Promotion of Food and Nutrition Security Through Farm Technologies and Behavioural Change Communication, Targeting Women

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Abstract Dietary diversification through crop diversification in a farming community is a useful low-cost strategy for combating micronutrient (Mn) deficiencies (hidden hunger) in Indian diets. With advocacy and awareness, even farmers with small and marginal land holdings can be persuaded to divert small pieces of land from traditional crops, to Mn-dense crops like vegetables, fruits, pulses, and millets. Backyard poultry with high egg-yielding birds is a good option to promote, since eggs are highly nutritious. To ensure that this farm produce is primarily consumed at home and only excess sold, there has to be a robust strategy of behavioural change communication. Educational intervention/technology transfer can be through a combination of centralised training programmes, hands-on training in farms, as well as through distribution of simple educational pamphlets. Since nutrition security goes beyond food security and includes safe environment, drinking water, and health care, the educational package should be a holistic one. Pregnant women and mothers with under 24-month-old children (the first 1000 days after conception) are the most effective group to target. Recent studies including the one reported here in a tribal community show that such a strategy can help crop diversification, as well as marked improvement in the mothers’ understanding of health, food, and nutrition. Significant improvement in household vegetable consumption can also be achieved.

Keywords Micronutrient · Deficiencies · Malnutrition · Crops

The Problem of Malnutrition in India

Despite the post-independence, economic and scientific progress made by India, the curse of malnutrition persists (1–3). Even while pre-transition diseases like communicable diseases and under nutrition persist, there is growing incidence of over nutrition (obesity) and associated non-communicable diseases, the double burden.

Food security implies that “all people, at all times, should have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life” (FAO, 2000, reaffirmed officially in 2009).

Nutrition security goes beyond food security. For nutrition security, there has to be awareness and access at affordable cost to 1. food security and correct infant and child feeding practices, 2. safe drinking water and disease-free environment, and 3. healthcare outreach. With this, the 4th A. Absorption will be taken care of.

Diet surveys done in India show that Indian diets, which are predominantly cereal based, are qualitatively deficient in micronutrients—vitamins and minerals (Mn) (hidden hunger) due to deficient intake of protective foods like vegetables and fruits, pulses, and animal products (milk, eggs, fish, meat) [1, 2]. In vegetarian diets, pulses are an important source of proteins, besides being rich in micronutrients (Mn,) such as several B-vitamins and
Strategies for Combating Hidden Hunger

Strategies for combating hidden hunger include: (i) supplementation with micronutrients (the pharmacy-based approach), (ii) food fortification, and (iii) dietary diversification—a farm-based approach. Crop biofortification through conventional breeding, marker-assisted molecular breeding, or genetic engineering/gene editing is an important technological approach to enrich the germ plasm with specific micronutrients.

While all these have a place, dietary diversification—food–food fortification has the advantage of empowering the community, avoiding any risk of excess, and providing a package of nutrients rather than one or two nutrients. Some of the earlier work on a farm-based approach for dietary diversification has been discussed [7–11].

Rural Hub for Promoting Health, Food and Nutrition Security

For almost two decades, the authors have been promoting “Nutritionally sensitive and environmentally sustainable agriculture” in villages of Medak District, Telangana, India. For wider dissemination of some of the promising strategies in the area of food and nutrition security developed by the authors, over the years, a hub for food and nutrition security has been established. Every 6 months, few new villages are selected and a combination of technological intervention with social engineering (behavioural change communication) used to promote food, and nutrition security, and health in the community.

The impact of this approach in a tribal area is discussed.

Methodology

The project location was 13 tandas (tribal settlements) attached to 4 major villages in Narsapur Mandal, Medak District of Telangana State, covering a population of about 3000. While a family approach was used, pregnant women or women with 6–24-month-old children (nutritionally the most vulnerable group) were specifically targeted.

Out of the 6 months study period, 1st month was spent in interacting with the villagers, explaining the purpose of the project, and conducting an initial Knowledge, Attitude and Practice (KAP) survey on women with 6–24-month-old children (registered at the ICDS centres), to assess their understanding of food, nutrition, sanitation, maternal and child caring practices and health (some common infectious diseases—their cause and management). Four months were spent in conducting centralised and de-centralised hands-on training/awareness generation programmes. The subjects covered were: (1) food, nutrition, and health, (2) raising homestead gardens of vegetables and fruits, and production and use of vermicompost, and botanical pesticides. Pulses and millets were also promoted, (3) backyard poultry, with high egg-yielding strains, and (4) food...
processing. Seeds and saplings of nutritionally rich vegetables and fruits were distributed free. Saplings of plants like drumstick, papaya, and creeper spinach (Basilla alba) were raised by women in their backyards, and purchased from them for distribution, giving the women some income.

Birds for backyard poultry procured from a poultry farm in Hyderabad were charged at Rs 300 per bird. Only few families bought 4 or 5 birds and housed them in properly constructed night shelters at night. The last month was spent in impact evaluation—land diverted for raising gardens, poultry units set up, and end-line KAP survey.

Due to COVID 19 pandemic, women were hesitant to come to Narsapur for the centralised training programmes. The methodology had to be tweaked. The education (behavioural change communication—BCC) was continued by distributing pamphlets in the local language Telugu, on different aspects of health, food, and nutrition. The Anganwadi (ICDS) teachers residing in the village, were involved in educating the women. Project staff continued to hold hands-on training in farm technologies in the villages by adopting COVID appropriate behaviour.

Statistical Analysis

A two-sample proportions Z test was applied to test the significance of the characteristics since the sample sizes were greater than 30. For quantitative data (Tables 1 and 4), two-sample proportions Z test and Wilcoxon Mann–Whitney U test were used.

Major Findings

Over 90 per cent respondents in both the surveys (initial and end line after 5 months) had studied up to and beyond 7th standard. Education level of men was similar to that of women. Such high level of literacy is a positive finding. It helped to continue educating the women through pamphlets. Increase in female literacy is seen in recent years, in Medak District.

Agriculture-Related Practices

Most women had some land but land holdings were small–3 to 4 acres. Agriculture was the main occupation. Besides own land, women worked as labour on each other’s land.

Homestead gardens: Acceptance of homestead vegetable gardens was good. 132 vegetable gardens were raised diverting, 28.65 acres of land from traditional water guzzling crops like paddy and sugar cane to raising vegetables, pulses, and millets.

BYP: Sixty-one families (not necessarily from the target group) established BYP (one male and four female birds per unit), by paying Rs 300 per bird.

Food processing: Only one centralised programme could be conducted. Methods of preparing cereal–pulse combination foods with added vegetables, for complementary feeding, and recipes like vegetable khichdi, roti mixed with vegetables were taught.

KAP Surveys

Impact on Agriculture practices: Table 1 shows marked increase in the number of families growing vegetables, pulses and millets, and use of organic fertilisers and pesticides in the end-line survey as compared to the initial survey.

Only few respondents mentioned keeping backyard poultry in the initial survey, with only insignificant improvement in the end-line survey. This was because, the respondents who participated in the KAP survey, did not belong to the households that introduced BYP with high egg-yielding birds after intervention.

Change in Mothers’ Understanding of Healthy Cooking Practices, Care During Pregnancy, Breast Feeding and Child Feeding Practices (Table 2)

Healthy cooking practices: Most respondents in both the surveys said that vegetables should be washed before cutting. Most families in rural areas (including the present cohort) discard excess water (ganji) after cooking rice, fearing pesticides. In the end-line survey, 100% said, ganji should not be discarded. They were advised to cook rice with right amount of water or use the excess water if any for cooking vegetables or rotis (Indian flat bread made with cereals or millets).

Care during pregnancy and infant and child feeding practices: Most mothers in both the surveys had received more than 6 antenatal check-ups, and had received iron-folic acid tablets to prevent anaemia. However, only 70–75% had consumed the tablets regularly.

There was a remarkable improvement in mothers’ understanding of need for more food during pregnancy. Food taboos like avoidance of papaya, banana, green leafy vegetables, etc. are common in India. Table 2 shows that while these beliefs were common initially, there was improvement in the end-line survey.

Remarkably over 90% mothers in both the surveys mentioned that breast feeding should start within 1 h after birth and complementary feeding by 7th month. The latter is particularly surprising because delayed initiation of complementary feeding is one of the weakest practices under child caring in India [3].
There was improvement in the mothers’ understanding of the components of complementary food to be fed to the child (Table 2). Significantly higher numbers of respondents mentioned vegetables including green leafy vegetables, and roti for complementary feeding in the end-line survey. Discarding yellow of the egg is another unhealthy practice in rural areas. There was some improvement in that response also.

Components of a Balanced Diet, Nutrients in Food and Causes of Common Deficiency Diseases

Table 3 shows remarkable improvement in mothers’ understanding of foods which constitute a balanced diet; nutrients in foods, causes of nutritional deficiency diseases like protein calorie malnutrition (PCM), night blindness (vitamin A deficiency), anaemia (iron deficiency), and foods rich in vitamin A and iron.

There was also improvement in mothers’ knowledge regarding causes of common infectious diseases like diarrhoea (contaminated food, and water,) malaria (mosquito bite mentioned even initially), TB (infection through cough), jaundice (contaminated food), and care to be taken.

Impact on Family Food Consumption

Table 4 describes the impact on the frequency per week of different foods consumed and per capita quantity of food consumed per day. Compared to the initial survey, there was significant increase in the frequency as well as quantity of GLV, and vegetables consumed by the families of the respondents.

Indebtedness and Government Schemes

Most women had taken loans from banks or DWCRA. Only few mentioned money landers. All had availed of government schemes like loan waiver and Rythu Bandhu (cash transfer for agriculture) suggesting that these schemes were functioning.

Comments

In an agriculture community, promotion of crop diversification towards horticulture, legumes, and millets has a dual advantage of promoting food security and environment
These crops are more water and climate resilient compared to cereals. Pulses help to fix nitrogen in soil. Technological intervention through hands-on training did lead to crop diversification and setting up of vegetable and fruit gardens (Table 1 and farm survey). More families in the final KAP survey mentioned raising vegetable gardens, and growing pulses and millets, besides using organic methods like vermicompost and botanical pesticides. However, technological intervention has to be accompanied by BCC, to ensure that the farm produce is consumed at home and all of it is not sold. In poor communities, “economic compulsion outweighs nutritional wisdom”. The positive impact of combining farm technologies with BCC on the KAP of the mothers and family food consumption even within the short period of 6 months (Tables 1–4) is encouraging, and suggests that this is indeed a promising strategy.

In 2018, GOI initiated the National Nutrition Mission (Rashtriya Poshan Abhiyan) a participatory movement. The month of September 2020 was designated as Rashtriya Poshan Maah “The major activities identified were:

Table 2 Change in mothers’ understanding of care during pregnancy and child feeding practices

| Surveys                                      | Initial | End line |
|----------------------------------------------|---------|----------|
| No. of respondents                           | 50      | 50       |
| Antenatal check-up done > 6 times            | 94      | 100      |
| More food to be consumed during pregnancy    | 10      | 84***    |
| Consumption of Iron & Folic acid tables during pregnancy-yes | 100 | 100 |
| If Yes—Regular                               | 76      | 70       |
| Papaya avoided during pregnancy              | 100     | 74***    |
| Banana avoided during pregnancy              | 94      | 58***    |

Child feeding practices

| Initiation of breast feeding-within 1 h       | 90      | 92       |
| Complementary food started around 7 months of age | 92 | 98     |
| Complementary food started at 8 months       | 6       | 2        |
| Complementary food fed—roti                  | 8       | 32**     |
| Rice                                         | 100     | 100      |
| Dal                                          | 44      | 42       |
| Egg                                          | 72      | 86       |
| Milk & Milk products                         | 100     | 70**     |
| Vegetables                                   | 20      | 48**     |
| GLV                                          | 38      | 98***    |
| Yellow egg                                   | 62      | 94       |

Table 3 Components of a balanced diet, nutrients present in foods and common nutrition deficiency diseases % Respondents

| Surveys                                      | Initial | End line |
|----------------------------------------------|---------|----------|
| No. of respondents                           | 50      | 50       |
| Components of balanced diet—rice             | 100     | 100      |
| Roti                                         | 4       | 28***    |
| Dal (lentil soup)                            | 80      | 90       |
| Vegetables                                   | 24      | 76***    |
| GLV                                          | 62      | 92***    |
| Milk and milk products                       | 42      | 50***    |
| Egg                                          | 80      | 96*      |
| Fruits                                       | 2       | 46***    |
| Meat Fish                                    | 38      | 62**     |

Nutrients present in foods

| PCP—Insufficient food                        | 24      | 100***   |
| Frequent illness                             | 0       | 68***    |
| Night blindness—Vitamin A deficiency         | 12      | 94***    |
| Vitamin A-rich foods—GLV’s                   | 44      | 100***   |
| Papaya                                       | 10      | 72***    |
| Carrots                                      | 2       | 94***    |
| Mango                                        | 0       | 44***    |
| Meat                                         | 8       | 72***    |
| Egg                                          | 38      | 90***    |
| Yellow Pumpkin                               | 2       | 16**     |
| Anaemia—insufficient food                    | 60      | 92***    |
| Iron deficiency                              | 2       | 64***    |
| Frequent pregnancies                         | 0       | 10*      |
| Worm infection                               | 0       | 24***    |
| Mosquito bites                               | 0       | 20***    |
| Iron-rich foods—GLV’s                        | 52      | 100***   |
| Millets                                      | 0       | 58***    |
| Pulses                                       | 2       | 72***    |
| Meat                                         | 2       | 62***    |
| Egg                                          | 42      | 64*      |
| Liver                                        | 0       | 86***    |

Identification of Severely Acute Malnourished (SAM) Children and their management and plantation of Poshan Vatikas-Nutri gardens, along with awareness generation regarding importance of early breast feeding, and need for good nutrition during first 1000 days”. This is a low-cost positive approach and needs to be sustained.

*P < 0.05, **P < 0.01 ***P < 0.001
In a thought-provoking article entitled Undersized Indian children: nutrients-starved or hungry for development? [12], Sachdev emphasises the need for a holistic development strategy for combating undernutrition not confined to supplementary feeding. According to him “Other potential determinants of undersize (children) include water, sanitation, and hygiene (WASH); nutrition counselling; maternal characteristics; curative and preventive health care; maternal, household and community resources; literacy; income; women empowerment; safety nets; and genes”.

During our BCC, we have tried to adopt such overall strategy involving food, nutrition, sanitation, and health, to promote nutrition security. Relatively high literacy among even the tribal women helped to communicate through educational pamphlets. Affordability to ensure wholesome diet is indeed a challenge which should receive priority.

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Declarations

Conflict of interest There is no conflict of interest.

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