



Assessment of Nutritional Security Status in Farm Households from Nutrition Garden in Tonk District of Rajasthan, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Micronutrients deficiencies related malnutrition is quite common in Indian population especially in women and children of rural communities. The main causes of malnutrition are illiteracy, unawareness, low purchasing power, inadequate availability of vegetables and fruits in rural area of Tonk district.

Methods: Keeping this problem into consideration, *Krishi Vigyan Kendra*, Tonk conducted Front Line Demonstration on Nutrition Garden in the villages of Tonk district of Rajasthan. Prior to Front Line Demonstration, training programmes were organized on the importance of Nutrition garden at *Krishi Vigyan Kendra*, Tonk. A well prepared questionnaire was used to assess pre and post knowledge of Nutrition Garden. Pre and post Body Mass Index (BMI) and haemoglobin levels of

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farm women and anthropometric measurements of children were assessed to check the effect of Nutrition garden. For the conduction of Front Line Demonstration on Nutrition garden, 200 families having 4-6 members of Tonk district with the area of 250m² have been selected.

Results: On the basis of results, it was found that average per capita availability of vegetables increased from 57 to 396 gm/day showing an improvement of vegetables consumption at household level. Per capita nutrient availability from Nutrition garden increased significantly in terms of energy, protein, fat, carbohydrates, iron, calcium and beta carotene.

Conclusions: From this study, it is concluded that establishing Nutrition garden proved important technology to improve nutritional status of farm families of Tonk district.

Keywords: Nutrition garden; malnutrition; farm women; haemoglobin level; vegetables.

1. INTRODUCTION

The world population is increasing day by day at a rapid rate. According to the experts, it will reach over 9 billion by 2050 requiring world food production to increase by 70 %. Developing countries are facing chronic food insecurities at a higher rate than developed countries [1]. By 2030, India will have around 1.6 billion population. Increasing population is the main root cause of hunger, food insecurity and Nutrition insecurity. The household level data depicts that the average nutrients intake in Indian population are falling down from the past few years. According to Indian Council of Agriculture Research, an individual should consume at least 550 gm of vegetables and fruits (Green Leafy vegetables-100 gm, Roots and tubers-100 gm, other vegetables- 200 gm, Fruits-150) in a day [2-6]. Continuously increasing prices of fruits and vegetables and decreasing real income and purchasing power of rural people hinder the consumption of these food items leading low productivity.

A Nutrition garden is where fruits and vegetables are grown near the house for household use. Nutrition garden plays an important role in food and nutrition security [7]. Fruits and vegetables are a good source of Vitamins; A, B, K, C, folic acid, minerals; iron, potassium and phytochemicals. On the other hand, they provide palatability enhancing flavour. Regular consumption of fruits and vegetables helps to prevent and cure micronutrient deficiencies disorder like malnutrition, night blindness, anaemia and scurvy. If these deficiencies are not cured, they adversely affect immunity, physical and mental health increasing the rate of premature birth, low birth weight and perinatal mortality. Consumption of fruits and vegetables also helps to control cardiovascular diseases and obesity. Phytochemicals present in fruits and vegetables scavenge free radicals produced in

our body during metabolism reducing the chances of cancer which is a leading problem nowadays [8-11]. Establishing nutrition garden provides not only round the year availability of fruits and vegetables but also access to macro and micronutrients. So the benefits of establishing Nutrition garden are access to fresh fruits and vegetables, increased income, Food and Nutrition security, better health and Nutrition, increased productivity, enhanced social life and last but not the least satisfaction [12-13]. Many of the rural families of Tonk district grow vegetables near their houses or fields. Still they don't get adequate amount of fruits and vegetables because of unorganized cultivation. Keeping in view the importance of Nutrition garden, *Krishi Vigyan Kendra*, Tonk has conducted Front Line Demonstrations under Women in Agriculture discipline in Tonk district of Rajasthan.

2. METHODOLOGY

To ensure proper intake of fruits and vegetables, *Krishi Vigyan Kendra*, Tonk, Banasthali Vidyapith made an effort to establish Nutrition Garden on backyard of the rural area of Tonk district under Front Line Demonstrations. In this line, 100 Demonstrations have been conducted in the villages viz; *Sangrampura*, *Damodarpura*, *Chaturbhujpura*, *Rajwas*, *Shrigovindpura*, *Jalsena*, *Saidabad*, *Pachala* and *Kutka* of Tonk district. 100 Families having 4-6 members have been selected. Data of selected farm families was collected through a well structured questionnaire to elicit information of selected farm families. Area of Nutrition Garden has been kept 250m² and 15 plots have been prepared in it. In Rabi season, Spinach, Fenugreek leaf, Coriander leaf, Beetroot, Raddish, Tomato, Brinjal, Chilli, Cauliflower, Cabbage, Broccoli, Onion, Garlic, Potato and Sweet potato were grown in 15 plots of Nutrition garden. 15 vegetables seeds of Kharif season viz; Bottle

gourd, Cucumber, Sponge gourd, Tomato, Cluster bean, Cowpea, Green chilli, Radish, Spinach, Round gourd, Brinjal, Lady finger, Amaranth, Bitter gourd and Pumpkin have been sowed in different 15 plots of Nutrition garden. Same vegetable seeds were sown in Nutrition garden in Zayad season for round the year availability in farm families. Nutrition garden calendar has also been developed for round the year production of vegetables. To fulfill the basis requirement for establishing Nutrition garden, good quality seeds were procured from IARI, New Delhi and private distributor. Before starting demonstration, trainings on importance of fruits and vegetables on human health, layout preparation of Nutrition garden, seedling raising, importance on proper spacing between plants were organised for better understanding the concept of Nutrition garden. Data of grown vegetables in Rabi, Kharif and Zayad season, yield and consumption pattern were collected every fortnightly from selected farm families. Yield (kg), per capita consumption of vegetables before and after demonstration of Nutrition garden, per capita nutrient availability, gross cost, gross return, net return and B:C ratio have been calculated. Nutrients availability from Nutrition garden was calculated using Indian Food Composition Table, National Institute of Nutrition, ICMR, 2020. Pre and post nutritional status of farm women was also assessed. Body Mass Index (BMI) was assessed using the

formula weight (kg/height m²) and Haemoglobin levels with Sahli's method. In anthropometric measurements of children height and weight were assessed to check malnutrition level of children using WHO standards.

3. RESULTS AND DISCUSSION

3.1 Vegetables Yield and Per Capita Vegetables Availability from Nutrition Garden

According to the Indian Council of Agriculture Research, per capita consumption of vegetables is not according to the RDA (Recommended Dietary Allowances) and consumption of roots and tuber is more in comparison to green leafy vegetables. After establishing Nutrition garden, consumption of vegetables as well as green leafy vegetables increased significantly. The yield of vegetables from Nutrition Garden was 868.7 kg for Rabi, Kharif and Zayad season and per capita availability of vegetables increased significantly from Nutrition garden (Table 1). According to the season wise, results indicated that in Rabi season quantity of vegetables recorded highest while lowest in Zayad season. Requirement of vegetables on the basis of per capita from the Nutrition garden was fulfilled by 115 % in Rabi season, 100 % in Kharif season and 81.2 % in Zayad season (Table 2).

Table 1. Vegetables yield from Nutrition garden during Rabi, Kharif and Jayad season

Serial Number	Vegetables (Rabi)	Vegetable Yield (kg)	Vegetables (Kharif)	Vegetable Yield (kg)	Vegetables (Jayad)	Vegetable Yield (kg)
1	Spinach	22.4	Spinach	19.2	Spinach	18.4
2	Fenugreek leaf	6.2	Cucumber	8.5	Cucumber	9.4
3	Coriander	2.8	Lady finger	16.9	Lady finger	14.6
4	Beetroot	18.6	Cluster bean	14.6	Cluster bean	12.2
5	Raddish	21.4	Sponge gourd	17.3	Sponge gourd	14.8
6	Tomato	17.8	Bottle gourd	39.5	Bottle gourd	28.5
7	Brinjal	32.5	Brinjal	31.8	Brinjal	25.6
8	Chilli	26.7	Bitter gourd	12.6	Bitter gourd	9.8
9	Cauliflower	32.7	Cowpea	6.9	Cowpea	4.6
10	Cabbage	26.9	Amaranths	10.4	Amaranths	8.4
11	Broccoli	16.2	Tomato	24.6	Tomato	18.9
12	Onion	6.4	Chilli	21.5	Chilli	16.5
13	Garlic	39.8	Pumpkin	42.7	Pumpkin	33.8
14	Potato	47.5	Raddish	18.2	Raddish	12.7
15	Sweet potato	23.5	Round gourd	8.5	Round gourd	6.0
Total vegetables yield season wise=		341.4	293.2		234.1	
Grand Total vegetables yield for a year =		868.7				

Table 2. Per capita availability of vegetables from Nutrition Garden (Area 250 sqm)

Season	Per capita availability from Nutrition garden (Kg)	Requirement of vegetables (Kg)	% Difference in availability and requirement (kg)	Requirement fulfilled (%)
Rabi (123 days)	56.9	49.2	↑ 15.65	115
Kharif (122 days)	48.86	48.8	↑ 0.12	100
Jayad(120 days)	39.01	48	↓ 23.04	81.2

(According to ICMR 2020, per capita vegetable requirement is 400 gm)

3.2 Per Capita Consumption of Vegetables before and after Demonstration of Nutrition Garden

Per capita Consumption pattern of vegetables before and after demonstration of Nutrition garden was calculated. Table 3 depicts per capita consumption of vegetables for Rabi, Kharif, Zayad season, for one month and for one day. Per capita consumption of vegetables increased significantly from Nutrition garden. Before demonstration, per capita consumption of vegetable was 57 gram per day and after Nutrition garden demonstration it was increased by 594.7% per day (Fig. 1).

3.3 Nutrients Availability from Nutrition Garden

On the basis of yield of vegetables obtained from Nutrition garden, nutrients were calculated using Indian Food Composition Table, National Institute of Nutrition, ICMR, 2020. Per capita nutrient availability per day for energy, protein, fat, carbohydrates, iron, calcium and beta-carotene was calculated as 149 Kcal, 4.6 gm, 0.9 gm, 34.8 gm, 9.8 mg, 129.4 mg and 1859 µg respectively. Before the demonstration of

Nutrition garden the nutrient availability was found to be 45.73 Kcal energy, 1.69 gm protein, 0.50 gm fat, 3.86 gm carbohydrates, 2.22 mg iron, 39 mg calcium and 503 µg beta-carotene. Table 4 depicts significant increase in nutrients availability from Nutrition garden.

3.4 Economic Evaluation of Nutrition Garden

Economic parameters again important factors for sustainability of any technology. From the calculated B:C ratio, it was inferred that Nutrition garden proved an sustainable technology for food and Nutrition security. For economic evaluation of Nutrition garden, Gross Cost, Gross Return, Net Return and B:C ratio have been calculated. For check it was found Rs. 860 gross cost, Rs. 1230 gross return, Rs. 370 Net return and 1.4 B:C ratio while for demonstration, values were found Rs. 2500 gross cost, Rs. 10550 gross return, Rs. 8050 Net return and 4.22 B:C ratio. It is inferred from the Table 5 that establishing Nutrition garden is profitable having 4.22 B:C ratio. Cost of cultivation also included cost of labour, no matter who has done the job, labour or family members.

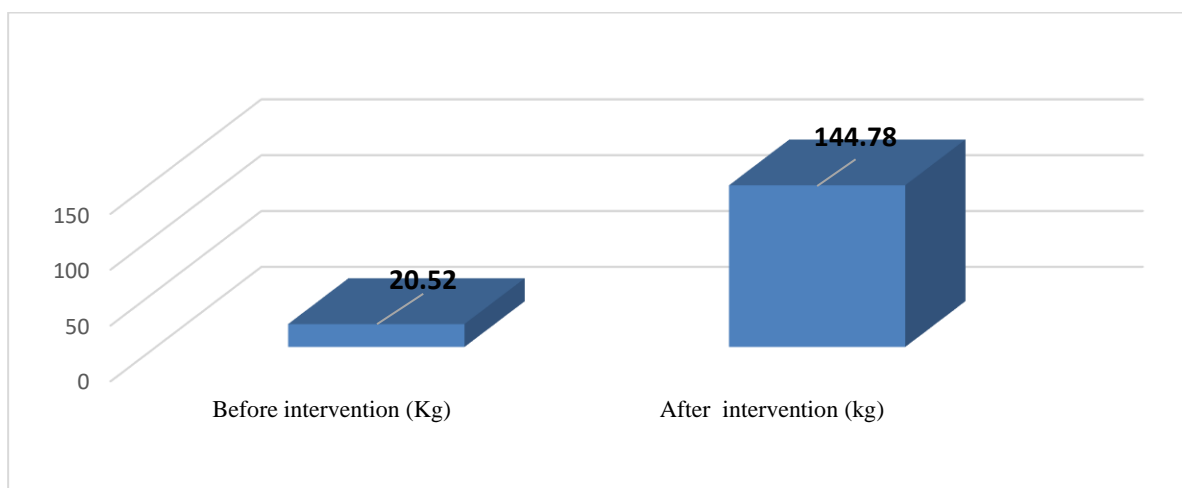


Fig. 1. Pre and Post Per capita Vegetable consumption for Rabi, Kharif and Zayad season from Nutrition garden

Table 3. Per capita consumption of vegetables before and after demo. of Nutrition garden

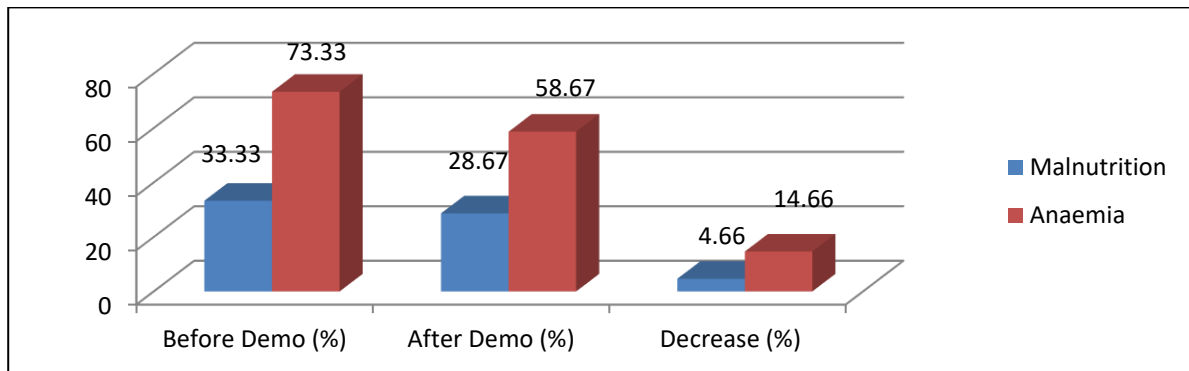
Serial Number	Per capita Vegetable consumption	Before Demonstration (Kg)	After Demonstration (kg)	Percent increase
1	Per capita Vegetable consumption for <i>Rabi</i> , <i>Kharif</i> and <i>Zayad</i> season	20.52	144.78	650.5
2	Per capita Vegetable consumption for one month	1.71	11.88	594.7
3	Per capita Vegetable consumption for one day	.057	0.396	594.7

Table 4. Per capita nutrient availability from Nutrition garden for selected farm families

Serial Number	Nutrient	Per capita nutrient availability/day		Percent difference
		Before	After	
1	Energy (KCal)	45.73	149	225
2	Protein (gm)	1.69	4.6	172
3	Fat (gm)	0.50	0.9	80
4	Carbohydrates (gm)	3.86	34.8	801
5	Iron (mg)	2.22	9.8	341
6	Calcium (mg)	39	129	227
7	Beta carotene (µg)	503	1859	269

Table 5. Economic evaluation of Nutrition garden

	Gross cost (Rs)	Gross return (Rs)	Net return (Rs)	B:C ratio
Check	860	1230	370	1.4
Demonstration	2500	10550	8050	4.22



Graph 1. Malnutrition and Anaemia status before and after Nutrition garden demonstration



Fig. 2. Assessing nutritional status



Fig. 3. Demonstrated Nutrition Garden at field

3.5 Malnutrition and Anaemia Status before and after Nutrition Garden Demonstration

Malnutrition is the main cause of children's morbidity and mortality in rural areas. Nutrition garden played very important role in reducing the status of malnutrition in children in the selected farm families. After the demonstration of Nutrition garden, Malnutrition status of children reduced 4.66 %. Before demonstration of Nutrition garden, the status of anaemia in farm women was recorded as 73.33%. It meant that around 7 in 10 women were found anaemia. The main cause of Anaemia in farm women was not having sufficient sources of iron in their diet. After the demonstration of Nutrition garden, Anaemia status in farm women reduced 14.66% showing remarkable achievement of Nutrition garden (Graph 1).

4. CONCLUSION

The results of Front Line Demonstration showed that there is a lot of potential for getting Food and Nutritional security as a strong foundation for a productive society. So establishing Nutrition Garden could be an effective tool to mitigate the problem of malnutrition which is a leading problem of rural communities of India. This demonstration showed a significant increase in the consumption of vegetables which in turn increased nutrient availability. Icing on the cake is that scientific cultivation of vegetables for their round the year availability encouraged rural communities to establish Nutrition garden in future. Establishing Nutrition garden is profitable having 4.22 B:C ratio. The savings from Nutrition garden was utilized in children's education. So in short, the benefits of establishing Nutrition Garden are access to fresh fruits and vegetables, increased income, food and nutrition security, better Health and Nutrition, increased productivity, enhanced social life and last but not the least satisfaction. This Front Line Demonstration has paved the way of healthier, long, prosperous and ecological life of the rural communities.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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