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Introduction of nutri-garden for household food security in Mahabubnagar district

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Abstract
Healthy life starts with healthy diet. Nutritious rich food promotes productivity and performance of the individual throughout their entire lifespan. From past few years knowledge regarding this field is growing rapidly. It was well-known that vegetables and fruits contains high amount of nutrients, and thereby introducing the Nutri-garden concept to the farm families will not only provide them with required quantity of vegetables and fruits but also help them crud malnutrition. This paper describes the introduction of Nutri-garden for household food security in Mahabubnagar District of Telangana. The intervention started with a detailed baseline survey and its assessment in 2015-16 which motivated to design and promote Nutri-garden in the district. Vegetable Seed kits and saplings were distributed to farm women under the YFA-KVK demonstrations. This study examines intervention of Nutri-garden from the year 2017-18 to 2019-20. A representative sample size of 200 households was selected and their change in food consumption (quantity and frequency) was compared with the data of before (2015-16) and after (2020) intervention. Over the period (2017-2020) the vegetables and fruits produced under Nutri-garden was utilized for household consumption. Monthly per capita consumption (g/CU/person) of fruits and vegetables, both quantities consumed, and frequency of consumption was analyzed. Comparison of data taken at two time periods (before and after intervention), showed that there is a significant difference in the consumption pattern before and after the intervention of Nutri-garden with 99% confidence under paired t test. It was also witnessed that with the introduction of Nutri-garden, green leafy vegetable consumption was improved by 92 percent under daily consumption compared to zero consumption marked before intervention (2015-16) of garden. Therefore, it is concluded that, with the introduction of Nutri-garden there is an increased availability of different groups of vegetables that which fulfilled the daily nutritional requirements of farm families of Mahabubnagr district.

Keywords: nutri-garden, consumption unit, frequency pattern, vegetables and fruits, paired t test

1. Introduction
Nutritional status is vital for human wellbeing and is the measure of health condition which is primary affected with the intake of food and utilization of available nutrition from it. According to the World Health Organization (WHO), healthy life does not mean an absence of disease but a state of complete mental and physical wellbeing for proper productivity and performance of an individual. Good nutritional status can only be realized and sustained when individuals within families and communities are food secure (FAO/WHO, 1992) [1]. Food security is achieved "when all people at all times consume food of sufficient quantity and quality in terms of variety, diversity, nutrient content and safety to meet their dietary needs and food preferences for an active and healthy life, coupled with a sanitary environment, adequate health, education and care" (FAO, 2012) [2].

The global population is growing at a rapid rate and is expected to reach over 9 billion by 2050. It becomes very crucial to produce and feed this continues growing population. It is been predicted that by 2050 the average daily energy need could reach 3050 kcal per person that which demand the global food production to increase by 70 per cent. (FAO, 2014) [3], besides India is suffering from triple burden of widespread poverty, food insecurity and under-nutrition. India is likely to be the most populous country by 2050 with a vast majority of hungry and malnourished people. Over half of the population suffers from chronic food insecurity (Phool Kumari *et al*. 2019) [7]. The lack of ability to access a minimum nutrition requirement, expressed in terms of daily energy intake in calories terms, has serious implications for human development.

Vegetables and fruits contain varying amount of food contents, such as carbohydrates, fats, proteins, vitamins, minerals, etc. Having vegetables and fruits in daily diet benefit the human health in many ways. These are excellent source of Vitamin A, Vitamin C, Potassium and Magnesium. The nutritional intake from fruits and vegetables is higher among urban population than that of rural population (Joanne L. Slavin and Beate Lloyd, 2012.) [5]. Along with the urbanization, people are likely to increase their food intake with fruits and vegetables unlike rural population who are still unbale to access the daily intake of vegetable and fruits as per the recommendation. Indian Council of Medical Research recommends that every individual should consume at least 300 g vegetables and 100 g fresh fruits /day (green leafy vegetables – 100 g, other vegetables 200 g, roots and tubers - 200g) (ICMR -2011)

This paper is focused on improvement achieved with introduction of Nutri-garden for household food security of Mahabaubngar district. The main objective of the study was:

1. To analyze the consumption pattern of vegetables and fruits by farm families of selected mandals of Mahabubnagar district.
2. To measure the average yield of vegetable and fruits produced under Nutri-garden in the selected mandals of Mahabubnagar district.
3. To compare the monthly per capita consumption and to assess the frequency percentage of vegetables and fruits in selected mandals of Mahabubnagar district.
4. To assess the nutrient content from Nutrigarden.

As part of the research, secondary data was collected to identify the health status of rural Mahabubnagar district. As per National Family health survey (2015-16), in the Rural Mahabubnagar dist., 34.9 percentage of childrens' under age five were Underweight (Low weight for age), 37.1 percent were Stunted (low Height for Age) and 18.7 percentage were Wasted (Low Weight for Height) and also 5.6 percentage were Severely Wasted and high levels of Anaemia (>55.8) percent prevails among children under five, adolescent girls and women (18-40 years).

In this scenario, development of innovative interventions for introducing nutrient rich food in the daily diet is crucial, hence the concept of Nutri-garden came into the picture. Nutri-garden as name suggests the garden with diversified vegetables and fruits for every households in their own backyards that improves the access of nutritive rich foods. Nutri-garden is advanced form of kitchen garden with vegetable and fruits which is richest source of essential nutrients and can play an active role in eradicating malnutrition. Besides it can be a good source for additional income. For small and marginal farmers, Nutri-garden can generate a critical contribution to the family diet and provide several other benefits.

2. Materials and Methods

Two mandals from Mahabubnagar district were identified, wherein five villages from each mandal were selected purposively based on the YFA-KVK Nutrigarden demonstrations. They are Metpally, Metpally Thanda, Nagamma Thanda, Kashimnagar and Dathaipally villages from Wanaprthy mandal followed by Kothapally, Nervin, Thirmulaipally, Ranipet Thanda and Shankarampet from Kothakota Mandal.

A sample size of 200 (20 sample from each village) were identified for the study purposively selected on the bases Nutri-garden establishment in their backyards.

In this study both quantitative and qualitative components were covered by undertaking group discussion, 24 hours dietary recall method and individual interviews from each farm families. Baseline survey was taken in the year 2015-16 in order to collect data on consumption of vegetables and fruit, dietary pattern and kitchen garden cultivation and access to vegetables and fruits and food frequency for the month using a questionnaires were carried out.

200 Nutri-garden demonstrations were conducted from ICAR-Youth for Action-Krishi Vigyan Kendra, Mahabubnagar-I for farmwomen from 2017 to 2020 under Poshan Abhiyan programme. Under each demonstrations vegetable seed kits and planting material were distributed as critical inputs in the selected villages.

To assess the impact of nutrition garden on nutritional security of farm families, an end line survey was conducted for the same selected villages in the year 2020. After the intervention of Nutri-garden, the Endline survey was structured on the lines of the baseline for comparison purpose besides data about area, crops grown under nutrigarden, harvesting frequency and yield at each harvest were collected.

3. Results and Discussion

3.1 Food Consumption Pattern

From the Table1, it was depicted that from Kothakota mandal of Mahabubnagar district the average daily consumption of green leafy vegetables, roots and tubers, other vegetables and fruits were 27.7, 69.4, 97.2 3.94 respectively. Secondly from Wanaparthy mandal of Mahabubnagar district, the average consumption of green leafy vegetables roots and tubers, other vegetables and fruits were 41.6, 138.8, 152.7 and 12.5 respectively. This is because it is observed from our baseline survey that the rural Mahbubnagar district farm families consume largely cereal dominated food groups compared to the vegetable and fruits in their daily diet. Therefore, it was witnessed that the Consumption of fruits and Vegetable was below the Recommended Daily Intake (RDI) as mentioned by Indian Council of Medical Research (ICMR).

Table 1: Average Consumption of vegetables and Fruits (g/CU/day) by farm families for the 2015-16

Food Groups	Consumption of vegetables and fruits by households' g/CU/day		RDI
	Kothakota(Mdl.)	Wanaprthy (Mdl)	
Green leafy Vegetables	27.7	41.6	100
Roots and Tubers	69.4	138.8	200
Other vegetables	97.2	152.7	200
Fruits	3.94	12.5	100

3.2 Introduction of Nutrigarden

For the introduction of Nutrigarden in the year 2017 through KVK demonstrations at selected mandals, interested 200 farm families were identified and provided them with vegetable seed kit viz., Green leafy Vegetables (Amaranthus, Spinach, Gogu and Ambati chukka) other vegetables (Tomato, Okra,

Beans Bitter Guard, Bottle Guard and Ridge Guard and roots and tubers (Carrot and Radish) for both kharif and rabi along with planting material of Moringa, Papaya and Mango. Number of awareness programmes in promoting balanced diet for rural households were carried under the demonstrations besides provided them training in planting the seed/sapling in the area 1000 Sq. feet for each demonstration.

Out of 200 households across the two mandals, 100 respondents of Wanaprthy mandal were distributed with seed kit in Kharif followed by 100 members of Kothakota mandal were distributed with seed kit in Rabi

The average quantities (Kgs.) of vegetables produced from both the seasons were presented in Figure 1. Which depicts that, in the initial year of Nutri-garden establishment that is 2017-18 the average production of 1177.42kgs was obtained from Wanaparthy mandal in kharif season followed by 1132.22 kgs of average production was obtained from Kothakota mandal in rabi season. The end-line data (2019-2020) represented that from kharif season the average production obtained from Wanaparthy mandal were 1197.38 kgs and 1186.4 kgs in rabi season from Kothakota mandal.

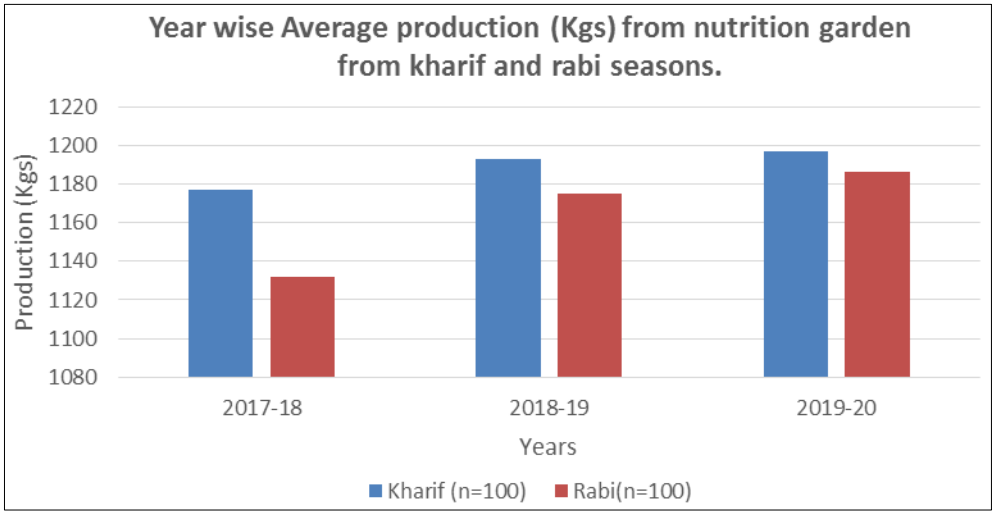

Fig 1: Year wise Average production (Kgs) from nutrition garden from both *kharif* and *rabi* seasons.

3.3 Household food consumption and frequency from Nutri-garden

Monthly per capita consumption (gram(g) per person per month) of vegetables and fruits along with their frequency percentage was worked out before introduction of Nutrigarden under baseline survey (2015-16). This data was compared to that of 2017-2020 data that is after the introduction of Nutri-garden in order to see if there was any improvement in food consumption patter of farm families of the selected villages (Tables 2 and 3).

The null hypothesis is: H0: There is no difference in mean before and after the Nutri-garden establishment. The alternative hypothesis is: H1: There is a difference in mean before and after Nutri-garden establishment. Comparison of data taken at two time periods that is at baseline and end line of the study in selected villages of two mandals showed that the t statistic (t) is 6.035, and p-value (Sig. (2-tailed)) is 0.009. Therefore, we may reject the null hypothesis (of no difference between the means of the two groups) with 95% confidence.

There is strong evidence ($t = 6.035$, $p < 0.01$) that the Nutri-garden intervention improves consumption of green leafy vegetables, other vegetables, roots and tubers and fruits. Alternatively, this can be described as an effect size given by the absolute value of the difference in means divided by the standard deviation which is 3.01 (this is classified as a large effect). The 'Lower' and 'Upper' limits of the 95% confidence interval tell us that we can be 95% confident that the population mean difference between before and after the Nutri-garden intervention is between 1752.509 to 5663 consumption (g/person/month) for 200 respondents.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	After Nutrigarden – Before Nutrigarden	3708.0250	1228.934	614.469	1752.509	5663.540	6.035	3	.009

From the Table 2 and figure 2, It was observed that the food consumption (g/per person/per month) in Wanaparthy mandal for a sample of 100 farm families was increased from the baseline year i.e., 2015-16 to endline year i.e., 2020 gradually. In the year 2015-16 the consumption of green leafy vegetable was 277.6 g, secondly in 2017-18 it was 1249.8 g further the third year i.e., 2019-20 the consumption of green leafy vegetable was increased to 2980g. Similarly, from figure 3, it was depicted that in Kothakota mandal (n=100), the food consumption (g/per person/per month) for green leafy vegetables for the sample of 100 farm families was 464g, 1044g and 2775.6g in the years 2015-16, 2017-18 and 2019-20 respectively. A similar pattern was observed for the other food group i.e., other vegetables, Roots and tubers and fruits.

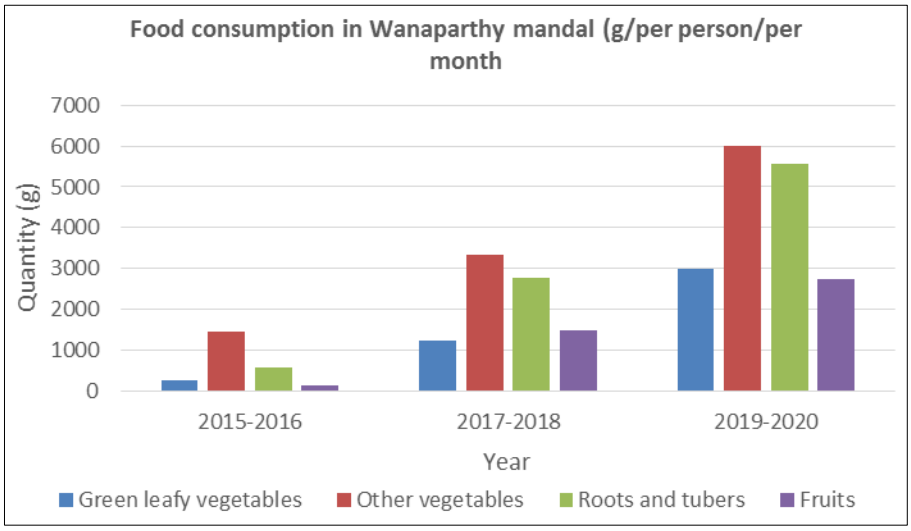

Fig 2: Food consumption in Wanaparthy mandal (g/per person/per month (n= 100)

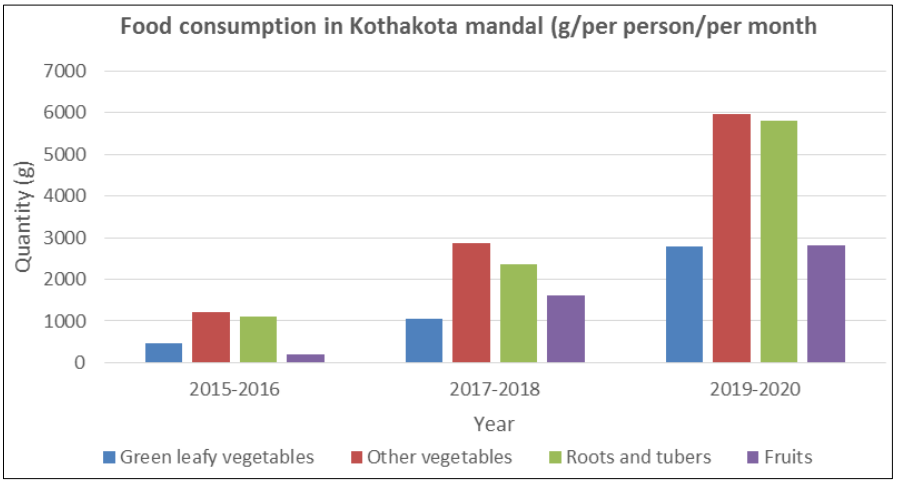

Fig 3: Food consumption in Kothakota mandal (g/per person/per month (n= 100)

Table 2: Comparison of monthly per capita consumption of vegetables and fruits

food groups	Food consumption in Wanaparthy mandal (g/per person/per month (n= 100)			Food consumption in Kothakota mandal (g/per person/per month (n= 100)		
	2015-2016	2017-2018	2019-2020	2015-2016	2017-2018	2019-2020
Green leafy vegetables	277.6	1249.8	2980	464	1044	2775.6
Other vegetables	1458.1	3332.4	5994	1220	2864.4	5958
Roots and tubers	570	2776	5554	1116	2371.2	5805
Fruits	138.8	1500	2748.6	186.6	1620	2805

From the Table 3, frequency of consumption of various food groups for 200 farm families in the selected villages of two mandals was worked out and after introduction of Nutri-garden, the end line data (2019-20) was compared with baseline data (2015-16) to see the improvement in the consumption levels of farm families.

It was witness from the Table 3, that the green leafy vegetable consumption were improved by 92 percent under daily consumption and 5.5 percent was twice a month consumption for the year 2019-20 compared to baseline data (2015-16) which was reported to be 0.00 percent daily and majority of the farm families consumed the green leafy vegetables occasionally by 62.5 percent. Similarly, for the mentioned food groups for three years the frequency consumption was worked and mentioned in the Table 3.

The radical change in the food consumption among the selected farm families was observed, this is because of the regular KVK advisories provided in maintaining Nutri-garden which increased the availability of their own vegetables and fruits, besides greater understanding of nutrition in their life's might have also contributed towards the change in food consumption frequency and for successful adoption of Nutri-garden.

Table 3: Comparison of frequency of consumption of food groups (Percentage of households N = 200).

Food Groups	Year	Daily	Twice	Thrice	Once a Week	Once a month	Occasionally	Never
Green leafy Vegetables	2015-2016	0	1	6	17	17	62.5	5
	2017-2018	87	5	6	3	0	0	0
	2019-2020	92	2.5	5.5	0	0	0	0
Other vegetables	2015-2016	63.5	12.5	9	0	0	0	0
	2017-2018	87	0	13	0	0	0	0
	2019-2020	97.5	0	2.5	0	0	0	0
Roots and Tubers	2015-2016	0	0	0	0	76	13	11
	2017-2018	79	0	21	0	0	0	0
	2019-2020	3.2	0	3.4	93.5	0	0	0
Fruits	2015-2016	0	0	0	0	10.5	89.5	0
	2017-2018	67.5	15	17	0	0	0	0
	2019-2020	91.5	0	8.5	0	0	0	0

3.4 Nutrients availability through nutrition garden.

Fruits and vegetables are universally promoted as nutritive choice for healthy lifestyle. They have historically held a place in food pyramid because of its high composition of vitamins, especially C and A; minerals, electrolytes and antioxidants. Additionally, fruits and vegetables are recommended as a source of dietary fiber (Joanne L. Slavin and Beate LIoyd, 2012.) [5].

In the Table 4, nutritional values of different vegetables and fruits grown under Nutri-gardens for two seasons were calculated with the help of nutritional value index (Table 4). The results indicated that a substantial proportion of the nutritional needs of the households can be met through a year-round maintenance of Nutri-gardens.

Table 4: Nutrients available to each household through nutrition garden (1000 Sq.ft)

S. No	Food item	Production (kg)	Energy (kcal.)	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A (I.U)	Vitamin C (mg)
1	Brinjal	276	66.24	0.82	49.68	1.04	204.2	33.12
2	Tomato	294	67.62	5.6	58.8	5.3	564.5	91.14
3	Okra	92	32.2	1.74	60.72	0.322	47.84	11.6
4	Bitter Guard	276	69	4.4	65.2	1.68	347.7	242.8
5	Bottle Guard	230	27.6	0.46	46	1.05	0	0
6	Ridge Guard	257.6	44	1.3	46.3	1	85	12.88
7	Beans	94.5	48.36	4.25	47.2	1.3	8.5	11.34
8	Spinach	19	4.94	0.38	13.8	0.2	1060.2	5.32
9	Gogu	19	10.6	0.32	32.68	0.4	550.6	3.8
10	Ambati chukka	19	2.85	0.3	11.97	0.14	695.4	2.28
11	Amaranthus	10	6.7	0.6	53	1.84	1419	8.1
12	Carrot	20	9.6	0.18	16	0.2	378	0.6
13	Radish	25	4.25	0.17	8.75	0.1	0.75	3.75

4. Conclusion

It may be concluded that as mentioned in the study, that the health status of rural Mahabubnagar (2015-16) which can be observed as a hindering aspect for rural development. With the introduction of Nutrigarden in the year 2017-18 through YFA- KVK in the selected mandals of Mahabubnagar, people mainly, rural farm women were aware of the importance of nutritive diet and started using adequate quantity of vegetables in their daily routine, this increased the consumption level of vegetables from 2017-2020. This improvement can be multiplied soon into large part of Mahabubnagar district and to the other areas around the district. Besides there are lot of social benefits associated with Nurtigarden which encouraged them to adopt the garden at community level. Therefore, Nutrigarden can be one of the low-cost sustainable approaches for enhancing the nutritional improvement and also mitigate the malnutrition in the farm families. This approach can be scaled up for national benefit through all KVKs by conducting regular extension programmes for motivating rural people from every nook and corner in adopting Nutri-garden.

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