm Women to Tackle Malnutrition

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Introduction

India has achieved record food production in grains, milk and animal produce yet India has the highest number of hungry people in the world i.e 194.6 million which accounts for 15 percent of India's total population during 2014-16. Forty six percent of the children population are facing the problem of malnutrition. Different determinants that affect nutritional status include food availability at household level, access to food within households, equity, access to health services, education level, access to safe drinking water, environmental sanitation and hygiene and cultural beliefs and practices. The access to food is unevenly distributed and public policies still focus on quantity (energy supply) while investments in improving nutrition security such as improving the quality of diets and access to sanitation are lagging behind. Girls and women face multiple deprivation because of gender discrimination and under nutrition in India.

Improving the access to good nutrition requires effective large scale nutrition sensitive programmes that focus on underlying determinants of nutrition and enhances the coverage and effectiveness of nutrition based interventions. Such intervention programmes should support adequate nutrition in early age itself. With the collaboration of different agencies working at district level for the upliftment of women and children can achieve the success in creating awareness among women for improved nutrition in the family with the easily available nutritional resources. Krishi Vigyan Kendras are working at district level with the farmers to improve all around development of agriculture and their health of the family. Subject Matter Specialists are working towards the improvement of nutritional status by motivating individuals to eat healthy and adequate diet. ICAR-CIWA Bhubaneswar and ICAR-ATARI, Zone-I undertook a collaborative project "Empowerment of farm women for improved quality of life". Project was sanctioned for a period of two years 2015 -2017. ICAR-ATARI, Zone-1 implemented this project with the assistance of Krishi Vigyan Kendra Patiala during June 2015.

Objectives

- Assessment of nutritional status of farm families.
- Suggestive interventions for the management of malnutrition among farm women.
- Need based technologies empowerment of farm women for nutritional security of family.

Methodology

Selection of KVK:

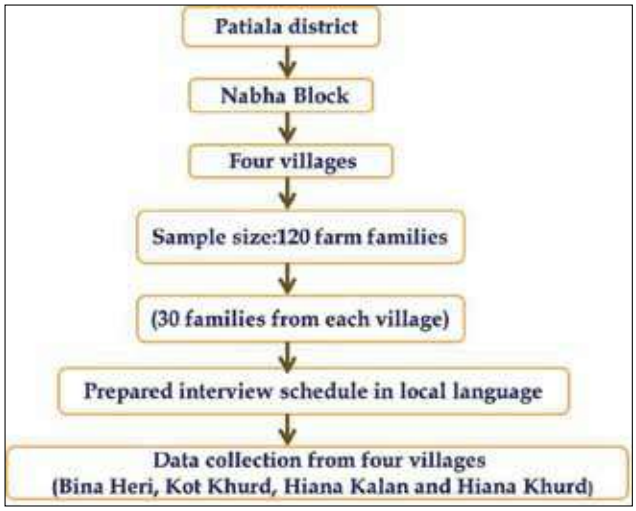
- For implementation of the project the collaboration of Krishi Vigyan Kendra Patiala from PAU, Punjab and ICAR-ATARI, Zone-I was taken during 2015-16 as district Patiala was selected for the study.

Selection of Block

- Patiala district consists of 8 blocks and Nabha block which is about 30 Km far away from Patiala city was selected for the study under the project.

Selection of Village and Families:

- From the selected Nabha block, a cluster of 4 villages namely (Bina Heri, Kot Khurd, Hiana Kalan and HianaKhurd) was selected for data collection from the farm families. For conducting survey, 30 farm families were randomly selected from each village. A total of 120 farm families were selected for data collection during November 2015 to April 2016.



Nutritional status assessment of farm families:

Anthropometric assessment including measurement of height and weight were measured to know their physical health of the families selected for the study under the project. Then the body mass index was obtained to know the overall health of the family members. The dietary assessment related to meals intake of each family member was recorded by 24 hour recall method for one whole day. After the data collection and statistical analysis the demand driven capacity building programmes were organized for the families of four villages selected for the study to improve the nutritional status and diet diversity of the family members.

Results and discussion

For the implementation of the project 120 farm families from four villages of Nabha block in Patiala district were selected for the study and the data was collected with the help of structured interview schedule. The following data was collected and tabulated.

Table 1: Social characteristics of selected farm women

Age Group	Marital Status			Educational Level				
	Married	Widow	Divorced	Uneducated	Primary	Middle	Matric	+2
18-25 Years	18 (15.92)	0 (0.00%)	0 (0.00%)	3 (5.45%)	3 (10.71%)	6 (40.00%)	4 (22.22%)	2 (50.00%)
26-33 Years	47 (41.59%)	1 (14.28%)	0 (0.00%)	20 (36.36%)	11 (39.28%)	5 (33.33%)	10 (55.56%)	2 (50.00%)
34-41 Years	40 (35.39%)	5 (71.43%)	0 (0.00%)	30 (54.55%)	10 (35.72%)	1 (6.67%)	4 (22.22%)	0 (0.00%)
42-50 Years	8 (7.07%)	1 (14.29%)	0 (0.00%)	2 (3.64%)	4 (14.29%)	3 (20.00%)	0 (0.00%)	0 (0.00%)
Total	**113**	**7**	**0**	**55**	**28**	**15**	**18**	**4**

It was found that majority (41.59 per cent) of selected respondents were married in the age group of 26-33 years, whereas only 7.07 per cent women were married at the age of 42-50 years of age group. It was concluded that 54.55 respondents under the age group of 34-41 years were uneducated and only 3.33 per cent of women were educated up to +2. There is an urgent need for promotion of education among girls for improving the overall health and education of children among rural families.

Shelter, water & sanitation security

S. No.	Shelter , water & sanitation security			
1	Annual Income	36000-49000 (16.66%)	50000-99000 (62.5%)	100000-150000 (20.83%)
2	Housing condition	mixed (Kuccha and Pucca)	Pucca	Pucca
3	Access to Electricity	Yes	Yes	Yes
4	Water	Yes	Yes	Yes

Health Security indicators

S. No	Particulars	Disease	Frequency
1	Illness	83% family suffered from malaria, Typhoid, dengue, jaundice	Once in year
2	Illness	incidence of diarrhea in 90% families	Twice in year
3	Illness	43% of family suffered from high BP, Sugar, etc	

Nutritional Status Assessment of farm family

Table 2: Body Mass Index of the farm families

Category	Normal	Over weight	Obese	Under Weight
Male/Female	Respondents (%)		Respondents (%)	
12 to 18 years Girls (81)	33 (40.00%)	3 (3.75%)	-	45 (56.25%)
12 to 18 years Boys (132)	65 (49.24%)	14 (10.60%)	-	53 (40.15%)
Female (120)	67 (55.83%)	18 (12.50%)	5(4.16%)	30 (25.00%)
Male (113)	88 (77.87%)	25 (22.12%)	-	-

Table 3. Key health indicators for India and Patiala

State	Adults (15 – 49 years)					
	BMI below normal		Overweight or Obese		Anaemic	
	Women	Men	Women	Men	Women	Men
India	22.9	20.2	20.7	18.6	53.0	22.7
Patiala	9.6	5.0	35.5	40.6	40.9	17.6

Source: NFHS-4

The average body mass index (BMI) for the normal Indian men and women is 22.9 kg/m^2.The data in table no. 2 revealed that 77.87 percent men and 55.83 percent women fall under the normal body mass index. Further 22.12 per cent males and 12.50 per cent females were overweight; whereas only 4.16 per cent females were obese. Fifty six per cent young girls and 40 .15 per cent boys between the ages of 12 to 18 years were under weight. The data depicts that there is need for immediate attention for improving the nutritional status for young boys and girls. The programmes based on nutrition awareness and education has to be disseminated with the help of mass media so that the large individuals can take the remedial action for the problems faced by them due to malnutrition. The focus should be given on infants and young children as they are future generations to run the country. The data from National Family Health Survey depicts that in district Patiala health indicators in rural areas are far better in rate of Body Mass Index and prevalence of Anaemia in Women and Men statistics but as far as obesity is concerned district Patiala is suffering from obesity problem.

Diet Pattern

Diet Pattern	Summer	Winter
Breakfast	2 Parathies (80 gms) + Curd (25 gms) + Tea	2 Parathies (80 gms) + Tea
Lunch	2 Chapties (50 gms) + Curd (25 gms) or Lassi + Seasonal Vegetables(30g) + Salad	2 Chapties (50 gms) + Curd (25 gms)+ Seasonal Vegetables + Salad
Evening	1 Cup Tea	1 Cup Tea
Dinner	2 Chapaties (50gms)+ Dal (25g)	2 Chapaties (50gms)+ Dal (25g)

Table 4. Livelihood assessment of farm family Indicators

S. No.	Nutritional Security	
1	BMI	23.01 BMI in women
2	Exclusive breast feeding for 6 months	62% of farm women
3	Weaning Practices	Suji kheer, Daliya, Khichdi
4	Iodized salt	90% of farm women.

Skill development programmes

A total of five skill development programmes were organized in the selected four villages of Nabha block under this project by KVK Patiala depicted in table 5. During these skill development programmes method demonstrations were organized for the farm women and school girls so that they get motivated as they see the process of making the healthy and nutritious recipes with locally available material. A total of 25 method demonstrations were conducted for the farm women in four different villages to improve their skill and bringing the diet diversity for the family members. Three off campus and two on campus skill development programmes were organized for benefit of 240 stakeholders during the implementation of the project.

One self help group was created to provide the healthy snacks and income generation for the women engaged in the activity. The farm women were motivated to improve the diets of their families as they were trained with ingredients already available in their household.

Harmonisation of efforts is required among all the stakeholders with regard to their understanding of the main cause of malnutrition and various useable options for addressing it.The empowering of women in nutrition education is vital as she provides the nutrition to the family. Proper implementation of nutrition programmes requires sustained efforts, capacity and commitment to make intervention programmes effective that will lead to eradication of malnutrition.

Nutrition is a double edged sword – both under and over nutrition being harmful…. …. Optimum nutrition combined with regular physical activity is the cornerstone of good health!!

Table 5. Capacity building programmes organized under the project

S. No.	Particulars	Venue	No. of farm women
1	**Household food security through kitchen gardening and preparation of low cost nutritious snacks.** • Preparation of coconut balls • Preparation of suji kheer • Preparation of besan barfi • Preparation of fruit chat • Preparation of poshtik poha • Preparation of ghia ladoo	Kot Khurd (6)	30
2	**"Mushroom cultivation and preparation of high nutrient efficient diet"** • Preparation of soyabean cutlets • Preparation of mushroom biryani • Preparation of mushroom delight • Preparation of soya and mushroom manchurian	Binaheri (4)	30
3	**Skill Development in preparation of nutritious recipes for adolescent girls** • Preparation of soyabean bhujia and kabab • Preparation of vegetable briyani • Preparation of soya cutlets and samosa • Preparation of soya and mushroom manchurian	KVK Patiala (4)	60
4	**Establishment of kitchen garden at home scale and value addition of seasonal fruits and vegetables** • Preparation of coconut balls • Preparation of semolina kheer • Preparation of besan barfi • Preparation of fruit delight • Preparation of poshtik poha • Preparation of mix vegetable kofta	Village Kot Khurd (6)	60
5	**Preparation of nutritious recipes from green leafy vegetables and other seasonal vegetables and their value addition** • Preparation of soya palak balls • Preparation of vegetable bullets using seasonal vegetables • Preparation of guava snack • Preparation of mixed vegetable pickle • Preparation of mixed fruit jam	KVK Patiala (5)	60
	Total		**240**

Technological empowerment under the project

After the data collection from the 120 respondents from four villages of Nabha Block of Patiala district KVK Patiala organised extension programmes along with the extension personnel both on campus and off campus so that a large number of women could be covered under this programme and sensitized about balanced diet and diet diversity through participation in these programmes. For encouraging the women radio programme was also aired so that women could understand the need of good nutrition in far areas. A radio goshti was also organized and this goshti was broadcasted in the programme, *"Krishi Vaani"* by All India Radio, Patiala. A total of 565 young and middle age women participated in seven extension programmes organized under this project which ran for a period of two years (2015-2017).

Awareness programmes conducted for farm women for achieving Nutritional Security

S. N.	Topic/Activity	Date	Venue	No. of Participants
1.	International day for women in Agriculture	4.12.2015	Binaheri	70
2.	Beti Bachao Beti Padhao campaign in collaboration with Deptt. of Social Security, Women & Child Development	12.1.2016	Binaheri	250
3.	Focused group discussion	28.3.2016	Binaheri	40
4.	Focused group discussion	21.7.2016	KotKhurd	35
5.	Workshop on breast feeding	08.08 2016	KVK Patiala	60
6.	National nutrition week	1-7.09. 2016	Binaheri & Kotkhurd	60
7.	Radio ghosti	08.03.2017	KVK Patiala	50
	Total			**565**

Extension programmes organized for the women

S. No.	Topic/Activity	Date	Venue	No. of Participants
1.	Beti bachao beti padhao campaign in collaboration with Deptt. of Social Security, Women & Child Development	12.1.2016	Binaheri	250
2.	Discussion on layout of nutrition garden	28.3.2016	Binaheri	40
3.	Discussion about uses of mushroom in human diet	21.7.2016	Kot Khurd	35
4.	Radio ghosthi	08.03.2017	KVK Patiala	50
	Total			**375**

Conclusion

The health assessment of farm women revealed that 65% of these women faced problems like anaemia, back-pain, headache and body weakness. Total sixteen training programmes on improving nutrition in four villages were organized for farm women. One self help group was created to provide the healthy snacks and income generation. For encouraging the women radio programme was also aired so that women could understand the need of good nutrition in far areas. Radio goshti was also organized and this goshti was broadcasted in the programme, "Krishi Vaani" by All India Radio, Patiala.

Reference

Data on different nutrition indicators are generated through National Family Health Surveys (NFHS). So far, four rounds of surveys have been conducted, i.e., NFHS-1 (1992-93), NFHS-2 (1998-99), NFHS-3 (2005-06) and NFHS-4 (2015-16).http://rchiips.org/nfhs/pdf/NFHS4/India.pdf

Poor Sanitation the Missing Link Between Agricultural Production, Nutrition & Health

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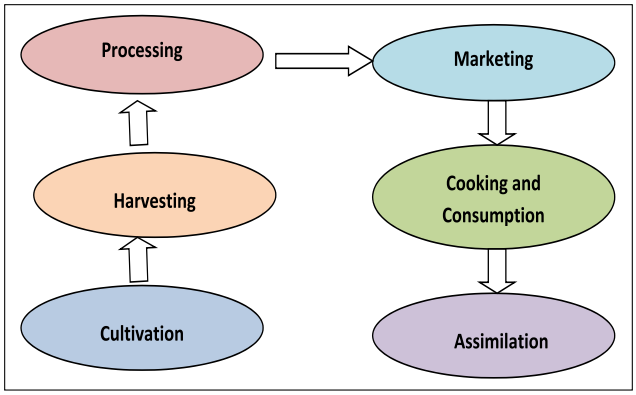
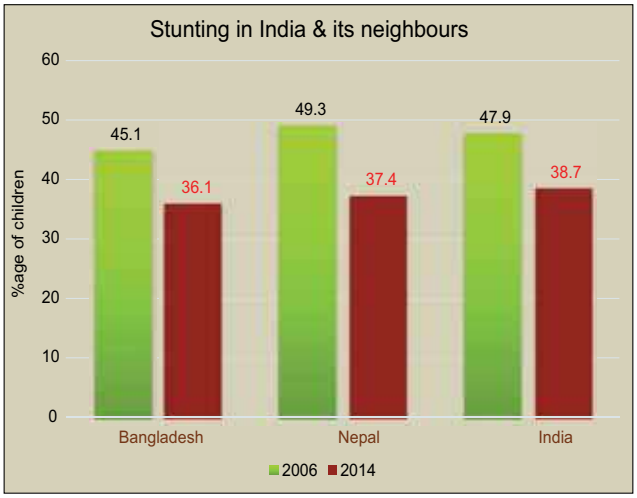
"Close to 50% of malnutrition around the world is caused not by lack of food or poor diets, but due to poor water, poor sanitation facilities and unhygienic practices" UNICEF, 2017.

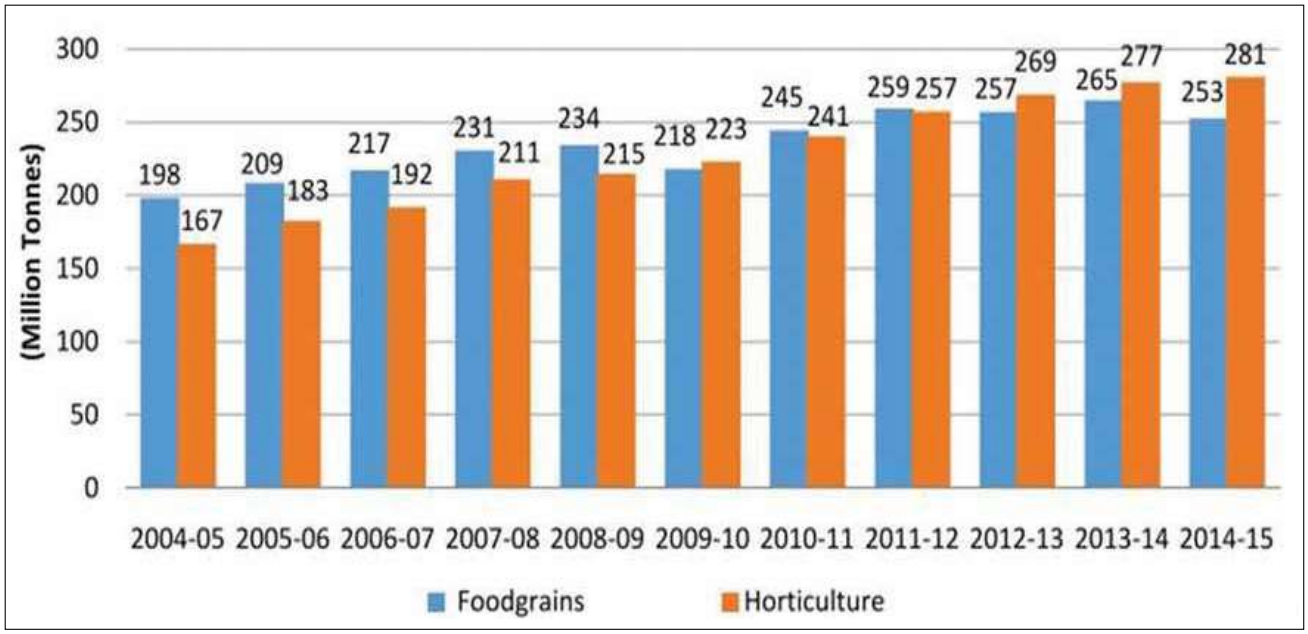
India has achieved greatly in terms of food grain production and enhancing nutrition quality. More children in India are stunted w.r.t. her neighbours around 30% children are underweight

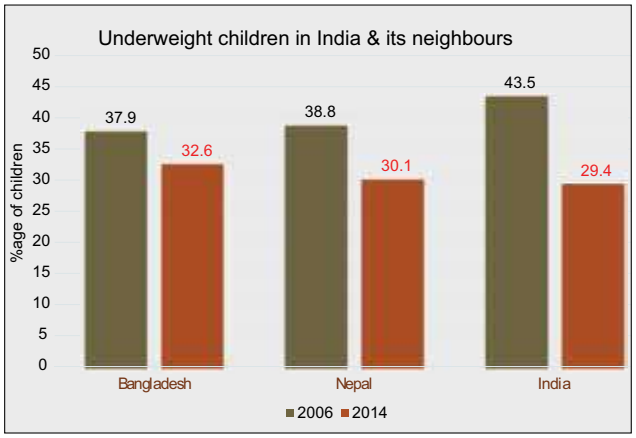
The missing link





India's agriculture vs. stunting in children





India's agriculture vs. stunting in children

Source: UNICEF, 2017

Compartmental management of our rural areas

Absence of convergence

Ministry of Agriculture

- Making seeds & other inputs to farmer
- Tracing harvesting
- Collection of produce
- Processing of seeds
- Domestic/Int'l marketing

Ministry of Rural Development

- Sanitation
- Irrigation & Water supply
- Rural roads
- Rural housing

Revenue Department

- Land registration
- Ownership record
- Permission for development
- Designation of Abadi/ Nistari areas
- Land dispute resolution

Ministry of Health

- Mother & child health development
- Supplying food additives
- Infusion of nutrients in food
- Providing health infrastructure

Nutrition: a focal point for convergence of SDGs

More sustainable diets could make a significant difference to climate change, biodiversity and our waters. Food production uses 70% of the world's freshwater supply, agriculture emits 20% of all greenhouse gas. Livestock uses 70% of agricultural land. Undernutrition leads to 45% of all under-5 deaths. Improved nutrition reduces sickness and lowers death rates, and so reduces the burden on health systems.

Nutrition

Investing in food security and the fair distribution of natural resources is critical for both nutrition resilience and reduced fragility. Improved nutrition supports 'grey matter infrastructure': healthy people with the knowledge, ability and energy to drive economic development and build the future. Good nutrition gives people more labour and mental capacity, offering a $16 return for every $1 invested.

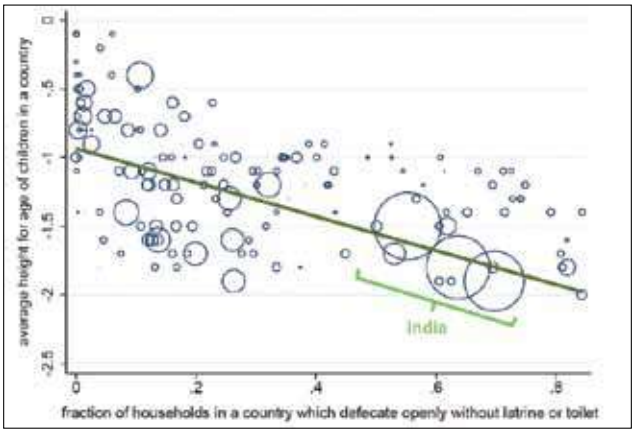
Well-nourished children are 33% more likely to escape poverty, and each added centimetre of adult height correlates to an almost 5% increase in wage rates. Improved nutrition means better outcomes in education, employment and female empowerment, as well as reduced poverty and inequality.(World Nutrition Report, 2017)

Link between SDG 6 and Nutrition

SD6 ensure availability and sustainable management of water & sanitation for all.

- **TARGET 6.2 :** By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.
- **Indicator 6.2.1 :** Proportion of population using safely managed sanitation services, including a hand washing facility with soap and water.

Open defecation explains cross- country differences in child height



Source: Bhutta ZA, Ahmed T, Black RE, et al. Maternal and child undernutrition 3: What works? Interventions for maternal and child undernutrition and survival. Lancet 2008; 371: 417–40.

Open defecation explains that there is 54% of international variation in child height and GDP only explains 29 % variation.

Stunting & Wash

Stunting is not a nutrition issue, it is a development issue. There is plenty of evidence available on impact of WASH interventions on stunting.


Viewpoint

Child undernutrition, tropical enteropathy, toilets, and handwashing

Explaining the link between SDG 6 and Nutrition Continued

Nutrition

- Assimilation of nutrients in human body through healthy gut.
- 50% of malnutrition is caused by poor sanitation facilities & unhygienic practices.

SDG 6

- Adequate nutrition makes sure there is enough 'grey-matter infrastructure' to sustain development of physical infrastructure.
- Healthy people with knowledge
- Ability and energy to drive economic growth.

Sanitation is important because chronic undernutrition typically occurs in early childhood. Stunting remains one of the world's most serious problems. Unsafe water, inadequate sanitation and poor hygiene can lead to chronic undernutrition (UNICEF, 2009) by suppressing appetite, impairing absorption of nutrients, increasing nutrient losses, and by diverting nutrients away from growth to fight off infections (Dewey and Mayers, 2011).

A high percentage of children in the developing world still live in environments exposed to high levels of faecal matter and about 44% of the population in developing countries does not have access to improved sanitation facilities and typically 83% of the population in the developing world does not wash their hands with soap after using the toilet (Curtis *et al.* 2009).

Environmental Enteropathy

In healthy intestines, food is absorbed through the villous lining. Prolonged exposure to many fecal pathogens calls in a large response of the immune system in flattens villous and makes it harder for food to get in, easier for disease. (Korpe & Petri, 2012)

RCT Preliminary Findings

1. Large and statistically significant effect on Height for Age z-scores (HAZ). Children in CLTS communities had a mean HAZ 0.17 standard deviations above children in the control group.
2. There was a 26% reduction in stunting and a small reduction in the number of underweight children.

In India 122 million children are below >5yrs. age out of them about 38% (46.36 million) are stunted, 15% (18.3 million) are under wasting category and 1,36,000 child death due to diarrhoea in 2012. High population density, lack of sanitation facilities, Open defecation stunts children due to loss of food & absorption in the gut.

Open defecation hampering nutrition absorption

Many enteric diseases damage the human gut. Open defecation engenders faecally-transmitted infections (FTIs) that damage gut. FTIs deplete absorption of nutrient in intestine & causes stunting. Around 40% of total Indian population defecates in the open, 56% of total rural population defecates in the open. Poor sanitation services & our age-old behaviour are also the problem. Because of these problems diet rich in nutrients fails to get assimilated in the body. We need to initiate collective local action to end open defecation.



When there was no upfront hardware subsidy but true empowerment was ensured; magnificent transformation began resulting in to splendid show of local innovation and the ability to change.



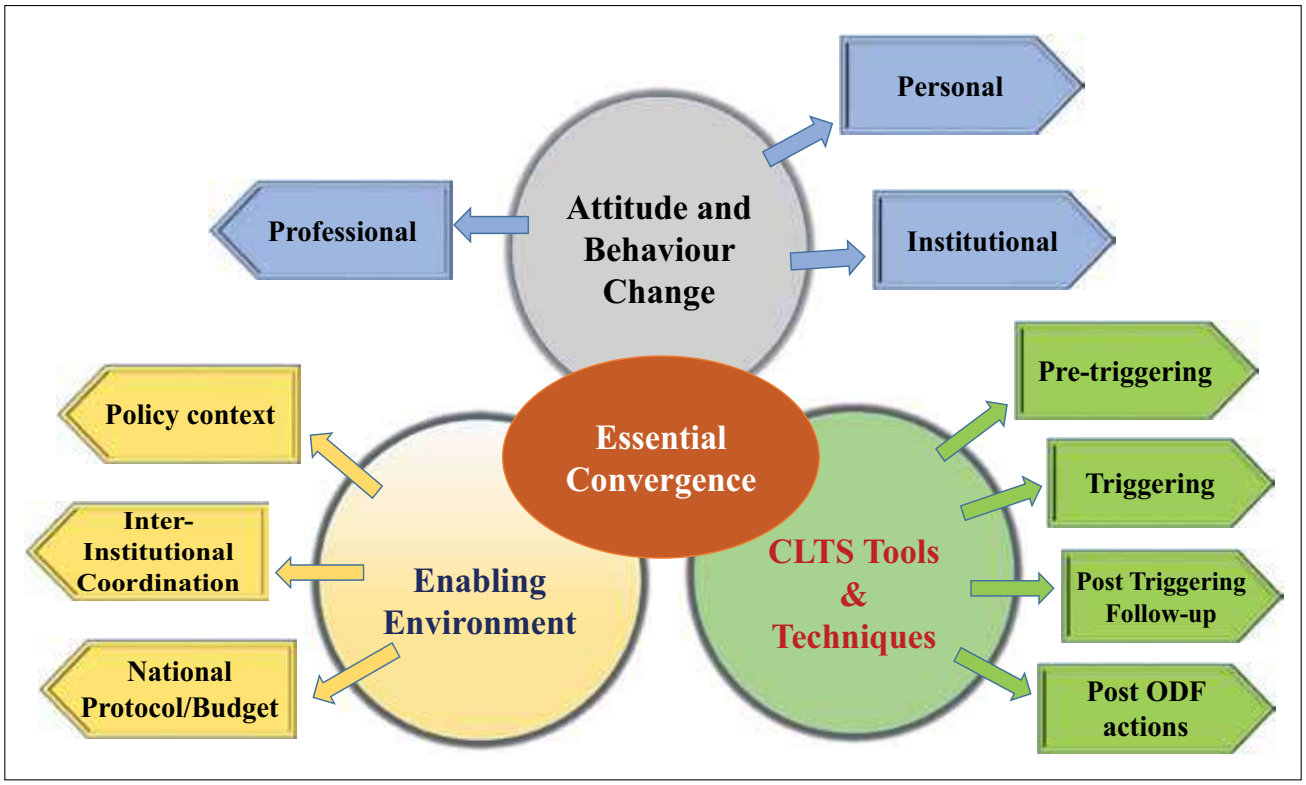
Skun Village, Cambodia

Use of ash after defecation in direct pit latrine is an innovation by the community of Skun villages of Tbeng Commune of Siem Reap province in Cambodia. One gets potash rich manure at the end.

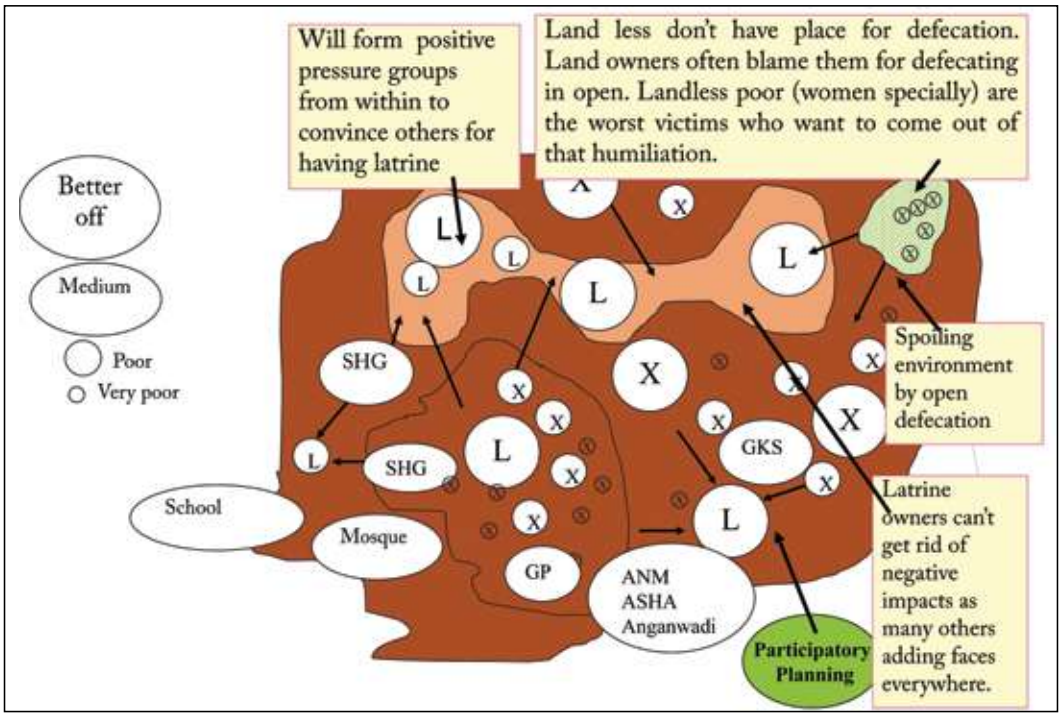
Community Innovated direct pit latrine- Skun village, Banteay Srei, Cambodia


Great mosaic of latrine models innovated local communities in Kampung spu in Cambodia

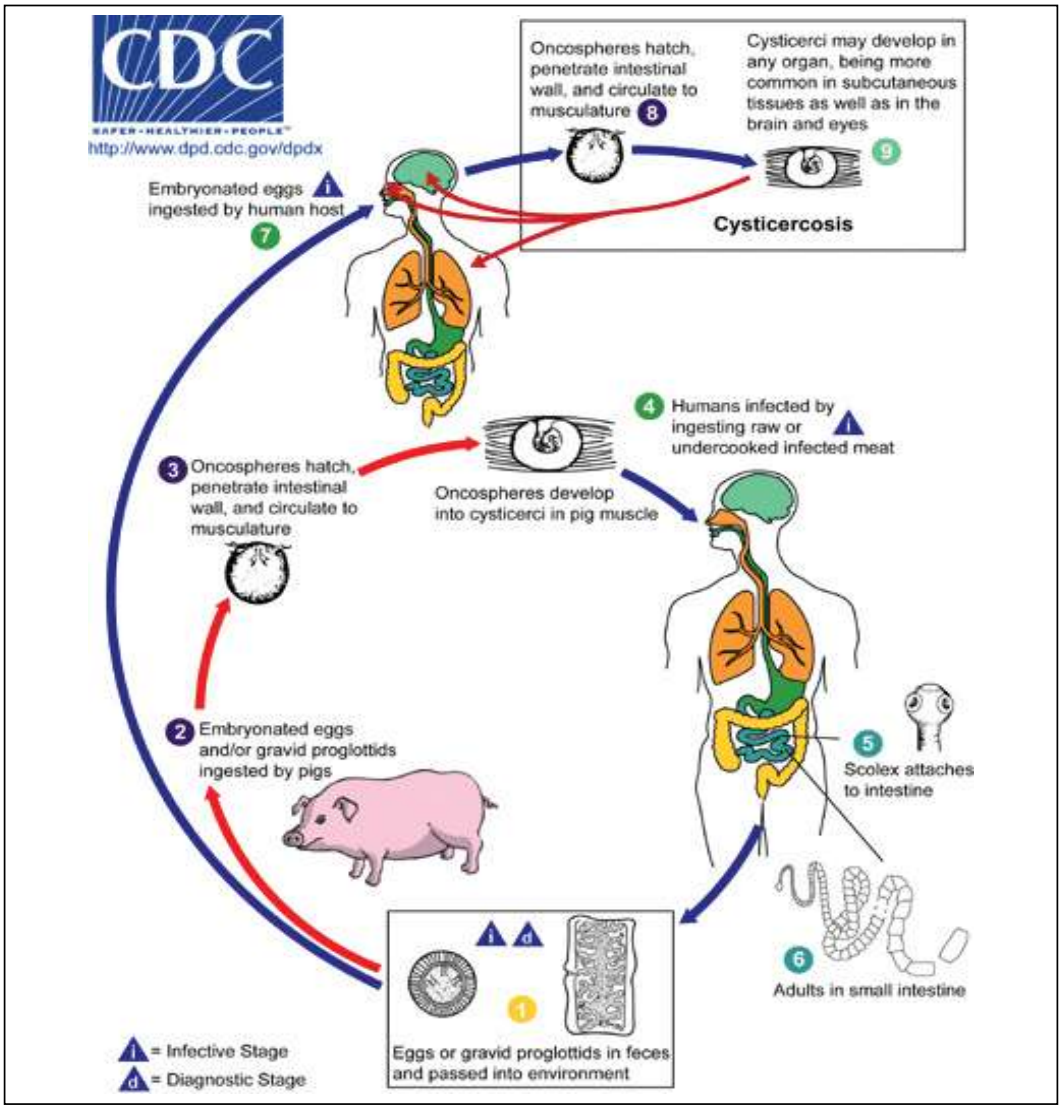
Dry pit latrine with retractable wooden lid-cover constructed within a few days of triggering in villages in Zuunkharaa Sum in Mongolia

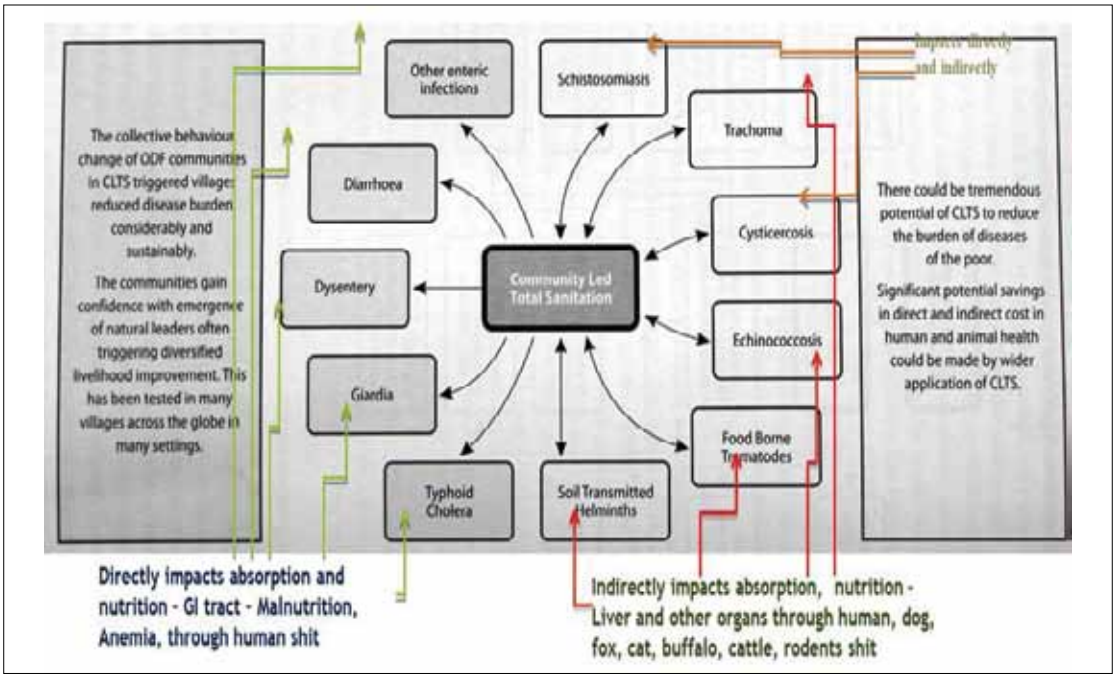


3 Pillars of CLTS

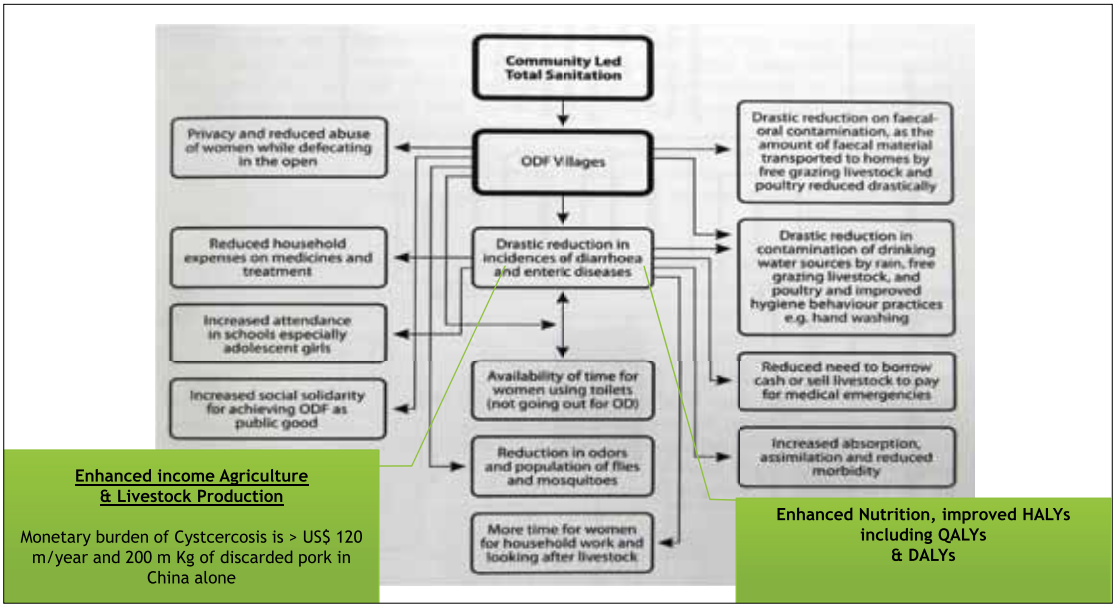


Moving towards 100% sanitized village





Potential positive impacts of CLTS on human health and possible impacts on Nutrition



Major economic, health & social impacts of CLTS

Health outcomes of CLTS: Mali

Health outcomes were analysed by comparing CLTS villages with other nearby villages. It was noticed that stunting was reduced by 13% in CLTS villages, 26% reduction in severe stunting , 15% reduction in number of underweight children, 35% reduction in severe underweight, decrease in frequency of diarrhoeal attacks and under 5 mortality reduced by 4.57%.

References

Curtis V. A., Danquah L.O. and Robert V. A. 2009. Planned, motivated and habitual hygiene behavior: an eleven country review. Health Education Research. 24(4). 655-673.

Dewey K.G. and Mayers D.R. 2011. Early Child Growth: how do nutrition and infection interact. Maternal Child Nutrition. 7(Suppl. 3). pp129-142.

https://www.unicef.org/publications/files/UNICEF_Annual_Report_2009_EN_061510.pdf

https://www.unicef.org/supply/files/Unicef_Annual_report_2017.pdf

Korpe P. S. and Petri W. A. 2012. Environmental Enteropathy: Critical implications of a poorly understood condition. Trends Mol Med. 18(6): 328-336.

Contribution of Women in Nutri Sensitive Agriculture

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Nutrition sensitive agriculture

Nutrition-sensitive agriculture can improve nutrition through a number of pathways, by treating agriculture as a source of food, as a source of income, as a source of poverty alleviation and as a driver of food prices. Agriculture has to empower women, contribute to macroeconomic growth, and ensure sustainable food and nutrition security and resilience. Nutrition-sensitive agricultural production can be implemented by (i) making food more available, affordable and accessible, (ii) by making food more diverse and production more sustainable, and by (iii) making food itself more nutritious.

Contribution of women in Nutri-Sensitive Agriculture

- 10 Crore-women who work in agriculture in India
- 79% of rural women contribute as agriculture labour
- 9% of them have own agriculture land

Entrepreneurship development among farm women is an important approach in gender mainstreaming in agriculture which helps not only in income generation but also empower them with appropriate agricultural technology and business skills. Agro-based enterprises offer a variety of options in crop selection and contribute to the nutritional security of farm households as many of them can be easily produced in the homesteads. Mushroom is one such crop which is ideally suited for farm women. Additionally, horticulture also has great potential in minimizing the degree of malnutrition as well as entrepreneurship development.

In the developed world, this work is usually done by machines. But in India, much of the labour is done by hand.

Paddy Transplanting

She has to put her fingers 1.2 lakh times into puddled field to transplant one acre of land.

Workers in indian agriculture

Worker as a source of power

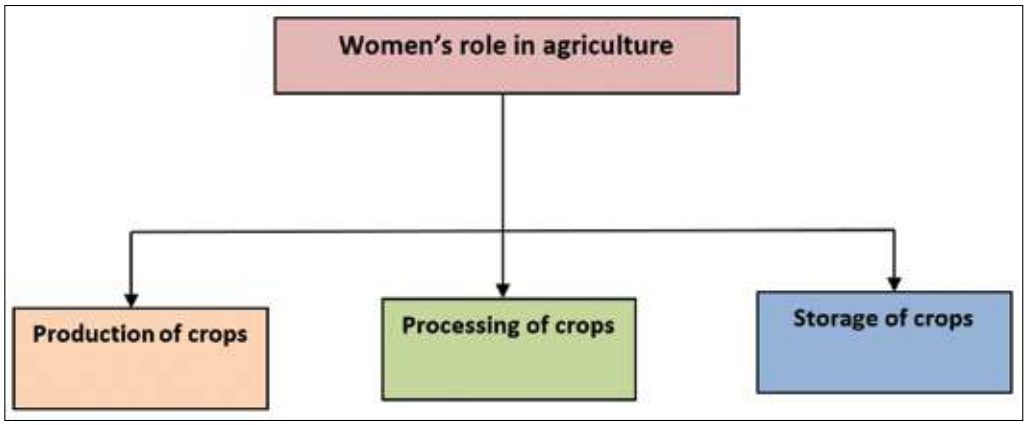
Worker as a machine operator

Upland cultivation

Wetland cultivation

Horticulture

Hill agriculture



Objectives

- To promote the spiritual, mental and social growth of farm women
- To promote women entrepreneurship skill development in agriculture production
- To upliftment of the status of farm women in the rural community
- To promote self-sufficiency in landless farm women through agriculture production

Women's role in agriculture

In general 60-70 per cent of labour input is provided by women which increases even up to 80 per cent in crops like paddy.

KVK's contribution

Krishi Vigyan Kendra is a grass root level village institute for transfer of technology conducting various programmes for socio-economic upliftment of farm women i.e. trainings, demonstrations etc.


Vegetable Cultivation


Drudgery


Vermicomposting


Flower Cultivation


Nursery Raising


Tailoring


Tie & Dye Training


Fruit Preservation


Value Addition

KVK, Zone- I

Trainings

Particulars	Type of training	No.	Participants
Vegetable cultivation	Short duration	5	123
Nursery raising	Short duration	3	76
Flower cultivation	Short duration	4	82
Mushroom cultivation	Short duration	2	58
	Vocational	3	116
Value addition to farm produce	Short duration	6	135
	Vocational	2	48

KVKs of zone -1 conducted trainings on vegetable cultivation, nursery raising, flower cultivation, mushroom cultivation and value addition to farm produce. Short duration and vocational trainings were provided to the pareticipaints.


Demonstration on tomato tieing


Demonstration on flower emasculation


Nursery raising in plug trays


Demonstration on casing application


Imparting Skills to farm women


Demonstration on mushroom cultivation

Table I. Personal characteristics of the respondents

Particulars	Respondents (%)
Age of the Respondents (Years)	
Less than 20	18%
Between 20 – 40	74%
More than 40	8%
Educational Level	
Illiterate	86%
Primary Level	6%
Middle Level	5%
Matric	3%
Secondary & Above	1%
Types of Land Holding	
Land	13%
Landless	87%
Types of training	
Vegetable growing	56
Vegetable nursery raising	25
Mushroom cultivation	19

Table II. Awareness and adoption of improved agricultural practices

Recommended Practice	Respondents (%)
Vegetable cultivation	
Nursery Tech.	88
Production Tech.	62
Harvesting (Picking)	59
Storage and Grading	63
Mushroom Cultivation	
Compost preparation	32
Spawning	18
Casing and harvesting	26
Value addition	
Preservation of fruits and vegetables	86
Agro-processing	90
Labelling and packaging	18

Table III. Impact assessment of agriculture enterprise on the socio-economic condition of rural women

S.N.	Impact	Respondents (%)
1.	Improvement in occupation	72
2.	Improvement in standard of living	64
3.	Better saving	60
4.	Improvement in knowledge and attitude	52
5.	Better food, clothing and shelter	52
6.	Creation of employment	32
7.	Improvement of social status	24

Table IV. Constraints perceived by rural women in adopting mushroom technology

S. No.	Constraints	Respondents (%)
1.	Value added items	64
2.	Non-availability of quality spawn	64
3.	Lack of storage and preservation	60
4.	Exploitation by middle man	44
5.	Fluctuation in marketing rates	36
6.	Bargaining price	32

Table V. Constraints perceived by rural women in adopting vegetable production technology

S. No.	Constraints	Respondents (%)
1.	Time Constraints Problems	11
2.	Capital Problem	88
3.	Marketing problems	77
4.	Credit Availability	77.5
5.	Distance from Market	33.75
6.	Water Deficiency	68

Household Food Security through Kitchen Garden: A Practically Workable Step by Krishi vigyan Kendra, Patiala

Nutri-smart village through frontline demonstration on nutrition Garden

Conclusion

Empowering women can be an economic game changer for any country. For instance, if women were to participate in the labour force to the same extent as men, national income could increase by 27 per cent in India.

Sustaining Nutrition Literacy through Capacity Building

Alpana Sharma and Alka Singh
Krishi Vigyan Kendra , Shahdol & Sidhi
E-mail : alpanasanu@rediffmail.com

Why women grow weak?

Traditional nutritional knowledge is embedded in the women in rural household and society yet she continues to be malnourished. Womens burn more energy as compared to men. Behind the curtain a woman in the house cooks & cares for the family, look after the cattle and farming activities. She is meant for only to serve, not served. She cooks and serves (first) and eats(if left) in the last. Mother and girls often sleep half or empty stomach.

Strong woman strong family

Woman nucleus in the family with children, husband and society orbits around her. Identification of her strength and making her realize it is the key to change. Family members motivate & mobilize her for revolution and women & womb ; nurture & nutrition.

Capacity building approach of the KVK has been driven by two overarching goals:

- The need to build the awareness of local communities about health and nutrition and thereby help contribute to enhancing their adaptive capacity.
- The need to sensitize local policymakers, practitioners and community and institutional leaders about nutrition and its role.

Action Areas of Capacity building

- Household Food Security and Livelihood
- Women and Child Care and Feeding Practices
- Health and Nutrition
- Water, Environmental Sanitation and Hygiene

Broad Areas of Capacity building

Household Food Security

At household food security level promotion of nutritious food and recipes for low cost and accessible food. Promoting backyard vegetable farming for round the year availability, promotion of drudgery reducing implements & tools to save time and energy burnt, preparation of millet products, soy fortified flour, multi grain flour for nutrient rich food and food processing, preservation and value addition to ensure its off season availability

Livelihood

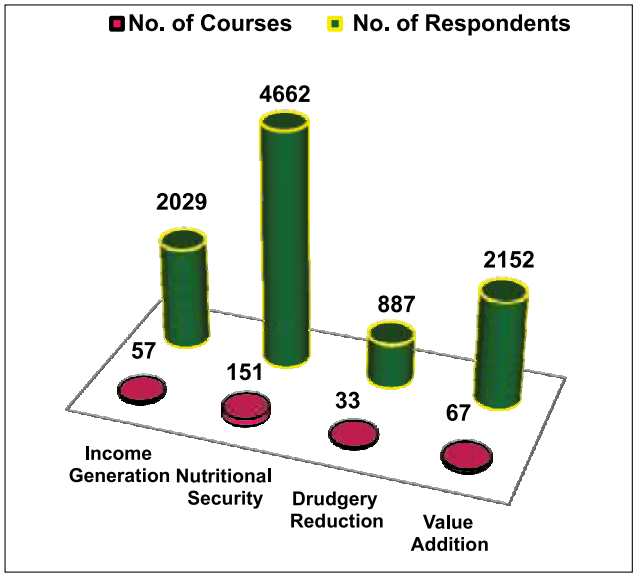
For livelihhod promoted tailoring, embroidery, poultry, goatry to generate additional income.

Women, Child Care, Sanitation and Hygiene

- Celebration of special days/ Weeks / *Pakhwadas* for general awareness and connectivity with target groups
- SMS Service for weekly alert on nutritional follow up

Training Programmes in MP

Category	No. of Courses	Duration (Days)	Participant
Farm Women	110	220	5280
Rural Youth	72	292	1680
Inservice	82	160	1882
Vocational	44	310	888
Total	308	982	9730



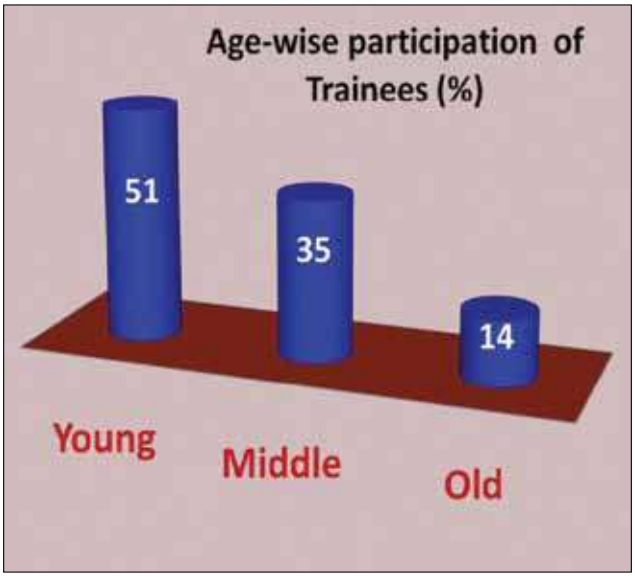


Table 1. Women centred activities in Madhya Pradesh

S. No.	Events	No. of	
		Villages	Participants
1.	Workshops	51	3468
2.	Trg on Preservation of fruits & Veg	38	2152
3.	Trg on income generation	65	2029
4.	Lalima diwas	38	2090
5.	Swacch Bharat Abhiyan	304	8218
6.	World Food Day	27	1252
7.	Mahila Kisan Diwas	38	2570
8.	Parthenium eradication day	84	2680
9.	World Women's Day	38	3350
10.	Exhibitions	154	42520

Effective Supervision of Integrated Management of Acute Malnutrition

Tarun Vij
India Country Director
E-mail : tvij@gainhealth.org

POSHAN: '**P**ositive and **O**ptimum care of children through a **S**ocial **H**ousehold **A**pproach for **N**utrition', is a project implementing Community-based Management of Acute Malnutrition (CMAM), in Rajasthan. It is led by the National Health Mission (NHM), Government of Rajasthan. POSHAN implementation is based on the principle of 'DOTS' (directly observed treatment, short-course), which became the hallmark of the success of Tuberculosis control strategy recommended by the World Health Organization. POSHAN is supported and co-funded by development partners: GAIN, ACF and UNICEF and follows global guidelines and protocols for implementation.

Rajasthan's Challenge

Total population : 68.5 million (2011)

- Total under 5 population (2011) -7.3 million
- Under 5 mortality rate-57 (SRS,2013)
- Prevalence of 6-59 months children with SAM-2.9% (RSOC 2013-14)
- Coverage of ICDS – Beneficiaries who availed supplementary food under ICDS (RSOC,2014)
  - Children 6-35 months : 33.7 %
  - Children 36-71 months : 22 %

Poshan: Intervention Districts

Phase 1	Phase II
13 Districts	Districts
41 Blocks	50 Blocks
584 Health sub-centres	750 Health sub-centres
1,574 Villages	3,000 Villages
3000 health workers	8500 health workers

Phase 1 Results

POSHAN Phase 1 Results: December 2015 to June 2016

- Total Children Enrolled : 9,640
- Discharged on Recovery : 9,127
- Defaulted* : 237
- Not-recovered** : 245
- Deaths : 41

*Defaulter (absent for 2 consecutive visits): Moved out from the programme on account of migration or parental unwillingness.

**Non-recovered: Did not reach the discharge criteria at the end of the project phase.

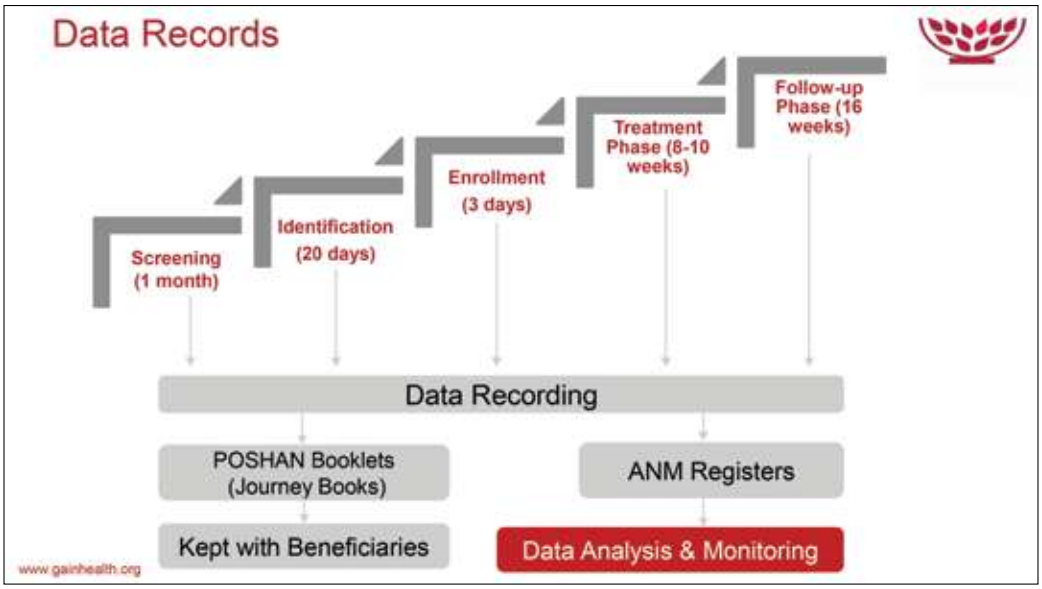
I am back to good health …

Rohit Singh *(name changed)* on enrolment day:

- MUAC : 9 cm
- Weight : 2.7 kg
- Height : 67 cm

Rohit Singh *(name changed)* on discharge:

- MUAC : 12.6cm
- Weight : 7.16 kg
- Height : 68 cm



Poshan Booklets

Phase 1 Monitoring and Coordination

ANM Registers

Weekly entries

- Child's personal details
- Screening & Enrollment records
- EDNS inventory at sub-centers
- Weekly monitoring and monthly follow-up records
- In-treatment referrals

Data entry into Excel sheet

- Data operators at block level
- Excel based
- Data downloaded in Excel formats
- Reports and analysis in excel
- Process and program data analyzed at State level

Challenges in monitoring Phase 1

Data Entry Errors: ANM registers and excel data sheets

- Mismatch at the time of uploading ANM register data
- Date discrepancies
- Duplicate entries in ANM registers
- Mismatched names
- Data not corresponding to WHO growth standards

Errors in aggregate MIS reports

- Duplicate names
- Lack of an aggregate dashboard for analysis by supervisors at district or state levels
- No notifications/alerts to prevent wrong data entry
- No feedback to project teams for course correction
- Multiple data rectification efforts

Recommendations from Phase 1

A. To get clean data from the field

- Improving quality of trainings of front-line workers for correct data recording

- Using technology for uploading data to minimize errors

B. To get a robust, multi-input adaptable software

- Inputs from project partners; front-line workers and technical consultants
- Testing multiple data input mechanisms to minimize human interface

Poshan Phase 2

POSHAN Phase 2 : June to December 2018

- Total Children to be screened: 3,40,000
- Children to be enrolled : 16,500
- Data of all children referred to MTC, health facility and Anganwadi's, throughout the course of the project to be captured

Mechanisms tested & challenges

A. Directly from ANMs

- **Smart weighing machines:** instrument reliability, time
- **IVRS:** mobile connectivity challenges and no provision for data rectification
- **Call center:** Expensive, sound quality & dialect recognition errors
- **Mobile App entry:** lack of smart phones that were software friendly

B. Via E-Mitra Centers:

- **Web-based entry:** connectivity challenges since data entry is online
- **Excel-based entry**: lack of capacity of E-Mitras
- **Scanning of records & Email:** large scan sizes

Data entry mechanism selected by NHM Rajasthan

ANM Registers

Photographs/Scans

ANM : WhatsApp/ E-mail to block representatives

Quality check : Block & district representative

Data Entry

Centrally by Technology partners

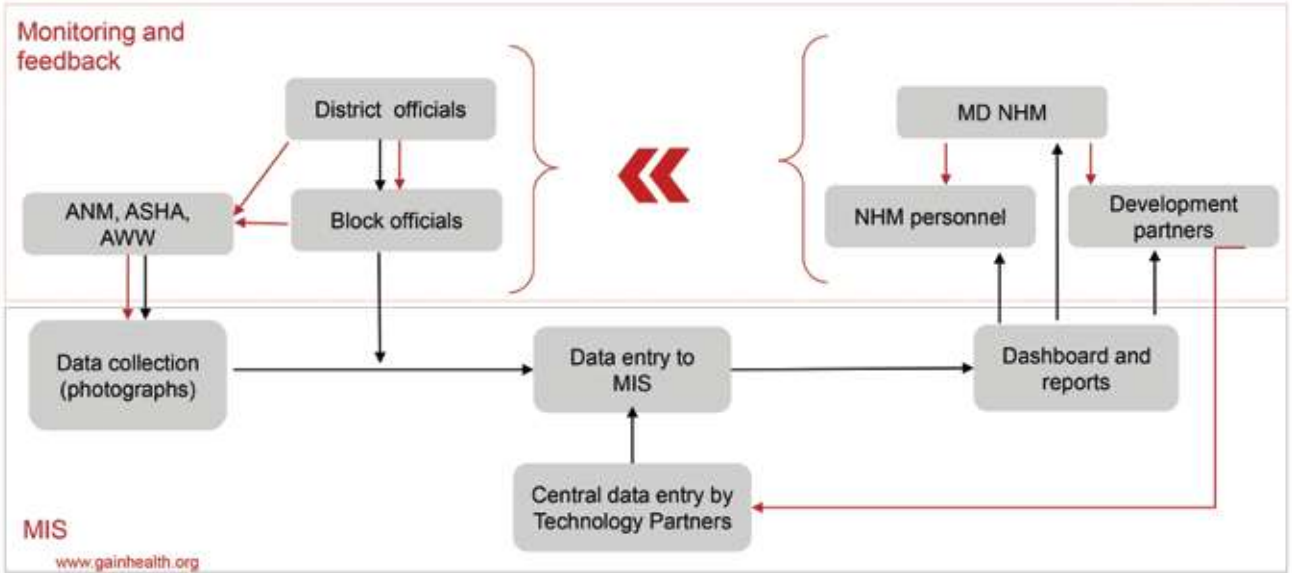
Input data and available outputs

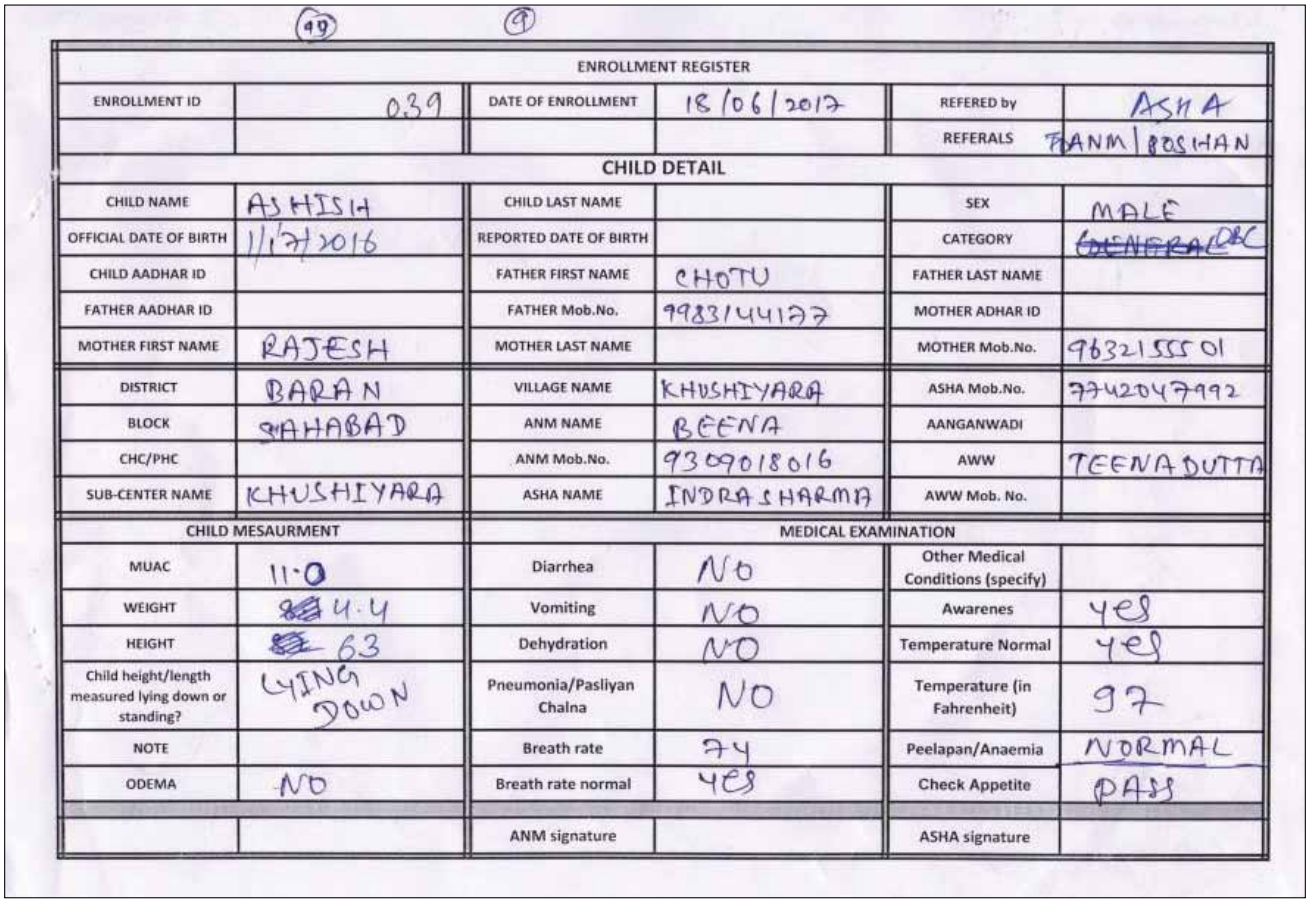
ANM Registers

- **Weekly entries**
  - Children
  - Enrolled
  - Referred to MTC
  - Referred to Anganwadi
- Weekly treatment & monthly follow-up
- EDNS Inventory
- In-treatment and post treatment referrals

Data entry into MIS system

- Central data entry from scans/photos
- Dashboard with live updates
- Individual child tracking
- District & block-wise progress reports
- Performance reports by sub-center (ANM) & Anganwadi (AWW)
- Alerts & notifications on actionable events





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ENROLLMENT REGISTER

ENROLLMENT ID	039	DATE OF ENROLLMENT	18/06/2017	REFERED by	ASHA
				REFERALS	ANM/BOSHAN

CHILD DETAIL

CHILD NAME	ASHISH	CHILD LAST NAME		SEX	MALE
OFFICIAL DATE OF BIRTH	1/7/2016	REPORTED DATE OF BIRTH		CATEGORY	~~GENERAL~~ OBC
CHILD AADHAR ID		FATHER FIRST NAME	CHOTU	FATHER LAST NAME	
FATHER AADHAR ID		FATHER Mob.No.	9983144177	MOTHER ADHAR ID	
MOTHER FIRST NAME	RAJESH	MOTHER LAST NAME		MOTHER Mob.No.	9632155501
DISTRICT	BARAN	VILLAGE NAME	KHUSHIYARA	ASHA Mob.No.	7742047992
BLOCK	SAHABAD	ANM NAME	BEENA	AANGANWADI	
CHC/PHC		ANM Mob.No.	9309018016	AWW	TEENA DUTTA
SUB-CENTER NAME	KHUSHIYARA	ASHA NAME	INDRA SHARMA	AWW Mob. No.	

CHILD MESAURMENT		MEDICAL EXAMINATION			
MUAC	11.0	Diarrhea	NO	Other Medical Conditions (specify)	
WEIGHT	14.4	Vomiting	NO	Awarenes	yes
HEIGHT	63	Dehydration	NO	Temperature Normal	yes
Child height/length measured lying down or standing?	LYING DOWN	Pneumonia/Pasliyan Chalna	NO	Temperature (in Fahrenheit)	97
NOTE		Breath rate	74	Peelapan/Anaemia	NORMAL
ODEMA	NO	Breath rate normal	yes	Check Appetite	PASS
		ANM signature		ASHA signature	

ANM Registers

References

RSOC.2013-14.https://wcd.nic.in/sites/default/files/RSOC%20 National%20Report%202013-14%20Final.pdf

RSOC. 2014. https://wcd.nic.in/sites/default/files/RSOC%20FACT%20SHEETS%20Final.pdf

SRS. 2013. http://www.censusindia.gov.in/vital_statistics/SRS_Reports_2013/11_Chap4_2013.doc

SECTION-VII

CAPACITY DEVELOPMENT OF WOMEN INSTITUTION/ SHGS/FIGS/FPOS

भाकृअनुप
ICAR

Role of Rural Women in Holistic Agriculture : An Overview

Gurupdesh Kaur, Rajni Goel and Rachna Singla
PAU – Krishi Vigyan Kendra, Patiala
E-mail : gurupdeshkaur@gmail.com

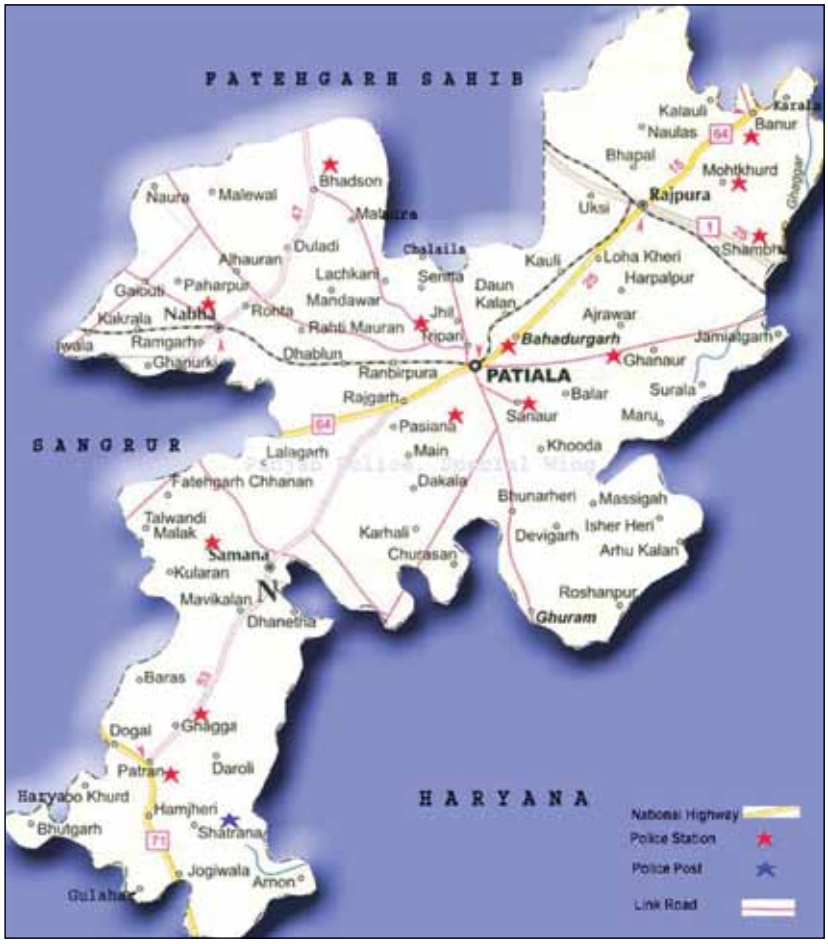
Women's participation in Agriculture

Women make significant contribution in the agriculture and allied sectors. Women's participation varies with the size of land holding, income, size of family, geographic location and agricultural season, stage of family life cycle and caste. Although the division of labour in agriculture is not very strictly on gender basis, yet women exclusively perform certain tasks. Cultural factors seem to affect the level of participation of women. The psycho-cultural environment in rural areas acts as an inhibiting factor in utilizing women's potentials. In tribal culture men and women work alongside and more decision making power rests with women. Participation of women varies with the crop. Men tend to grow cash crop whereas women grow crops for sustaining the food security. Women wage labourers are much higher in number than men. Women's economic contribution has been ignored. Farm women are greatly burdened with multiple responsibilities of home, farm, animal, reproduction and child rearing. Women suffer from resource scarcity they do not get inputs, credit, in the absence of exclusive policy provisions for them. Wage discrimination between men and women affects their economic gains and build poor social image. The long hours of work put in by women in fulfilling their multiple roles hardly leave any time for leisure and also have adverse effect on their health both mental and physical.

Blocks (8) : Ghanaur, Patiala, Bhunerheri, Sanaur, Samana, Nabha, Patran & Rajpura

Villages-934

Agricultural Canvas of Patiala



Geographical Area	3,22,000 ha
Cropping Intensity	198 %
Area under Paddy	1,92,000 ha
Avg. yield of Paddy	7264 kg /ha
Area under Basmati	38,000 ha
Avg. yield of Basmati	4571 kg /ha
Area under Wheat	2,31,000 ha
Avg. yield of Wheat	4968 kg /ha
No. of Tractors	23407
No. of Tube wells	80143
N : P : K	37.3 : 8.7 : 1
Ideal ratio	4:2:1

Administrative Sub-divisions:

Patiala district is sub-divided into 5 sub-divisons/tehsils, 3 sub-tehsils and 8 blocks.

S. No.	Sub-divisons/Tehsils	Sub-Tehsils	Blocks	No. of Villages
1	Patran	-	Patran	69
2	Nabha	Bhadson	Nabha	175
3	Patiala	Dudhan Sadhan	Patiala, Sanaur, Bhunerheri	367
4	Rajpura	Ghanaur	Rajpura, Ghanaur	250
5	Samana	-	Samana	73

Herbicide spray

Weeding

Harvesting

Farm based activities

- Seed treatment
- Harvesting
- Weeding
- Winnowing of cereals.
- Shelling of maize cobs.
- Drying and cleaning of grains
- Cleaning of storage structure.
- Grading of produce.
- Storage of grains.
- Care of small farm implements

Vegetable harvesting

- Chillies
- Okra
- Picking of Peas during winters
- Picking of pods of Pulses
- Digging of potato
- Cleaning and grading of fruits and vegetables
- Skill development training regarding value addition
- Acquiring of membership of Self help groups for marketing of their produce

Harvesting

Cleaning of vegetables

Dairy enterprise

Farm women are mostly involved in

- Milking of cattle.
- Bringing fodder and chaffing fodder
- Preparation of feed for calves.
- Cleaning of Animal shed
- Storage of milk
- Feed preparation for the dairy animal
- Health of the animal

Dairy Enterprise

Value added products

Other Enterprises

Farm women of Patiala are also involved in

- Beekeeping
- Mushroom Cultivation
- Nursery production
- Integrated Nutrition Garden
- Non – farm based activities
- Stitching and tailoring

Nursery production

Mushroom cultivation

- Craftwork
- Tie & dye
- Detergent making
- Macrame work
- Crochet
- Hand knitting

Assessment of available family resources

- Assessment of household, agriculture and allied activities involving drudgery.
- Method demonstrations for drudgery reduction of farm women using tools like vegetable cutter, maize sheller and protective gloves and other tools & equipments.

Need based technological empowerment of farm women

- To survey interest and preferences of young girls and farm women for entrepreneurial activities.
- Empowerment of women in farm based activities
- Empowerment of women in non farm based activities for income generation like contemporary uses of traditional craft like phulkari making, dori making etc.
- Stitch craft, block printing, tie & dye
- Detergent making and preparation of souvenirs

Extension strategies to empower women

- Vocational training for entrepreneurship
- Method demonstrations of nutritious recipes and drudgery reducing tools.
- Farm women fair
- Interface with scientists
- Exposure visits
- Literature development for farm women.

Income generating activities for rural women

Preparation of nutritious snacks

Nutrition Week (1-9th September)

Workshop on SHGs sponsored by NABARD

Nutrition Garden in Nutri-SMART Village of Dewas : Interventions and Impact

Moni Singh, N. Patel and A. K. Dixit
KVK- Dewas
E-mail : m_jadon@rediffmail.com

Introduction

Dewas is located in the Malwa plateau and is an old town in Madhya Pradesh. Dewas is a better placed district of MP in terms of agricultural production and industrial output, yet in rural areas there are cases of malnourishment among children & women and anemia among adolescent girls, pregnant women & lactating lady. Thus, the major cause is lack of social awareness, nutrition literacy and food Security at household level.

Food & nutrition security

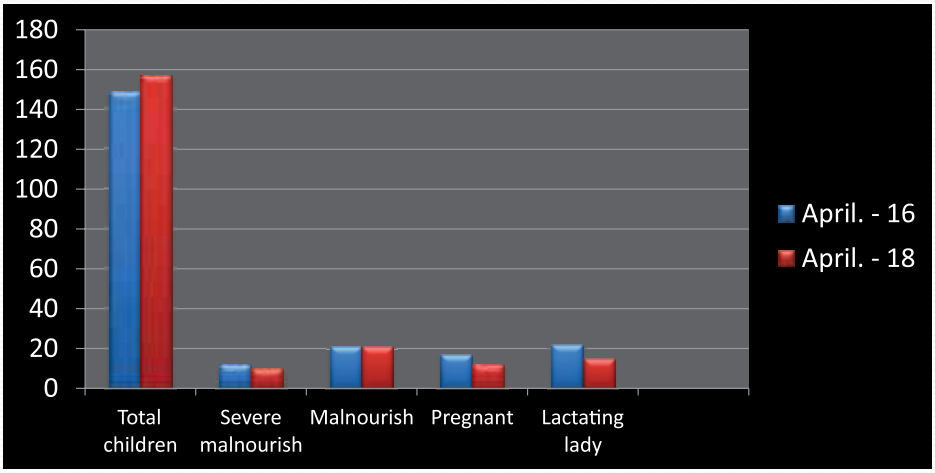
Household food insecurity is a socio-economical issue in this case all the members of the house suffers but in nutritional insecurity always being a social issue and only women, children and adolescent girls suffers the most (Food & Agril Org, FAO, (1996).

Nutri-SMART Village

- Agera, Block- Sonkutch, District- Dewas
- Population of NSV :
  1. Male: 888
  2. Female: 893
  3. Adolescent girl :122
  4. Pregnant women:16
  5. Lactating women:16
  6. 0 to 6 month children :25
  7. 6 months to 5 year children: 94

- **Vegetable requirement:** 114 g/capita
- **Vegetable Consumption :** 250g/capita

Malnutrition status of Nutri-SMART village Agera (From April 2016-2018)



Malnutrition status in Agera village

- Malnourish children (April 2016) - 21
- Severe Malnourish Children (April 2016)- 12
- No. Pregnant women (April 2016)- 17
- No. Lactating women (April 2016) -22

Interventions

- **Trainings on Balance Diet**
  - Importance of Nutritional Garden
  - Value addition
  - Nutritive food preparation
  - Fortification in different food
- **Demonstration**
  - Establishment of Nutritional garden
  - Income generation through Vermi composting
  - Nutritional security through Vegetable soybean
- **Trials**
  - Assessment of durum wheat porridge

Nutrition garden

Nutritive food preparation

Annaprashan

Vermicomposting

Intervention for Household Food Security "Nutritional Kitchen Garden"

Irrespective of the holding size of farm, all farmers has a backyard. Backyard of the house is generally utilized by farm women. In this existing resource of farm women is exploited to promote 'Nutritional Kitchen garden'.

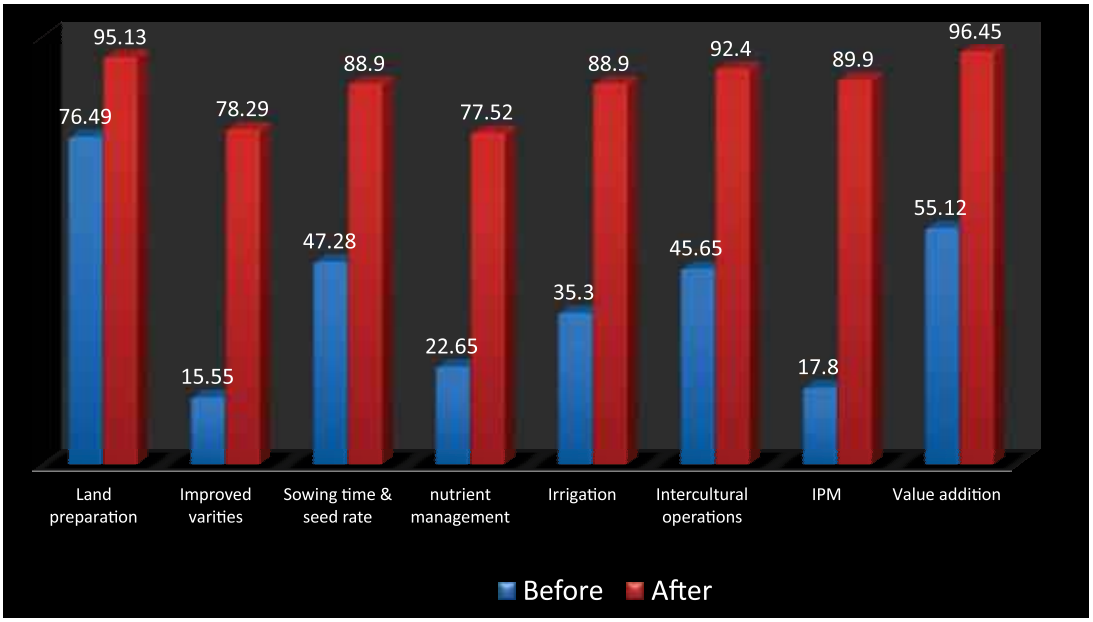
Nutrition kitchen garden

Nutritional garden with "SAAT DIN SAAT KYARI"

Concept (7days & 7 plots)

The concept is that crop (vegetable & fruit plan) for entire year (season-wise) in kitchen garden. The limited land in the backyard divided into space for fruit plants and seven small plots. Each plot for a day in the week (especially for leafy vegetables) along with other seasonal vegetables.

Training programmes for strengthen the farm women for Nutritional Garden



Percent of rural women having knowledge on various kitchen gardening aspects before and after training.

Source: : Machakaire and Hobane (2005), Zim VAC (2010), Harinder singh & Kaur A.P.(2014)

Lay out of Nutritional Garden "Saat din Saat kyari"

- Area - 210 sq m
- Size of kyari (first round) – 3X10 m.
- Size of kyari (Second round) – 3X5 m.
- Total Path area – 2 m.
- Each kyari divided in to two parts
- One green vegetable in each kyari
- Other vegetable of Kharif/Rabi season
- Fruits grown in out side of circle
- Banana tree as a symbol of SUBH as well as fruit plant

Vegetable availability before and after establishing kitchen garden

Technology	Average Yield (kg/unit area)	Average Per capita availability (g/ day)	% change in availability (g/day)	% RDA
Farmers Practice	77.9	169.0	-	56.33
Recommended Practice	119.1	271 .0	60.35	90.33

Nutrients availability/capita before and after establishing nutritional garden

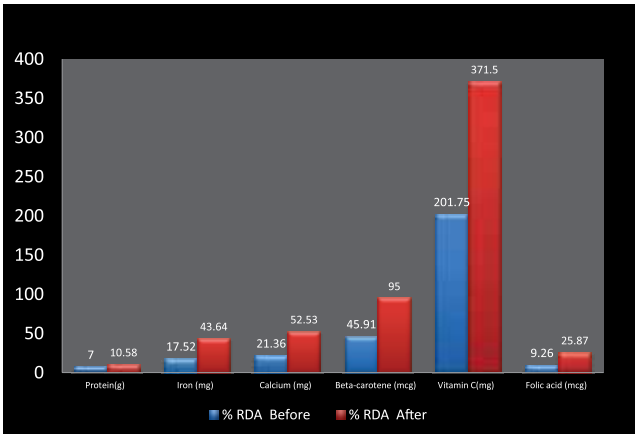
Nutrients	Per capita availability of nutrients/day		% RDA	
	Before	After	Before	After
Protein(g)	4.2	6.35	7.0	10.58
Iron (mg)	2.98	7.42	17.52	43.64
Calcium (mg)	128.2	315.2	21.36	52.53
Beta-carotene (mcg)	2203.8	4560.2	45.91	95.00
Vitamin C (mg)	80.70	148.6	201.75	371.5
Folic acid (mcg)	18.52	51.74	9.26	25.87

Availability of nutrients as per RDA

Establishment of Nutritional garden "SAAT DIN SAAT KYARI"

Nutritional garden at Full Bloom

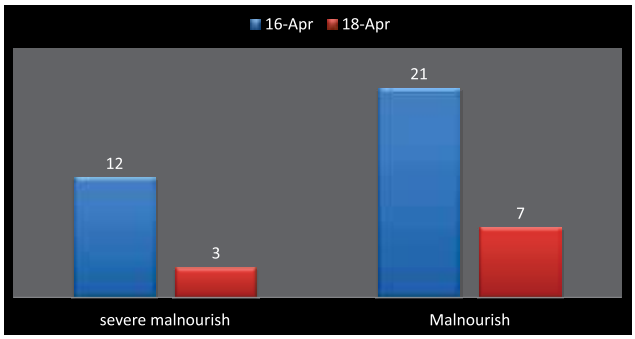
Glimpses of Nutritional Garden



Percentage of RDA before and after nutritional garden

Source: Harinder Singh & Kaur A.P.(2014)

Malnutrition status of Model Nutri Smart Village (Number of Children) (Targeted as on April 2016)



References

Food & Agril Org, FAO. 1996. food security: some macroeconomic dimensions, http://www.fao.org/3/w1358e/w1358e14.htm.

Harinder Singh and Kaur, A. P., 2014. Impact assessment of integrated nutrition garden concept for nutritional security and livelihood interventions under central Punjab conditions Food Science Research Journal 2014 Vol.5 No.1 pp.51-55 ref.5.

Machakaire V. and Hobane A., 2005. Review of Garden Based Production Activities for Food. Security in Zimbabwe. Extensive Survey of Zimbabwean Horticulture, Great Minds. Investments (PVT) Ltd.

T. Nandakumar, Ganguly K., Sharma P., and Ashok G. 2010., Food and Nutrition Security Status in India Opportunities for Investment Partnerships, ADB Sustainable Development Working Paper Series, No. 16, November 2010.

Zim VAC., 2010. Strengthening Food Security Analysis in Zimbabwe. Institutional Framework for Moving Forward, Harare May 2010.

Rethinking Nutrition : Nutri-SMART Village Initiative in Neemuch District of Madhya Pradesh

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The scaling out of nutrition smart agriculture technologies and practices using community based adaptation strategies is a potential solution to food security and nutrition challenges. Nobel laureate Kailash Satyarthi recently said the government needs to take serious steps to check malnutrition in the state. Each child is a unique individual whose heredity and environment shape the course of his or her life. Woven into the daily life are aspects of food and nutrition. But the question is not only of statistics that what is the exact number of malnourished children in Madhya Pradesh or how many are dying every day but the fact that in the race of bright and shining development, we are trampling upon out children. The truth is bitterer for Madhya Pradesh since during a period that the state was getting awards and recognition for progress and development, the latest Census figures reported the population of children under five years of age in MP is 91,42,292. According to National Family Health Survey (NFHS) 42.8% of the children (39,12,900) are underweight, 42% children (38,39,762) have stunted growth and 9.2% children (8,41,090) are severely malnourished. It also says that only 14% children under the age of 3 Years breastfed within one hour of Birth and 82.6% of Children between the age of 6-35 Months (the most critical period of life for mental and physical development) are anemic. Not only children, vulnerable groups of the society like adolescent girls, pregnant and lactating women and adults are also malnourished.

Nutri-SMART village

The concept of nutri smart village emerged after several workshops, sensitizations and consultation process by ATARI- Zone-9 (ICAR), Krishi Vigyan Kendras (SAUs-RVSKVV, JNKVV , IGKVV) & Department of Women & Child development (GoMP).

Mutually acceptable and achievable development plan was the basic issue that was stressed to promote nutrition in rural sector through establishment of Nutri-SMART villages.

Concept of Nutri smart village-Dalpatpura

Promote "Eat what you grow, Grow what you eat" In kitchen garden

Mapping of nutrition available in Nutri-SMART village

Nutrient Content Surplus/Deficit			
Nutrient Content	**Availability**	**Required**	**Surplus/Deficit**
Protein(q)	1665.97	191.62	1474.35
Fat(q)	2330.34	95.812	2234.53
Energy (Kcal)	48675.5	8718.9	39956.56
Vitamin A (q)	4028.10	0.015	4028.09
Vitamin C (q)	3.23	0.127	3.10
Mineral Ca (q)	1018.76	1.916	1016.84
Iron (q)	45.28	0.054	45.22

Nutritional Gap was calculated based on

Availability = Production x Nutrient content

Requirement = Population x Per capita requirement

Surplus/Deficit = Availability – Requirement

Existing food production in Nutri-SMART village

Crop Category	**Crop/other food Item Name Existing**	**Existing**	
		Total Area (ha)	**Production (in q)**
Pulses	Black Gram	4	40
	Gram	200	2000
Cereals	Maize	3	80
	Wheat	40	1600
	Barley	10	350
Oilseed	Soybean	180	1778
	Ground Nut	15	180
	Sesamum	5	40

Crop Category	Crop/other food Item Name Existing	Existing	
		Total Area (ha)	Production (in q)
Fruits	Guava	1	260
	Mandarin	5	1300
Vegetables	Brinjal	4	1000
	Garlic	10	750
Others	Milk	0	60
	Meat	0	5
	Fish	0	0
	Egg (no.)	0	300
	Total	477	9743

Change in food production in nutri smart village

Crop Category	Change in Crop Plan		
	Crop/other food Item Name	Increased/change Area (ha)	Increased Production (in q)
Pulses	Black Gram	10	80
	Pigeon Pea	5	50
	Green Gram	5	70
	Gram	150	1800
Cereals	Maize	10	250
	Wheat	30	1200
	Barley	10	350
Oilseed	Soybean	165	2475
	Groundnut	10	180
	Sesamum	40	400
Fruits	Guava	5	1375
	Mandarin	5	1400
Vegetables	Brinjal	10	2500
	Garlic	10	900
	Onion	10	2500
Others	Milk	0	70
	Meat	0	5
	Fish	0	0
	Egg (no.)	0	350
	Total	475	15955

Poshan Thaali

A balanced Nutrition Thali including all food groups and nutrient coverage as per the RDA based on the local food items available was developed keeping into mind the four vulnerable groups of the life span namely infants, school going children, pregnant and lactating mothers.

Poshan Thaali is developed based on -

- Recommended dietary allowances (RDA) of 4 vulnerable groups
- Local nutritious recipes
- Locally available ingredients
- Fulfills 1/3rd - 1/4th RDA

Implementation

Nutri-SMART villages are established in convergence mode with key partners

- Krishi Vigyan Kendra
- Department of Women and Child Development
- Department of Farmers Welfare & Agri Development
- Department of Horticulture & Food Processing
- Ayush Department

Establishment of Backyard Kitchen Garden

Outcome

Results

Technology	Yield (kg/unit area)	Per capita Consumption g/ day	% change in Consumption g/day	% RDA
Farmers Practice	50-200	122.60	12.45	36.26
Recommended Practice	70-300	155.65		45.32

Nutritional Assessment % adequacy of nutrient consumption of farmwomen compared to RDA

Nutrients	Consumption of nutrients/day		RDA
	Before	After	
CHO	130.33	112.53	360
Energy	93.89	88.50	2425
Protein	81.12	84.32	60
Fat	119.48	75.90	20
Calcium	71.31	103.42	400

Nutrients	Consumption of nutrients/day		RDA
	Before	After	
Iron	38.63	58.57	28
Vitamin A	24.89	74.99	2400

Health monitoring activities in Nutri-SMART village

Nutrient Content

Nutrients / 100 g			
Nutrients	**T_1 Wheat Ladoo**	**T_2 Besan Ladoo**	**T_3 Soya Poha Ladoo**
Energy (Kcal)	712.60	739.13	724.56
Fat (g)	44.21	48.93	49.21
Protein (g)	5.30	13.95	15.43
Fibre(g)	0.82	1.06	1.21
Calcium (mg)	26.08	69.56	86.08
Iron (mg)	2.19	3.47	8.33
Folic acid (µg)	15.56	53.80	53.80
Vit.A (µg)	130	238.04	238.04

No. of Trails	Performance Indicator / Parameter		Anthropometric measurements		
	Name of vegetable/Fruit/ Product	Per capita Consumption g/ day	Increase in Wt. (kg)	Increase in Ht.(cm)	Increase in BMI (%)
07	Wheat Ladoo	100	0.37	0.2	0.4
	Besan Ladoo	100	0.65	0.5	0.67
	Soya Poha Ladoo	100	0.64	0.2	0.8

Physical Outcome - Nutritional Status

Year	No. of Malnourished Children	No. of malnourished Preg. women	No. of malnourished lactating women
2017	33 (1 Y, 32 O)	10	8
2018	33 (2 G, 14 Y, 17 O)	6	0

G- Normal wt., Y – moderate wt. (medium), O – very low weight

S. No.	Name of the child	Previous			Present		
		Weight (kg)	MUAC (cm)	Grade	Weight (kg)	MUAC (cm)	Grade
1	Suraj	9.4	14	0	10.9	15	Y
2	Udal	8.1	14.5	0	9.2	14.5	0
3	Suraj	8.6	17	0	9.6	14.5	0
4	Parween	11.9	17	0	12.6	14	Y
5	Ashwina	8.4	15.5	0	9.9	13	Y
6	Manish	7.7	15	0	8.8	14	Y
7	Archana	7.2	13	0	8.9	13	Y
8	Lalita	8.0	15	0	9.4	12	0
9	Durga	11.0	12.5	0	11.7	12.5	Y
10	Divyanshi	11.5	15.5	0	12.2	15.5	y

G- Normal wt., Y – moderate wt. (medium), O – very low weight

Trainings

Trainings were organized on value addition of soybean, nutrient Conservation during cooking, causes & prevention of PEM and Anaemia and importance of consumption of germinated cereals and sprouted pulses.

Conclusion

After applying all this services and technique the overall problems of Dalpatpura village are reduced. Due this the cultural, social(Improving the well-being of every individual in society, increase self-sufficiency, reduce the poverty), economical (due to various income generation activities and standard of living increases), environmental (use of natural resources reduce the pollution and plantation brings the friendly environment), educational (e-learning and other modern techniques increases the level of thinking and personal development) , living standard and overall status of village increases. Besides, an overall environment was created to think, discuss and act for nutrition security in the villages. In the coming years, better results in terms of nutrition security can be expected.

Terrace Garden for Urban Household Nutrition Security

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Due to the urbanization and growing population, there is a big threat to nutritional security. One of the measures would be to have a terrace garden to utilize the available open space in a productive way. It serves many purposes. But one important purpose definitely served would be for those who have a passion for gardening. Terrace gardens also contribute tremendously towards the health betterment of the occupants. Moreover fresh home grown vegetables taste delicious, are good for health and safe from chemicals. Nutrition is about all the aspects of food and how it is used in the body. Most people eat because they are hungry. However, while the feeling of hunger tells you to eat, it does not tell you what to eat. Some of home garden foods provide healthy meals. Food is made up of nutrients such as carbohydrates, fats, protein and micronutrients (vitamins and minerals). Nutrients are needed for energy (working and playing), for growth (building and maintaining the body) and for protection against infection. Green leafy vegetables such as pumpkin leaves and orange fruits are very rich sources of vitamins A and C for protection. The easiest way to get a variety of nutritious foods on a daily basis is from a terrace garden. The easiest way to get a variety of nutritious foods on a daily basis is from a Terrace garden.

Objectives

- Provide daily nutritional needs for the family
- Provide more income/saving in purchasing vegetables from market
- Diversity in food.
- Make use of all terrace area available
- Planting crops for a continuous food supply

Terrace garden

- Productive use of terrace space
- Creativity
- Quality time spend
- Grey terrace turn green
- Fresh and pesticide free vegetables anytime
- Money, time and energy saving of women
- Terrace gardening keeps the house cool

A view of vegetable cultivation in terrace space



Terrace Garden

Promotion of terrace garden

Initially promoted through On Farm trials taken four urban women from Jeevan Vihar Colony, Telibandha, Raipur, Chhattisgarh into confidence.

Input support

- Grow bags- size 16x16 x30 cm
- Fibre containers – 2.5ft L x 1.9 ft W x 8.5 inch
- Sprayer (01) & water Soluble Nutrients
- 10-Plastic pots of different sizes
- Seeds of improved varieties of vegetables
- Substrate-Cocopeat, vermicompost, soil in ratio 1:3 each
- Plant protection : *Trichoderma virdie* and neem formulations

Bag filling

Planting of brinjal plants

Brinjal

Technical input

- Group meeting-Importance of Terrace garden.
- Training on Filling of pots and grow bags
- Nursery raising & plantation
- Application of water soluble nutrients
- Plant protection measures.



Diverse view of Terrace vegetable garden

Diverse vegetables during different seasons

S. No.	Kharif	Rabi	Summer
1	Water Spinach	Water Spinach	Water Spinach
2	Corriander	Corriander	Corriander
3	Mint	Mint	Mint
4	Poi Bhaji	Poi Bhaji	Poi Bhaji
5	Chaulai	Palak	Kheda bhaji
6	Green garlic	Laal bhaji	Amranthus
7	Kharif onion	Methi	Onion bhaji
8	Kharif onion bhaaji	Capsicum	Ridge gourd
9	Early cauliflower	Onion (for bulb)	Smooth gourd
10	Tomato	Garlic (for bulb)	Bitter gourd
11	Chilli	French bean	Bottle gourd
12	Brinjal	Mid, late cauliflower	Pumpkin

Vegetables in bag and pots

S. No.	Kharif	Rabi	Summer
1	Okra	Tomato	Bitter gourd
2	Cluster bean	Okra	Bottle gourd
3	Brinjal	Brocolli	Okra
4	Early cauliflower	Cabbage	Ridge gourd
5	Chilli	Cauliflower	Smooth gourd
6	Tomato	Cowpea	Pumpkin

Outcome-Sense of achievement

Immediate-

- Pesticide free fruit and vegetable in daily diet
- Nutritional and health security for family.

Social

- Utilization of leisure time.

Physical

- Exercise and health benefits.

Performance of Terrace garden

Production per unit (kg)	Cost of input (Rs.)	Net Return (Rs.)	Saving in Rs.	B:C ratio
209	2550	1930	4180	2.16

It was found that terrace garden fulfilled daily vegetables needs of the families. Per unit 209 kg vegetables was recorded and cost of cultivation per unit was 2550 Rs. with net return 1930 Rs. This way terrace garden not only provided nutrition to urban families but also minimised their cost for vegetable purchasing.

Household nutritional requirement from terrace garden

Iron	Calcium	Vitamin A	Vitamin C
Spinach	Amaranthus	Amaranthus	Spinach
Lal Bhaji	Poi bhaji	Fenugreek leaves	Mint leaves
Amaranths	Broccoli	Lettuce leaves	Radish leaves
Broccoli	Spinach	Water spinach	Broccoli
Water spinach	Coriander leaves	Radish leaves	Amaranthus

Iron	Calcium	Vitamin A	Vitamin C
Colocasia leaves	Tomato	Pumpkin	cucumber
Bathua	Cabbage	Amaranthus leaves	Sweet potato
Fenugreek leaves	Fenugreek leaves	Mint leaves	Amranthus

Cow pea

Bitter guard

Reach

- Area Covered - 400 sqft. roof top/family.
- Beneficiary - 4 families in 2017
- Production - 209Kg/family /roof top /year
- 20 families in 2018

Harvest from terrace

- Best way to utilize roof top & ensure daily nutritional needs of family in urban areas
- Empower housewives and also encourage their hidden creativity
- Provide pesticide free healthy and fresh vegetables .
- Contribution towards increasing vegetable production

Conclusion

- It is best to choose a variety of vegetables that do not send runners and spread as they will fill up the space of containers.
- By combining vertical supports in squares or containers, we can also grow beans, peas, and small gourds.
- Carrots, radishes, lettuce, beets are also easy to grow.
- Best way to meet nutritional needs of family in urban areas.

In general, better to choose large containers when growing plants for terrace garden because in large containers, plants grow more easily better moisture conservation and nutrient supply, room for ample root development.

References

Role of terrace garden in sustainability and environment(A case study) Poornima Rao. International journal of Management, Information Technology and Engineering (Best: IJMITE) ISSN (P):2348-0513, ISSN(E): 2454-471X, Vi.4, Issue 2, Feb 2016,19-22

www.thealternative.in

Green roofs-wikipedia

NOTE

NOTE

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