J Krishi Vigyan 2023, 11 (Supple) : 149-155 DOI : 10.5958/2349-4433.2023.00103.4

Nutrition Garden: A Sustainable Model for Improved Nutrition Security of Rural Mass of Assam, India

Mridusmita Borthakur[1], M. Neog[2], Sanjoy Borthakur[3] Roshmirekha Saikia[4], Dipsikha Hazarika[5], Arifa M. Begum[6], Toslima Begum[7], Sushmita Khatoniar[8], Pompy Bora[9], Asfeeka Islam[10], Porna Sarmah Chakraborty[11], Sapna Chowdhury[12], Bikash Nagaria[13], Manuranjan Gogoi[14], Madhusmita Deka[15], Bhaskar Talukdar[16], Homeswar Mazumdar[17], Sangita Bora Saikia[18], Mrinmoy Chetia[19], Amrita Khound[20], Sourov Dutta[21], Abhilasa Kousik Borthakur[22], Sukanya Gogoi[23], Mandakini Bhagowati[24], Nabanita Nath[25], Bhabes C. Deka[26] and P.K. Pathak[27]

Assam Agricultural University, Assam

ABSTRACT

The KVKs under Assam Agricultural University had conducted 177 numbers of demonstration on nutrition garden at 23 districts of Assam to enhance the food security of farm families. Survey was conducted before and after one year of establishment of nutritional garden to analyze the impact on nutritional status of selected families. It has been revealed from the study that average per capita availability of vegetables increased from 89.62 g/day to 243.09 g/day after intervention of nutrition garden. Crops like cabbage, cauliflower, knolkhol, brinjal, spinach and french bean were produced more than expected yield. Per capita availability of nutrients per day was also recorded to be increased significantly after intervention. It was observed that due to the intervention availability of protein, iron calcium, beta-carotene, vitamin C and folic acid had been enhanced to 26.74%, 44.15%, 32.48%, 341.41%, 132.66% and 56.267%of RDA, respectively. The study also indicated that the availability of vegetables due to intervention had become 81.03% of recommendation level of Indian Council of Medical Research, New Delhi.

Key Words: Consumption, Intervention, Nutrients, Nutrition Garden, Production.

INTRODUCTION

Food security continues to be a matter of serious concern for all the states of India. The State of Assam is situated in the north east of India, has a considerable population under the poverty line and its marginalized population solely depend upon food entitlements mandated under the National Food Security Act (NFSA) 2013. Despite of numerous features which could set it on the upward trajectory of development, Assam does not have shown much improvement in its health and nutrition indicators. With 35 percent of children under 5 years of age were stunted and thirty three percent were under-weight which taken into account both acute and chronic undernutrition. The level of undernutrition is relatively high in rural children.

Corresponding Author's Email: borthakursanjoy@gmail.com

1. Subject Matter Specialist (Community Science), KVK Golaghat, 2. Associate Director of Extension Education, Assam Agricultural University, Jorhat, 3. Senior Scientist and Head, KVK, Jorhat 4. SMS (Community Science), KVK Bongaigaon 5. SMS (Community Science), KVK Lakhimpur, 6. SMS (Community Science), KVK Sunitpur 7. SMS (Community Science), KVK Sivasagar 8. SMS (Community Science), KVK Jorhat 9. PA (Community Science), KVK Udalguri 10. SMS (Community Science), KVK Nagaon 11. SMS (Community Science), KVK Kokrajhar 12. SMS (Community Science), KVK Barpeta 13. PA (Community Science), KVK Cachar 14. SMS (Community Science), KVK Dhemaji 15. PA (Community Science), KVK Kamrup 16. SMS (Plant Protection), KVK Karimganj 17. SMS (Horticulture), KVK Nalbari 18. PA (Community Science), KVK Dibrugarh 19. SMS (Community Science), KVK Tinsukia 20. SMS (Horticulture), KVK Baksa 21. SMS (Horticulture), KVK Karbi Anglong 22. PA (Plant Protection), KVK Darrang 23. SMS (Horticulture), KVK Morigaon 24. SMS (Horticulture), KVK Chirang 25. SMS (PP), KVK Dhubri 26. Senior Scientist and Head, KVK, Golaghat 27. Director of Extension Education, Assam Agricultural University, Jorhat

One third of women and 30% of men of Assam are malnourished and undernutrition is particularly high in younger age group (15-19) especially in rural areas (Anonymoous, 2021).

Nutrition gardens are the micro solution for addressing undernourishment and food insecurity in both urban and rural families. Fruits and vegetables grown in nutrition gardens play an important role in filling the gap in nutritional needs by providing access to food that is harvested, prepared and consumed by family members. Establishment of nutrition garden in the household also enhances access to vegetables and fruits; increases skill, sets in usage of sustainable agricultural practices, utilization of nutri-dense foods, tackling the problem of malnutrition and micronutrients deficiencies in rural areas and also provides additional income generation activities. It involves many crops that can be repeatedly harvested to meet a family's vegetable needs throughout the year. The crops and their varieties are scientifically selected to be highly nutritious with minimum susceptibility to commonly prevalent insect-pests and disease problems. Although the North-eastern states are full of flora and fauna, consumption of fruits and vegetables in the region is very meagre. The daily requirement of vegetable per individual is 300 g as per ICMR but its availability is very low. Many of the rural families used to grow vegetables in their backyards for their household consumption. But still, they lack in adequate consumption of vitamins and minerals because of unorganized cultivation of vegetables.

Nutrition garden is a structured model with multiple crops suited to all the seasons. The crops in the nutrition garden range from leafy vegetables to spices as well as fruit crops covering the entire food basket which cater to the nutritional demands of family. Due to inadequate consumption of vegetables, deficiency of micro-nutrients especially of iron, vitamin A and iodine are prevalent in the state of Assam. Keeping in view the importance of vegetables in daily diets and its low availability to the rural populace, Krishi Vigyan Kendras under Assam Agricultural University situated in 23 different districts of Assam has taken up demonstration programmes for popularization of nutrition garden among the rural farm women following the layout of nutrition garden developed by AAU (2020).

MATERIALS AND METHODS

Study Area

The study was conducted in 23 districts of Assam, *viz.*, Bongaigaon, Jorhat, Golaghat, Tinsukia, KarbiAnglang, Dhemaji, Dhuburi, Lakhimpur, Nagaon, Morigaon, Darrang, Barpeta, Chirang, Nalbari, Kamrup, Sunitpur, Dibrugarh, Sivasagar, Karimganj, Cachar, Baksa, Kokrajhar and Udalguri district of Assam. All total of 177 numbers of nutrition garden was developed and nutritional assessment was conducted by the Krishi Vigyan Kendras under Assam Agricultural University situated in the districts.

Map of Study Area

Layout of Nutrition Garden

Layout of Nutrition Garden developed by AAU, Jorhat (2020) was effectively implemented in all 177 numbers of households, which is cost effective and holistic nutrition garden model aimed at providing nutritious, organic and diverse fresh vegetables to rural families throughout the year.

Distribution of Inputs

Krishi Vigyan Kendra has provided seed and planting material of improved varieties and vermicompost to the selected households. For *kharif* season, the vegetables selected for the garden included amaranthus, okra, bottle gourd, sponge gourd, bitter gourd, brinjal, tomato, cow pea, spinach, and radish whereas for *rabi* season, they were provided seeds/planting material of coriander, fenugreek, spinach, radish, carrot, beet root, cauliflower, cabbage, tomato, brinjal, chilli and green pea. Average yield of all the crops has been recorded.

Observations

After one year of establishment of nutritional garden, a post-survey was done to analyze the impact of nutrition gardens on nutritional status of selected families. Data were collected by face-to-face interview with the help of structured interview schedule. The nutrient availability to every individual member of the household was calculated using the Indian Food Composition Tables by Longvah, *et al*. (2017). Then the nutrient availability was compared with the recommended dietary allowances given by ICMR (2010) for Indian population. The data so collected were analyzed using measures of central tendency, percentage and to study the impact of intervention 't' statistic has been calculated.

RESULTS AND DISCUSSION

Production, purchase and consumption of vegetables before and after establishment of Nutrition Garden

A scientifically laid out nutrition garden helps to meet the entire requirements of fruits and vegetables for a family all the year round. Fruits and vegetable production provides a promising nutritional opportunity for addressing micro nutrient deficiencies. Insufficient production of fruits and vegetables leads to insufficient consumption which contributes to various micronutrient related health problem including energy imbalance. Essential preventive action should be promoted to increase fruits and vegetable consumption in rural families by increasing production.

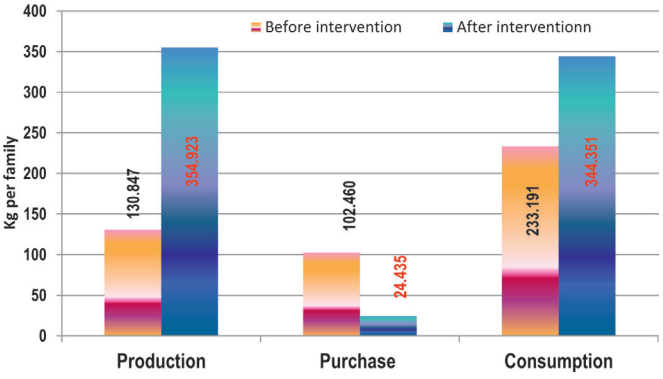

Fig 2. Production, purchase and consumption status of vegetables per family before and after intervention

Fruits and vegetables grown in home gardens play an important role in filling the gap in nutritional needs by providing access to food that is harvested, prepared and consumed by family members (Birdi and Shah, 2016). It was evident (Fig. 2) that demonstration on nutrition garden resulted in tremendous increase in both homestead vegetable production and consumption. It was observed that production of vegetables increased from 130.847 kg per annum to 354.923 kg with a production change of 171% which resulted in increased consumption from 233.191 kg to 344.351 kg per annum with 47.67 percent change in consumption level of the respondents. Thus, availability of vegetables for consumption has been improved to a great extent after intervention. It was found that the change in production, purchase and consumption occurred after intervention was statistically significant and after developing nutrition gardens women saved more than 75 percent of expenditure on vegetable purchase (Table 2). Singh *et al*(2018) and Sudhakarrao (2020) also reported the increased vegetable production after intervention of nutrition garden in Sagar District, Jabalpur.

Average yield obtained against the expected yield from few important crops grown in the nutrition garden

It was evident (Fig.3) that average yield of crops was satisfactory in the nutrition gardens. In

Table 2. Per unit production, purchase and consumption status of vegetables before and after intervention.

Particulars	Before intervention	After intervention	% Change	t statistic
Production (kg)	130.847	354.923	171.25	7.429**
Purchase (kg)	102.460	24.435	-76.15	7.697**
Consumption (kg)	233.191	344.351	47.67	4.730**

** Significant at 1% level of significance

crops like cabbage, cauliflower, knolkhol, brinjal, spinach and French bean, the productivity has been recorded to be even more than expected level of yield. The majority (90-95%) produce from nutrition garden was used for household consumption and rest were either sold out or distributed to neighbours. It was found that maximum production per household as well as all the three groups of vegetables i.e., green leafy vegetables, roots and tubers and other vegetables was during winter. Mohsin *et al* (2017) also reported that kitchen gardens provide cheap vegetables thereby reducing the daily food cost and also protect the environment.

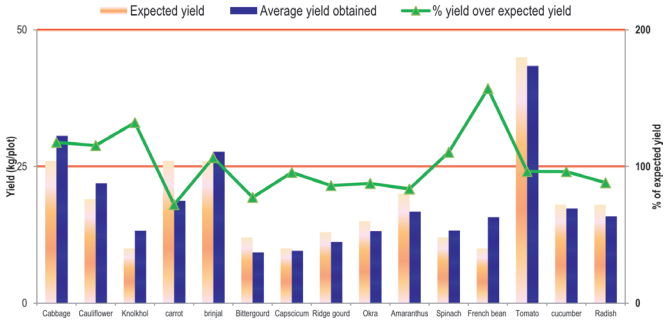

Fig. 3. Average yield obtained against the expected yield from few important crops grown in the nutrition garden

Recommended Dietary intake of fruits and vegetables

The expert committee of Indian Council of Medical Research (ICMR) recommends that every individual should consume at least 300 g vegetables (green leafy vegetables 50 g, other vegetables 200 g, roots and tubers 50 g) and 100 g fresh fruits per day. It is revealed from the Fig. 4 that after intervention of nutrition garden, availability of vegetables has become 81.03% of recommended level while, availability of green leafy vegetables was equivalent to the recommended level, roots and tubers availability was 58.32% and other vegetables availability was 81.85% of recommended level. Kammar *et al*(2017) found that after introduction of nutritional garden, the consumption of fresh vegetables increased in the daily diet which contributed towards the good health.

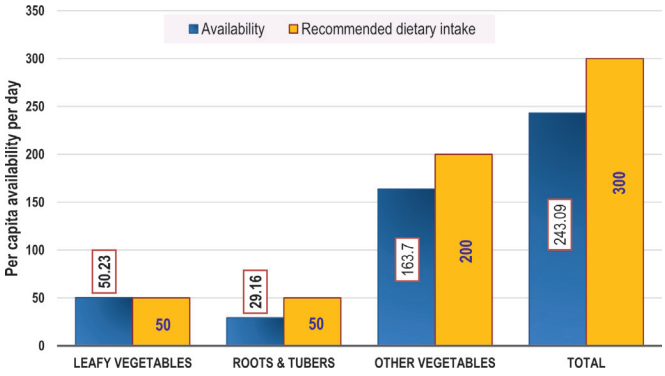

Fig. 4. Availability of vegetables for consumption after intervention from nutrition garden

Per-capita availability of nutrients before and after establishment of Nutrition Garden

The results indicated that a substantial increase of household diet diversity through promotion of nutrition gardens and nutritional needs of the households were significantly met through the year-round production of nutrition garden. Nutrition garden can supplement the micronutrients to the diet, besides providing knowledge on cultivation of vegetables and perennials. Pradhan *et al* (2018) reported positive outcomes in terms of improved household diversity by promoting nutrition garden in Odisha and Maharashtra.

Availability of vegetables in terms of nutrient before and after establishment of nutrition garden (Table 4) reveals that per capita availability

of nutrients/day increased significantly after intervention as compared to before intervention. A case study from Zimbabwe found that nutrition gardens have a positive impact on livelihood as they provide steady incomes (Nyasha *et al*, 2014) and curb diet-related diseases. Another study revealed that the Mesoamerica region, which suffers from poverty and malnutrition, uses home gardens for basic food requirement as well as income generation thereby promoting food security (Montagnini, 2006). Home gardening contributes to household food security by providing direct access to food to the family members (Musotsi *et al*, 2008). UNICEF's community-led Nutrition Gardens in Chhattisgarh sets a good example in promoting nutrition levels, livelihood and improved indicators of food security, and reduction in incidence of diseases associated with malnutrition.

Protein

Protein is a macro nutrient mainly present in animal foods; deficiency of protein leads to stunted growth especially in children. In the present study protein obtained from vegetables were also considered and there is a significant contribution of protein in terms of 26.74 percent of RDA after intervention against 13.03 percent before intervention. (Table 4). Study conducted in Western Kenya found that access to community-based nutrition interventions like kitchen gardens with increase in food production helped in reducing prevalence of stunting in children (Bloss *et al*, 2020).

Iron

Sixty-six per cent of women in Assam are anaemic. Anaemia is particularly high in rural areas compared to urban area of Assam affecting mainly the productive age group of 40-49 years. It was observed from the Table that %RDA in iron has increased to 44.15 after intervention against 20.79 before intervention. Similar results were also reported by Nandal and Vashisth (2009).

Calcium

Although Calcium is mainly present in dairy products after intervention it was observed that the calcium received from vegetables were able to fulfill about 32.48 percent of Recommended Dietary allowances. Increase in calcium intake was also reported by Yusuf *et al* (2008).

Table 4. Availability of nutrients and %RDA from nutrition garden produce before and after intervention.

Nutrients		Before intervention	After intervention	t statistic
Protein	Average (g)	5.995	11.996	4.507**
	%RDA	13.03	26.74	
Iron	Average (mg)	6.028	12.803	11.473**
	%RDA	20.79	44.15	
Ca	Average (mg)	155.958	324.858	6.610**
	%RDA	15.60	32.49	
β - Carotene	Average (µg)	1497.360	2867.812	6.768**
	%RDA	178.26	341.41	
Vitamin C	Average (mg)	44.059	86.228	6.054**
	%RDA	67.78	132.66	
Folic Acid	Average (µg)	60.777	123.787	7.528**
	%RDA	27.63	56.27	

** Significant at 1% level of significance

Vitamin A (β carotene)

Vitamin A has a role in maintaining resistance of the body to common infections. Considering the plentiful presence of Carotenoids in fruits and vegetables that are green or deep yellow/orange in colour, such as green leafy vegetables, carrots, tomatoes, sweet potatoes were incorporated in the layout of nutrition garden which leads to a significant increase of Beta carotene (341.40%) after the intervention. Kammar *et al* (2017) also supported that nutrition garden can play an important role in combating vitamin A deficiency.

Vitamin C

The data (Table 4) revealed that before intervention only 67.783 percent of RDA was fulfilled but after intervention an increase of 132.65 per cent of RDA was observed in case of vitamin C. Vitamin C is an essential nutrient required for healthy bones and teeth. It also promotes iron absorption. This finding is also supported by Yusuf *et al* (2008).

Folic acid

Folic acid is a haemopoietic vitamin essential for multiplication and maturation of red cells in our body. Its deficiency leads to megaloblastic anaemias. Folic acid intake during pregnancy protects the foetus from developing certain congenital defects. It also promotes the birth weight of infants. Folic acid deficiency increases homocysteine levels in blood, thereby increasing the risk for heart disease. Green leafy vegetables, legumes, nuts and liver are good sources of folates. After successful intervention of nutrition garden it is observed that 56.26 percent of RDA can be achieved in case of folic acid.

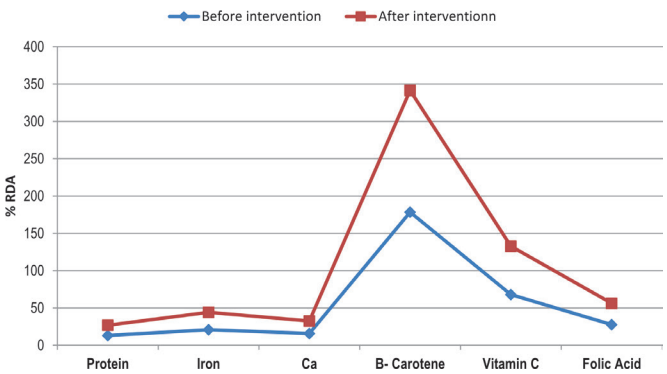

Fig. 5. Percent RDA of nutrients in vegetable produced in nutrition garden before and after intervention

The result showed that the average nutrient uptake has been improved after establishing nutrition garden and it is an effective measure to ensure household food security, health and nutrition. A scientifically laid out nutrition garden helps to meet the entire requirements of fruits and vegetables for a family all the year round. Therefore, establishment of nutrition garden can be advocated as a means for preventing malnutrition, increasing awareness of vegetable production and achieving food, nutrition and economic security for farm families. Rybak *et al* (2018) conducted a study in Tanzania documented kitchen gardens as a promising opportunity to grow fruits and vegetables high in micronutrients and to address food insecurity and malnutrition issues.

CONCLUSION

The establishment of nutrition gardens had immense role in tackling the problem of malnutrition and micronutrients deficiencies in rural areas through year-round vegetable production as vegetables are nutritional powerhouses, key source of micronutrients needed for good health. Promotion of nutrition gardens has increased availability of and access to different groups of vegetables; most of which are being consumed by the households. The improved dietary diversity has the potential to help improve nutrition outcomes in the area and other neighbouring areas. It will also help in conserving crop diversity including some indigenous species as well as strengthen family relationships through sharing of nutrition garden produce with neighbours and relatives. Most of the constraints in nutrition garden recorded can be tackled through proper awareness, trainings and demonstration, which must be carried out by all the stake holders and Govt. can play a major role in this regard.

REFERENCES

Birdi T J and Shah S U (2016). Implementing perennial kitchen garden model to improve diet diversity in Melghat, India." *Global J Health Sci* **8**(4): 10.

Bloss E, Wainaina F and Bailey R C (2004). Prevalence and predictors of underweight, stunting, and wasting among children aged 5 and under in western Kenya. *J Tropical Pediatrics* **50**(5): 260–270.

Kammar M, Biradar A P, Angadi S C and Vidyavathi G Y (2017). Impact of school nutrition garden on the nutrient intake of children. *Asian J Agri Ext, Econ & Sociology* **18**(2): 1-6.

Mohsin M, Anwar M M, Jamal F, Ajmal F and Breuste J (2017). Assessing the role and effectiveness of kitchen gardening toward food security in Punjab, Pakistan: A case of district Bahawalpur. *Int J of Urban Sustain Dev* **9**(1): 64–78.

Montagnini F (2006). Homegardens of Mesoamerica: Biodiversity, food security, and nutrient management, In *Tropical Homegardens* (pp. 61-84. Dordrecht: Springer,).

Musotsi A A, Sigot A J and Onyango M O A (2008). The role of home gardening in household food security in Butere division of western Kenya. *African J Food, Agric, Nutri and Dev* **8**(4): 375–390.

Nandal J K and Vashisth S (2009). Sustainable household food security through nutrition gardens. In: *Proceeding International conference horticulture*, pp. 1966-1967.

Nyasha M, Shiela N and Chikozho Martin C (2014). Effectiveness of Nutrition Gardens in enhancing sustainable livelihood of orphans and vulnerable children: A case study of Mkoba Nutrition Gardens in Gweru Urban, Zimbabwe. *Int J Manage* **2**(5): 209–221.

Pradhan A, Sathanandhan R, Panda A K and Wagh R(2018). Improving household diet diversity through promotion of nutrition gardens in India. *Am J Food Sci Nutr* **5**: 43-51.

Rybak C, Mbwana H A, Bonatti M, Sieber S and Müller K (2018). Status and scope of kitchen gardening of green leafy vegetables in rural Tanzania: Implications for nutrition interventions. *Food Security* 10(6): 1437–1447.

Singh V, Yadav K S and Tripathi A K (2018). Kitchen gardening: A promising approach towards improving nutritional security in rural households. *Int J Microbiol Res* **10** (5): 1216-1219

Sudhakarrao R M (2020). Vegetable nutrition garden: effectual method to improve nutritional security in rural areas of Nanded district. *Int J Res and Rev* **7**(7): 320-324.

UN-ESCAP (2009). Sustainable agriculture and food security in Asia and the Pacific. Bangkok.

Yusuf AM, Mustaque AM and Badirul IM (2008). In: Proceeding of National workshop on multiple cropping held at Bangladesh Agricultural Research Council, Farmgate, Dhaka, Bangladesh on 23-24 April, 2008.

Received on 3/9/2023 *Accepted on 25/10/2023*