**Impact of School-based Kitchen Gardening and Nutrition Education on Children's Health and Dietary Habits**

**Abstract:**

Over the past 25 years, extensive data on the dietary and nutritional status of rural populations across various Indian states have been collected, conducted by the National Nutrition Monitoring Bureau (NNMB) and the National Institute of Nutrition (NIN), in Hyderabad. These surveys have covered 12 states. The findings reveal that the diets of these rural communities are generally poor and lack essential nutrients. Kitchen or home gardens significantly enhance food security for economically disadvantaged rural families in developing countries. FLD on the establishment of kitchen gardens at schools along with nutrition education is initiated in the Kasthurba Gandhi Balika Vidyalaya school children, who are interested and have unutilized ground, were chosen for the backyard kitchen gardening intervention in the adopted schools. The primary objectives of the study are i) To assess the impact of the school nutrition garden on the micronutrient intake of children, ii) To combat micronutrient deficiency among children, iii) To increase the ability and interest in incorporating healthier foods. In the year 2019-2020, around 100s of Kitchen Garden kits were distributed among schools, in Mydukuru, Khajipeta and Duvvuru mandals of Dr. YSR District, under FLD programme of Dr. YSRHU KVK, Vonipenta. Data on their basic profile was collected, which included information regarding their nutritional assessment, and general information. Statistical analysis was done to calculate the mean values of pre and post-test nutrition education, interviewed consumption patterns, and observed clinical signs and symptoms of the sample and control group.

The study revealed that school kitchen gardening in KGBV, BC, and SC welfare girls’ high schools increased the interest in consuming vegetables when compared to the previous situation, and children enjoyed every day evenings in gardening activities like irrigation, weeding and harvesting. Awareness of deficiencies and symptoms through nutrition education. Organized pre and post-tests evaluation with questionnaire dev. Children observed a significant change in themselves on dysmenorrhea (Iron Deficiency Anaemia). In 10 schools, 8th and 9th class students were selected and volunteered students 1000 (each school, N=100) participated in the kitchen garden activities and nutrition education program. However, around 5000 children consumed the produce along with other vegetables from the market, which decreased expenditure on vegetables, increased the availability of varied vegetables and green leafy vegetables in the diet, and led to an increased consumption. After starting the kitchen gardening activity, the production and consumption of vegetables increased by 85% and 90%, and they were conscious about nutrition aspects. It is recommended that the implementation of school nutrition gardens be mandated for high schools, accompanied by the provision of a school garden kit. Furthermore, ensuring community support is essential for the successful integration and sustainability of these nutrition gardens in high schools.

**Keywords**: Kitchen garden, KGBV, BC, and SC welfare schools, NHRDF, Nutritional education.

**Introduction:**

A balanced diet has always been a priority for humans. However, in India, the situation is dire. Every day, millions go hungry, and potentially over a billion people face malnutrition. Over the past 25 years, extensive data on the dietary and nutritional status of rural populations across various Indian states have been collected, conducted by the National Nutrition Monitoring Bureau (NNMB) and the National Institute of Nutrition (NIN), in Hyderabad, these surveys have covered 12 states. The findings reveal that the diets of these rural communities are generally poor and lack essential nutrients. Even with the many efforts to reduce malnutrition in India, it remains the predominant risk factor for deaths and disease burden in children younger than 5 years and the leading risk factor for disease burden in all ages combined (Swaminathan et al., 2019). Kitchen or home gardens significantly enhance food security for economically disadvantaged rural families in developing countries (Asaduzzaman, 2011). Additionally, poorer households tend to incur higher food costs as they often purchase in smaller, more costly quantities and may travel long distances to access cheaper prices, ultimately offsetting any savings through additional transportation expenses (Smit, 2001). A kitchen garden/ homestead garden includes those people who are the greatest resource for development with a view to improving their livelihood and empowerment as envisaged in the concept of rural university (Singh et al., 2021). Kitchen gardening significantly enhances food and nutritional security by facilitating immediate access to fresh produce that can be harvested, prepared, and consumed by families as needed. This practice represents a critical innovation in increasing vegetable production and offering affordable vegetables directly to consumers. Families can utilize these gardens to access vegetables throughout the year, which is particularly vital in rural areas characterized by low purchasing power and limited access to markets. Vegetables are essential sources of vitamins, minerals, and dietary fibre, playing a crucial role in our diets by supporting numerous bodily functions. Additionally, vegetables contribute to the palatability and digestibility of meals, enhancing overall appetite. Gardening has been shown to alleviate acute stress (Berg, 2011), which in turn enhances the well-being of those involved. Evidence suggests that kitchen gardens have already emerged as a significant supplementary food source in countries like India and Sri Lanka. Moreover, kitchen gardening has demonstrated its cost-effectiveness and sustainability in producing organic vegetables like cauliflower, radish, and turnip (Mohapatra et al., 2024). More than half of the global population experiences chronic food insecurity. Projections indicate that to satisfy the average daily calorie needs of the global population by the 2050s, food production must increase by 70%. School kitchen gardens have been observed to have beneficial effects, particularly on children identified as "non-academic" or those exhibiting "learning difficulties" and challenging behaviours. Teachers described the educational environment as "transformed" for children with complex needs due to the introduction of the garden (Block, 2012).

The present study was carried out by Dr. YSRHU, Krishi Vigyan Kendra, Vonipenta, and has provided seed and seedling of improved NHRDF varieties to the selected 10 schools under Front Line Demonstration program for 2 consecutive seasons (*kharif and rabi*) along with nutrition education.

This paper presents the impact of kitchen gardens established along with nutrition education in schools on the nutrient intake of children.

1. To assess the impact of the school nutrition garden on the micronutrient intake of children.

2. To combat micronutrient deficiency among children

3. To increase the ability and interest in incorporating healthier foods.

**Materials and methods:**

The present work was carried out in KGBV, BC, and SC welfare girls’ high schools in Mydukuru, Khajipeta, and Duvvuru mandals of YSR Kadapa district during the year 2019 to 2020. Nutrition education training programs were conducted in these schools, with a total of 1000 children participating. The objective of the training on nutrition education was to upgrade the knowledge of hostel children from different rural areas regarding the importance of kitchen gardening, nutritional deficiencies, nutritional sources to overcome, and the technical aspects of its establishment. Data on their basic profile was collected, which included information regarding their nutritional assessment, and general information. Before intervention, to find out the nutritional knowledge of children, a pre-assessment with a questionnaire with multiple objectives, was conducted. In 10 schools, each Kitchen Garden in ≤ ¼ ac was taken for establishment, which was underutilized for a playground for children. Statistical analysis was done to calculate the mean values of pre and post-test nutrition education, consumption patterns were interviewed, and clinical signs and symptoms of the sample and control group were observed. Audio visual aids, charts, posters, and drama, role plays by students for nutrition education, were used. The kitchen garden kit contains 13 different vegetables and 5 green leafy vegetables (GLV) seeds procured from National Horticulture Research Foundation (NHRDF), and Perennial fruit crops like Papaya, Banana, Amla and Acid lime, Karonda and Moringa was supported by Horticulture Research Station AR Peta, and Department of Horticulture, YSR Kadapa.

**Results and Discussions:**

Nutrition education played a pivotal role in the growing and maintenance of kitchen gardens by students in schools. Children are committed to growing organic vegetables and consume them in their kitchen. 1000 children were assessed before initiation of FLD through a questionnaire, and the children scored low marks on nutrition knowledge. After intervention, the same assessment with the same questionnaire was organised. The children scored high marks and a lot of change in their attitude and behaviour towards vegetable consumption, healthy habits, and education levels, were observed.

**Table 1. Area reserved by each school for the nutrition garden and the quantity of vegetables harvested**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.NO.** | **Name of the school**  | **Area sown in (gunta)** | **Average GLV quantities Harvested /day in grams** | **Average quantities Harvested/day in grams** |
| 1. | KGBV school Mydukur | 10 | 1500 | 6000 |
| 2. | BC welfare girls’ High school, Mydukur | 9 | 1000 | 5000 |
| 3. | SC welfare girls’ High school, Mydukur | 10 | 1000 | 7000 |
| 4. | KGBV school, Khajipeta  | 7 | 1000 | 6000 |
| 5. | BC welfare girls’ High school, Khajipeta | 10 | 2000 | 8000 |
| 6. | SC welfare girls’ High school, Khajipeta | 9 | 1000 | 6000 |
| 7. | KGBV school, Duvvuru | 9 | 1500 | 6500 |
| 8. | BC welfare girls’ High school, Duvvuru | 9 | 1000 | 8000 |
| 9. | SC welfare girls’ High school, Duvvuru | 10 | 1000 | 7000 |
| 10.  | BC girls high school-2, Mydukur  | 10 | 1000 | 6000 |

The schools vary considerably in their agricultural productivity and focus. BC Welfare Girls’ High School Khajipeta stands out for both the highest total yield and GLV production per gunta, making it the most efficient among the listed schools. Schools like SC Welfare Girls’ High School, Mydukur and BC Welfare Girls’ High School, Duvvuru also show strong total yields. The analysis highlights that while all schools have managed to utilize their resources effectively. Approximately 65 days post-planting, the crops enter a critical growth phase where they reach what can be described as a 'flourishing stage,' achieving full yield potential. At this juncture, the daily harvest ranges between 5,000 to 7,000 grams of mixed vegetables. Additionally, between 1.5 to 3 kilograms of Green Leafy Vegetables (GLVs) are collected each day. This substantial quantity of produce is effectively utilized in the preparation of various nutritious dishes, such as dhal, chutneys, tiffins, and sambar, contributing significantly to the dietary intake of students.

**Table 2. Mean scores of pre and post-test of nutrition education (N=1000)**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **pre-test**  | **post-test** |
| **S.NO.** | **Name of the school**  |  **Sample****(N=500)** | **Control****(N=500)** | **Sample** **(N=500)** | **Control** **(N=500)** |
| 1. | KGBV school Mydukur | 15 | 15 | 36 | 16 |
| 2. | BC welfare girls’ High school Mydukur | 20 | 18 | 41 | 24 |
| 3. | SC welfare girls’ High school Mydukur | 21 | 21 | 45 | 25 |
| 4. | KGBV school Khajipeta  | 18 | 18 | 41 | 29 |
| 5. | BC welfare girls’ High school Khajipeta | 15 | 15 | 48 | 26 |
| 6. | SC welfare girls’ High school Khajipeta | 17 | 17 | 40 | 29 |
| 7. | KGBV school Duvvuru | 18 | 18 | 42 | 26 |
| 8. | BC welfare girls’ High school Duvvuru | 25 | 25 | 48 | 32 |
| 9. | SC welfare girls’ High school Duvvuru | 17 | 17 | 39 | 20 |
| 10.  | BC girls high school-2 Mydukur  | 15 | 15 | 39 | 21  |

The questionnaire comprised 50 questions on the food pyramid, functions of foods, nutritional deficiencies, food sources, clinical symptoms, hygiene, metabolism, vitamins, minerals and their importance in daily life, etc. The greatest improvement in the sample group occurred in schools like the BC Welfare Girls’ High School, Khajipeta and the BC Welfare Girls’ High School Duvvuru. On the other hand, the control groups showed more moderate improvements, with the highest observed at the BC welfare girls’ High school Duvvuru.

The findings indicate that while the government provides a daily supplement of Rs. 2.80 per person for vegetables, this amount is insufficient to meet the required micronutrient intake according to the Recommended Dietary Allowances (RDA). However, the nutrition garden made a significant contribution, particularly in providing iron and beta-carotene to children, although these nutrients still fall short of the ICMR’s recommended levels. Based on these results, it can be concluded that nutrition gardens have the potential to play a crucial role in addressing iron deficiency anaemia and vitamin A deficiency. In addition to supplementing micronutrients in the diet, these gardens offer valuable education on vegetable and perennial cultivation. Research demonstrates that the implementation of nutritional gardens has led to an increase in the consumption of fresh vegetables, enhancing overall health. Studies suggest that incorporating produce from school gardens into school meal programs can elevate the nutritional quality of the meals provided during school lunches. This integration not only enhances nutritional education but may also potentially lower the cost of school meals (Alaimo, 2008; Graham, 2005). Table 3 revealed that children's consumption was higher than before, and complaints of dysmenorrhea among children who are fully involved in the intervention reduced.

**Table 3: Mean percentage of children with iron deficiency anaemia and dysmenorrhea**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **pre-test**  | **post-test** |
| **S.NO.** | **Name of the school**  |  **Sample****(N=500)** | **Control****(N=500)** | **Sample** **(N=500)** | **Control** **(N=500)** |
| 1. | KGBV school Mydukur | 78 | 80 | 45 | 78 |
| 2. | BC welfare girls’ High school Mydukur | 90 | 76 | 40 | 74 |
| 3. | SC welfare girls’ High school Mydukur | 87 | 87 | 44 | 79 |
| 4. | KGBV school Khajipeta  | 90 | 68 | 47 | 79 |
| 5. | BC welfare girls’ High school Khajipeta | 89 | 89 | 34 | 80 |
| 6. | SC welfare girls’ High school Khajipeta | 81 | 89 | 61 | 82 |
| 7. | KGBV school Duvvuru | 79 | 83 | 47 | 75 |
| 8. | BC welfare girls’ High school Duvvuru | 80 | 87 | 48 | 83 |
| 9. | SC welfare girls’ High school Duvvuru | 83 | 91 | 48 | 87 |
| 10.  | BC girls high school-2 Mydukur  | 82 | 90 | 42 | 83 |

Prior to the implementation of the intervention (pre-test), high prevalence rates of iron deficiency anaemia and dysmenorrhea were observed across all schools. For instance, all schools in Mydukur, Khajipeta and Duvvuru had a prevalence of 78% to 91% in the sample and control group. Following the intervention (post-test), a marked reduction in these prevalence rates was noted in the sample groups of most schools, suggesting a positive effect of the intervention. Specifically, the BC welfare school experienced a decrease in prevalence from 89% to 34% within the sample group, whereas the control group exhibited no significant change, maintaining a prevalence rate of 78%. This differential outcome highlights the potential efficacy of the intervention in mitigating iron deficiency anaemia and dysmenorrhea among the children in hostels.

**Conclusion:**

These findings suggest that kitchen gardens at schools provide children with a steady source of fresh, organic vegetables and facilitate the acquisition of nutritional and crop management knowledge. Based on these outcomes, it is recommended that the implementation of school nutrition gardens be mandated for high schools, accompanied by the provision of a school garden kit. Furthermore, ensuring community support is essential for the successful integration and sustainability of these nutrition gardens in high schools.

**COMPETING INTERESTS DISCLAIMER:**

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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1.

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3.

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