

Improving food and nutritional security of small and marginal coconut growers through diversification of crops and enterprises

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Abstract

This paper presents the impact of integrating interventions like nutrition gardening, livestock rearing, product diversification and allied income generation activities in small and marginal coconut homesteads along with nutrition education in improving the food and nutritional security as well as the income of the family members. The activities were carried out through registered Community Based Organizations (CBOs) in three locations in Kerala, India during 2005-2008. Data was collected before and after the project periods through interviews using a pre-tested questionnaire containing statements indicating the adequacy, quality and diversity of food materials. Fifty respondents each were randomly selected from the three communities, thereby resulting in a total sample size of 150. The data was analysed using SPSS by adopting statistical tools like frequency, average, percentage analysis, t – test and regression.

Participatory planning and implementation of diverse interventions notably intercropping and off-farm activities along with nutrition education brought out significant improvements in the food and nutritional security, in terms of frequency and quantity of consumption as well as diet diversity. At the end of the project, 96% of the members became completely food secure and 72% nutritionally secure. The overall consumption of fruits, vegetables and milk by both children and adults and egg by children recorded increase over the project period. Consumption of fish was more than the Recommended Dietary Intake (RDI) level during pre and post project periods. Project interventions like nutrition gardening could bring in surplus consumption of vegetables (35%) and fruits (10%) than RDI. In spite of the increased consumption of green leafy vegetables and milk and milk products over the project period, the levels of consumption were still below the RDI levels. CBO-wise analysis of the consumption patterns revealed the need for location-specific interventions matching to the needs and preferences of the communities.

Keywords: food and nutritional security, diversification, intercropping, livestock rearing, community based organizations, consumption pattern, dietary intake, diet diversity

1 Introduction

Food and nutritional security is an integral component of economic growth and development of the society. Usually the development will be measured in terms of economic and social indicators. Economic upliftment not only implies increase in income, but also the well

being in terms of food and nutritional security of the communities. Household food security is a function of availability of food coupled with the purchasing power available with each household. USAID (1992) defines food security as, “when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life.” A Discussion Paper on Research into the Effectiveness of Sustainable Agriculture Projects by the NGO Food Security Program Effectiveness Group (Caouette *et al.*, 2002) reviewed that at least four factors were at work in small-scale agriculture interventions with positive food

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security and nutrition outcomes: women's perspectives and priorities are reflected in project planning and implementation; knowledge of nutrition is strengthened through targeted education; agricultural diversity and ecological processes are promoted in agricultural production systems; options are created for people to pursue a range of livelihood strategies. While formulating any research project to improve the food and nutritional security, it should encompass options of interventions for local production of food materials, additional income generation activities which can enhance the purchasing power for procuring other essential food items as well as the generation of knowledge for efficient utilization of available food items through proper processing and storage.

The small and marginal coconut growers in most of the coconut growing countries are facing difficulties to sustain the livelihoods of their families from coconut-derived income alone. Apart from improving their income, it is equally important to enhance the food and nutritional security of their family. A concerted effort was undertaken with this purpose in strategically selected coconut-growing communities through a project network entitled 'Overcoming Poverty in Coconut-Growing Communities: Coconut Genetic Resources for Sustainable Livelihoods in India', supported by IFAD / COGENT / Bioversity International with 11 coconut growing countries as partners. In India, the project was implemented by the Regional Station, Kayangulam, Kerala of the Central Plantation Crops Research Institute. The major objectives of the project were to improve food and nutritional security and income of the family members of the small and marginal coconut holdings through diverse interventions like nutrition gardening, livestock integration, product diversification and allied income generation activities along with nutrition education for proper utilization of the available food materials.

2 Methodology

The project was implemented in three locations namely Pathiyoor, Devikulangara (Alappuzha Dist.) and Thodiyoor (Kollam Dist.) in Kerala during 2005-2008 (Figure 1). In all the three project areas, Community Based Organizations (CBOs) were established and registered with around 100 active members. A total amount of US\$ 10,000 was disbursed to these communities as microcredit, which was utilized mainly for intercropping including nutrition gardening, nursery establishment, livestock rearing, production of high value products, mushroom production and azolla cultivation.

The activities were carried out through the CBOs based on the annual action plans prepared by the members. The major goals of CBOs were to improve the

productivity and efficiency of coconut-based farming systems through intercrops, livestock and to establish agro-processing enterprises based on coconuts and intercrops, thereby resulting in higher income and improved food and nutritional security. Effective linkages were established with various agencies for technological support, input supply and credit facilities. The CBO members were supported through provision of inputs, appropriate technologies, village level equipments and capacity building for improving the technical and managerial abilities. The CBOs are also envisioned to eventually continue the activities that had been initiated by the project in partnership with them, sustain and hopefully expand the activities and benefits to the members and to other communities beyond the project duration.

The interventions were selected with emphasis to improve food and nutritional security along with income enhancement. The communities selected suitable intercrops – both cash and food crops for meeting all their requirements. Crops such as tubers were intended to enhance food security of the members, whereas fruits, vegetables and mushrooms for improving nutritional status. The community members were also trained on the production of high value products like baby food and other nutritional foods from locally available raw materials. Nutrition gardening, livestock integration and mushroom production were the other activities introduced for improving the nutritional security of the members. Apart from these, effective recycling of coconut and other crop wastes through vermicomposting was introduced in all the communities to improve crop production and to keep the homesteads free of wastes.

Food and nutritional status of the community members were collected before and after the project periods to analyse the impact of the project interventions in improving the standard of living. The food consumption pattern of the individuals in the three locations were also measured before and after the project to observe the differences in the dietary habits between localities as well as the changes occurred over the project period. Data was collected through personal interviews using a pre-tested questionnaire. A detailed questionnaire containing statements indicating the adequacy of food materials for measuring the food security and nutritional quality of food materials to measure the nutritional security was used for data collection. The statements on the food and nutritional security situations experienced by the clients during the past three months prior to the time of interview were rated on a continuum with options never, sometimes and always. As all the statements reflected inadequacy of food and nutritional conditions, the option 'never' was taken as a completely secure condition, 'sometimes' as a moderately secure condition and 'always' as insecure condition. The percentage of respondents under each option was worked out statement-wise and the average for all the statements was taken for this



Fig. 1: Map showing project areas

purpose. From each of the communities, 50 respondents each were randomly selected, thereby resulting in a total sample size of 150. The collected data was coded and analysed using SPSS by adopting statistical tools like frequency, average, percentage analysis, t – test and regression.

3 Results

3.1 Change in poverty status and income

Significant change was recorded in the poverty status after the project, in terms of the number of holdings below the poverty threshold level (IUS \$ per head per day). The percentage of holdings below the threshold level reduced from 95 to 56. The highest reduction in poverty incidence was recorded in Pathiyoor CBO (48%), followed by Devikulangara (36%) and Thodiyoor (34%).

Due to the project efforts, the income from intercrops increased by four folds, livestock rearing by six folds and household level processing by 33 folds. The average annual per capita income enhanced from US \$ 140 to US \$ 320 over the project period.

3.2 Food and nutritional security

The respondents were categorized as completely secure, moderately secure and insecure in the case of food

and nutritional security and the results are presented in Table 1.

A significant change (t-test) in the food and nutritional status was noticed after the project period. Regarding food security, the overall data for the three sites revealed a better position with 67% of the CBO members in the completely secure category during the pre-project period, which was further enhanced to 96% with the project efforts. But, in the case of nutritional security, the percentage of respondents under the completely secure category was only 8 before the project, which showed a remarkable increase to 72 after the project. After the project period, none of the CBO members fell under the totally insecure category for both food and nutritional security.

Although the mean difference in income as well as food and nutritional security gives an indication of the

Table 1: Level of food and nutritional security

| Category | Food security (%) | | Nutritional security (%) | |
|-------------------|-------------------|--------------|--------------------------|--------------|
| | Pre-Project | Post-Project | Pre-Project | Post-Project |
| Completely secure | 67 | 96 | 8 | 72 |
| Moderately secure | 31 | 4 | 76 | 28 |
| Insecure | 2 | 0 | 16 | 0 |

Table 2: Summary of outcome indicators

| Explanatory variables | Significant influence of project by income category [†] | | | | Food & Nutritional security |
|-----------------------|--|-----------|----------|--------------|-----------------------------|
| | Intercrop | Livestock | Off-farm | Total income | |
| Pathiyoor | 151.61** | – | 94.45* | 1993.75*** | + 4 |
| Thodiyoor | – | – | 136.02* | 1719.80*** | + 4 |
| Devikulangara | 145.29*** | – | – | 1524.88*** | + 4 |
| Overall | 105.53*** | – | 71.09** | 1561.71*** | + 4 |

[†] These are the coefficients of the second stage regressions. Coefficient significant at * 0.10 level, ** 0.05 level and *** 0.01 level

change that occurred during the course of the project, it does not determine whether these changes have been caused by the project itself or whether external factors have caused this change. Hence, the influence of project on income as well as food and nutritional security was statistically worked out by second-stage regression with ordinary least square. Table 2 shows an overview of the regressions for the outcome indicators like intercrop, livestock, off-farm and total income and food and nutritional security. The food and nutritional security was measured using the following statements with the question for respondents to indicate whether in the last three months prior to the time of interview they experienced the situations never, sometimes or always:

- (1) I worry whether my food will run out before I get some more money to buy more.
- (2) The food that I bought just didn't last and I didn't have money to get more.
- (3) I ran out of the food that I needed to put together a meal and I didn't have money to get more food.
- (4) I cannot afford to give my child(ren) a balanced meal.

The column of food and nutritional security shows the change in the occurrence of the four situations. The indicated numbers are derived by giving a value of +1 for a positive change, –1 for a negative change and 0 for no change for each situation and adding them for the total four situations.

Very clear impact on both income and food and nutritional security has been obtained for all the three sites as well as for the overall data. All the four situations related to food and nutritional security recorded positive changes, indicating a completely secure condition. In general, the project could make significant improvement in the income derived from intercrops and off-farm income. At Pathiyoor, the project significantly influenced income from intercrops and off-farm activities, while, the influence was on off-farm income at Thodiyoor and on intercrop income at Devikulangara.

3.3 Coping mechanisms versus food and nutritional security

The coping mechanisms adopted by communities before and after the project (Table 3) were recorded as they are directly linked to the food and nutritional security as well as poverty status.

Among the coping mechanisms to improve the food and nutritional security, homestead/ backyard gardening had a prominent role with an adoption level of 87% followed by food processing (85%) and livestock/fish/poultry rearing (64%). Even if these mechanisms were being practiced earlier by the members, significant increase was noticed during the project period. In addition, the income through these activities was further enhanced through modified adoption of the existing practices. Substantial reduction in the percentage of respondents (55), who borrowed money for food, is an indication of the self reliance developed through adoption of project interventions as a coping mechanism.

The improved rate of adoption of coping mechanisms is a clear indication of the impact of project interventions on the socio-economic conditions and food and nutritional security of the CBO members, thereby supporting the regression data on project influence on various income generation activities.

Table 3: Coping mechanisms to improve food and nutritional security

| Coping mechanism | Adoption (%) | | |
|----------------------------------|--------------|--------------|--------|
| | Pre-Project | Post-Project | Change |
| Homestead/Backyard gardening | 41 | 87 | +46 |
| Food processing | 55 | 85 | +30 |
| Livestock/ Fish/ Poultry rearing | 32 | 64 | +32 |
| Borrowing money for food | 60 | 5 | –55 |

Table 4: Percentage of children and adults consuming specific foods in a day (CBO-wise)

| Food items | Pathiyoor | | | | Thodiyoor | | | | Devikulangara | | | |
|------------------------------------|--------------|------|------------|------|--------------|------|------------|------|---------------|------|------------|------|
| | Children (%) | | Adults (%) | | Children (%) | | Adults (%) | | Children (%) | | Adults (%) | |
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Cereals and Tuber crops | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Fish, Meat, Poultry | 40 | 88 | 44 | 88 | 80 | 96 | 84 | 96 | 80 | 96 | 84 | 96 |
| Eggs | 8 | 32 | 4 | 8 | 8 | 36 | 4 | 4 | 44 | 56 | 12 | 16 |
| Milk, Milk products | 40 | 68 | 4 | 24 | 56 | 68 | 12 | 24 | 64 | 80 | 20 | 20 |
| Green, Leafy, Yellow vegetables | 28 | 44 | 32 | 44 | 16 | 24 | 16 | 24 | 24 | 40 | 24 | 40 |
| Other vegetables | 24 | 92 | 24 | 92 | 16 | 36 | 16 | 36 | 24 | 68 | 24 | 68 |
| Fruits | 12 | 44 | 8 | 44 | 4 | 20 | 4 | 12 | 12 | 40 | 8 | 28 |
| Fats and Oils | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Sugars and Sugar products | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Others (Pulses, Coconut meat etc.) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

3.4 Improvements in the consumption pattern and dietary intake

The frequency of intake of different food items and their quantity were assessed before and after the project to evaluate the change in food and nutritional security status. CBO-wise daily consumption of specific foods by children below the age of 6 years and adults is given in Table 4.

In general, the percentage of both children and adults consuming vegetables, fish /meat/egg, milk and fruits daily has increased over the project period. CBO-wise analysis revealed glaring impacts on the daily consumption of vegetables at Pathiyoor, followed by Devikulangara. Majority of the CBO members from Pathiyoor adopted intercropping interventions as it was a traditional tract of vegetables, banana and tuber crops thereby increasing the consumption. In case of Devikulangara, which is close to backwaters, an increase in vegetable consumption was noticed due to higher production achieved through the identification of vegetable varieties suited to the locality. But the increase in consumption of vegetables was only marginal in Thodiyoor mainly because of the preference of non-vegetarian diets by the community. This implies that the interventions selected should be suited to the locality and compatible to the needs and preferences of the communities.

Further analysis of the overall change in the percentage of children and adults consuming specific foods in a day was made and results are given in Table 5.

Significant change was observed in the percentage of children and adults consuming specific foods like vegetables other than green leafy and yellow, fish/meat products and fruits daily. Further, the percentage of children consuming eggs and milk daily also showed moderate improvement.

As the data on daily consumption (in terms of percentage of respondents) of food items except fish/ meat by children and adults and milk by children during pre-project period was low, data on average number of days of consumption was worked out and are given in Table 6.

Even during the pre-project period, all the respondents were taking cereals/tubers, fats and oils, sugars and other products like pulses, coconut meat etc. daily. The analysis indicated that the consumption of other food items in terms of the average number of days per week increased in all the three CBOs. CBO-wise analysis revealed frequent consumption of fish/meat (average of 6 days/week) both before and after the project in Thodiyoor and Devikulangara, whereas, in the case of Pathiyoor, an increase of 4 to 6 days / week was observed. Improvements in the consumption of fruits and vegetables were also noticed in Pathiyoor and Devikulangara.

The overall data revealed significant changes in the consumption frequency of fruits by both children (111%) and adults(156%), egg consumption by children (130%) and milk and milk products by adults(81%). Moderate improvement (38%) was only noticed in the case of vegetables for both children and adults.

As the food security situation in the project areas was moderate, it was very much essential to assess the quantity of consumption along with the frequency of consumption. The CBO-wise data related to this are presented in Table 7.

CBO-wise consumption data indicated improvements in the consumption of tuber crops, vegetables and fruits in Pathiyoor and milk and milk products in Devikulangara. This may be due to the adoption of more intercropping interventions at Pathiyoor and livestock inter-

Table 5: Percentage of children and adults consuming specific foods in a day (Overall for 3CBOs)

| Food items | Children (%) | | | Adults (%) | | |
|------------------------------------|--------------|------|--------|------------|------|--------|
| | Pre | Post | Change | Pre | Post | Change |
| Cereals and Tuber crops | 100 | 100 | 0 | 100 | 100 | 0 |
| Fish, Meat, Poultry | 67 | 93 | 26 | 71 | 93 | 22 |
| Eggs | 20 | 41 | 21 | 7 | 9 | 2 |
| Milk, Milk Products | 53 | 72 | 19 | 12 | 23 | 11 |
| Green, Leafy, Yellow vegetables | 23 | 36 | 13 | 24 | 36 | 12 |
| Other vegetables | 21 | 65 | 44 | 21 | 65 | 44 |
| Fruits | 9 | 35 | 26 | 7 | 28 | 21 |
| Fats and Oils | 100 | 100 | 0 | 100 | 100 | 0 |
| Sugars and Sugar products | 100 | 100 | 0 | 100 | 100 | 0 |
| Others (Pulses, Coconut meat etc.) | 100 | 100 | 0 | 100 | 100 | 0 |

Table 6: CBO-wise consumption frequency of specific foods by children and adults in a week (average no. of days)

| Food items | Consumption frequency (average no. of days per week) | | | | | | | | | | | |
|------------------------------------|--|------|------------|------|--------------|------|------------|------|---------------|------|------------|------|
| | Pathiyoor | | | | Thodiyoor | | | | Devikulangara | | | |
| | Children (%) | | Adults (%) | | Children (%) | | Adults (%) | | Children (%) | | Adults (%) | |
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Cereals and Tuber crops | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Fish, Meat, Poultry | 3.8 | 6.3 | 4.2 | 6.3 | 5.8 | 6.8 | 6 | 6.8 | 5.5 | 6.7 | 6.4 | 6.8 |
| Eggs | 1.4 | 3.9 | 0.4 | 1.4 | 1.1 | 3.5 | 0.6 | 1.4 | 2.9 | 5.1 | 1.4 | 1.2 |
| Milk, Milk Products | 3.4 | 5.5 | 1.2 | 2.5 | 4.2 | 5.6 | 1.2 | 3.0 | 5.0 | 6.4 | 2.0 | 2.5 |
| Green, Leafy, Yellow vegetables | 2.8 | 4.3 | 2.8 | 4.3 | 2.6 | 3.6 | 2.6 | 3.6 | 3.1 | 3.8 | 3.1 | 3.8 |
| Other vegetables | 3.9 | 6.7 | 4.1 | 6.7 | 2.8 | 4.8 | 3.3 | 4.8 | 4.2 | 6.0 | 4.4 | 6.0 |
| Other Fruits | 1.7 | 4.5 | 1.3 | 4.3 | 1.0 | 3.0 | 0.8 | 2.7 | 2.6 | 3.7 | 1.8 | 3.0 |
| Fats and Oils | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Sugars and Sugar products | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Others (Pulses, Coconut meat etc.) | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |

ventions at Devikulangara based on the requirement of the CBO members. In general, consumption of fruits increased in all the three sites mainly because of the project efforts to plant banana in each homestead. The awareness created on the importance of balanced diets also would have resulted in improved food habits.

Pre and post-project data related to overall quantity of specific foods consumed and the consumption deficit in relation to recommended dietary intake (RDI) are given in Table 8.

Quantity of consumption followed a similar trend as that of consumption frequency of specific foods. The overall consumption of fruits, vegetables and milk by both children and adults were increased over the project period. Consumption of eggs by children also increased. When we compare the consumption with recommended

dietary intake (RDI) for an adult Indian, it is interesting to note that the consumption of fish was 30% more even before start of the project, while the consumption of all other food items were below the RDI. Post - project data showed increased consumption of fish (80%), other vegetables (35%), fruits (10%) and fats and oils (5%) than RDI. Even though the consumption of green leafy vegetables and milk and milk products increased during the project period, the post-project consumption quantities are far below the RDI levels. The consumption of cereals both before and after the project was found to be below the RDI levels.

3.5 Improvements in the diet diversity

Another indicator of the food and nutritional security is the diversity of diets. Diet which includes di-

Table 7: Quantity of specific foods consumed by children and adults – CBO-wise (g/day)

| Food items | Consumption quantity (g/day) | | | | | | | | | | | |
|------------------------------------|------------------------------|------|------------|------|--------------|------|------------|------|---------------|------|------------|------|
| | Pathiyoor | | | | Thodiyoor | | | | Devikulangara | | | |
| | Children (%) | | Adults (%) | | Children (%) | | Adults (%) | | Children (%) | | Adults (%) | |
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Cereals | 98 | 115 | 255 | 296 | 85 | 102 | 275 | 307 | 86 | 107 | 266 | 294 |
| Tuber crops | 13 | 22 | 28 | 63 | 15 | 30 | 32 | 43 | 13 | 14 | 30 | 41 |
| Fish | 17 | 22 | 35 | 48 | 18 | 23 | 54 | 63 | 18 | 22 | 43 | 52 |
| Meat | 4 | 7 | 6 | 9 | 5 | 9 | 11 | 14 | 5 | 6 | 8 | 12 |
| Eggs | 10 | 25 | 5 | 10 | 10 | 25 | 3 | 10 | 20 | 33 | 10 | 8 |
| Milk, Milk Products | 120 | 193 | 48 | 114 | 62 | 106 | 41 | 60 | 82 | 230 | 55 | 85 |
| Green, Leafy, Yellow vegetables | 6 | 18 | 12 | 26 | 8 | 14 | 6 | 16 | 4 | 8 | 5 | 9 |
| Other vegetables | 33 | 64 | 41 | 107 | 26 | 34 | 44 | 69 | 24 | 33 | 31 | 68 |
| Fruits | 13 | 55 | 7 | 38 | 5 | 33 | 3 | 19 | 26 | 58 | 18 | 41 |
| Fats and Oils | 9 | 10 | 15 | 22 | 10 | 13 | 16 | 19 | 9 | 10 | 19 | 21 |
| Sugar and Sugar products | 30 | 32 | 16 | 23 | 20 | 33 | 10 | 25 | 25 | 32 | 21 | 23 |
| Others (Pulses, Coconut meat etc.) | 15 | 15 | 35 | 41 | 11 | 19 | 25 | 31 | 15 | 23 | 31 | 33 |

Table 8: Quantity of specific foods consumed by children and adults – Overall for 3 CBOs (g/day)

| Food items | Consumption quantity (g/day) | | | | | | | | |
|------------------------------------|------------------------------|------|--------|------------|------|--------|------|--------------------------------|--|
| | Children (%) | | | Adults (%) | | | | | |
| | Pre | Post | Change | Pre | Post | Change | RDI* | Deficit / Surplus [†] | |
| Cereals | 90 | 108 | 20 | 265 | 299 | 13 | 460 | -161 (35) | |
| Tuber crops | 14 | 22 | 57 | 30 | 49 | 63 | 50 | -1 (2) | |
| Fish | 18 | 22 | 22 | 44 | 54 | 23 | 30 | +24 (80) | |
| Meat | 5 | 7 | 40 | 9 | 12 | 33 | } 30 | -9 (30) | |
| Eggs | 13 | 28 | 115 | 6 | 9 | 50 | | | |
| Milk, Milk Products | 88 | 176 | 100 | 48 | 86 | 80 | 150 | -64 (43) | |
| Green, Leafy, Yellow vegetables | 6 | 13 | 122 | 8 | 17 | 113 | 50 | -33 (66) | |
| Other vegetables | 28 | 44 | 60 | 39 | 81 | 109 | 60 | +21 (35) | |
| Fruits | 15 | 49 | 224 | 9 | 33 | 263 | 30 | +3 (10) | |
| Fats and Oils | 9 | 11 | 22 | 17 | 21 | 24 | 20 | +1 (5) | |
| Sugar and Sugar products | 25 | 32 | 28 | 16 | 24 | 50 | 30 | -6 (20) | |
| Others (Pulses, Coconut meat etc.) | 14 | 19 | 36 | 30 | 35 | 17 | 40 | -5 (13) | |

* Source: National Nutrition Monitoring Bureau (1991)

[†] Figures in parenthesis are in percentage

verse types of foods is internationally recommended as a healthy one. Improvements in the number of food items included in the diet over the project period were measured and are presented in Table 9.

Overall diet diversity data showed that majority of the children (53%) in all the three communities had very

good diet diversity before the project, whereas, majority (54%) got shifted to the excellent condition after the project, recording a change of 31%. In the case of adults, a reduction to the tune of 30% was observed in the good category, which was shifted to very good and excellent conditions.

Table 9: Distribution of diet diversity of adults and children in percentage (Overall for 3 CBOs)

| Rating based on number of food items | Children (%) | | | Adults (%) | | |
|--------------------------------------|--------------|------|--------|------------|------|--------|
| | Pre | Post | Change | Pre | Post | Change |
| 10 (excellent) | 23 | 54 | 31 | 4 | 20 | 16 |
| 8-9 (very good) | 53 | 41 | -12 | 51 | 65 | 14 |
| 6-7 (good) | 21 | 5 | -16 | 45 | 15 | -30 |
| 4-5 (poor) | 3 | 0 | -3 | 0 | 0 | 0 |
| 1-3 (very poor) | 0 | 0 | 0 | 0 | 0 | 0 |

4 Discussion

Very clear positive impact on income, poverty level and food and nutritional security has been obtained in all project areas. The major reasons can be attributed to the diverse interventions introduced coupled with the synergistic effect of community participation and nutrition education as observed in a Discussion Paper on the Effectiveness of Sustainable Agriculture Projects by Caouette *et al.* (2002) in the NGO Food Security Program Effectiveness Group. The project efforts in identifying suitable intercrops like vegetables, banana and tubers and off-farm activities for each of the CBOs were the major factors in achieving the success. Farmer participatory market analysis was conducted for identifying the suitability of crops and high value products and based on which the farmers selected appropriate income generation activities for themselves. Radhakrishna & Reddy (2004) also observed that the diversified and accelerated agricultural growth would enhance the food security by improving the purchasing power of the poor. A high purchasing power generated through increased income from project activities further contributed for the sustenance of the activities.

The overall consumption - in terms of frequency and quantity- of fruits, vegetables and milk by both children and adults and egg consumption by children recorded increase over the project period. Consumption of fish was more than recommended dietary intake (RDI) level during pre and post project periods. Project interventions could bring in surplus consumption of other vegetables and fruits than RDI. In spite of the increased consumption of green leafy vegetables and milk and milk products over the project period, the levels of consumption were below the RDI levels, which need to be monitored further. The consumption of cereals both before and after the project was found to be below the RDI levels. Several studies (Radhakrishna & Ravi, 1992; Rao, 2000; Amarasinghe *et al.*, 2007) revealed that there has been a clear shift in recent decades from the consumption of grains to non-grain foods and animal products. Consumption of cereals actually goes down as income of households increases (Nawani, 1994). Radhakrishna & Ravi (1992) attributed the reason for the striking decline in cereal consumption as the changes in consumer

tastes and preferences towards superior food items with increase in the incomes of the household. Rao (2000) has shown that the decline has been sharper in the rural areas where improvements in rural infrastructure made other food and non - food items available to the rural households. Reduction of manual work in agriculture due to farm mechanization might have also reduced the felt need for cereals. However he has pointed out that a reduction in the intake of food grains should not be taken as deterioration in human welfare.

The findings show that further monitoring of the project is required to create more awareness on the composition of balanced diet and the need to re-orient the home gardens so as to include required food items like green leafy vegetables in the diet for making it balanced. However, the food and nutritional security situation after the project was found to be very much encouraging when compared to the pre-project period.

A major challenge to food security comes from dietary diversification of the poor (Radhakrishna & Reddy, 2004). The importance of dietary variety is based on several studies that have shown that diverse diets are accompanied by positive health outcomes (Drescher *et al.*, 2007). The overall diet diversification in the project areas was shifted to excellent conditions from good and very good. Based on several reviews on changing consumption patterns in India, Amarasinghe *et al.* (2007) emphasized the need for diversification of future agriculture production, especially to high value non-grain crops for improving the food and nutritional security. The attempts made under this project also proved successful in bringing out significant improvements in the food and nutritional security of the communities preferably through intercropping with non-cereal foods, vegetables and fruits; animal husbandry and dairy activities and off-farm activities including diversification of products from coconut and other crops. Women members were trained on preparation of nutritious foods like squashes, snacks and baby food using locally available fruits, cereals, coconut and other materials. Nandakumar *et al.* (2010) also identified nutritional implications of consumption diversification as an important aspect that needs to be adequately addressed – not just for calorie and protein intake but also for the impact of micronutrients on consumption.

5 Conclusion

Interventions like intercropping/ homestead gardening, livestock rearing and household level processing/off-farm activities along with nutrition education were proved as successful in improving food and nutritional security in terms of frequency and quantity of consumption as well as diet diversity in all the project areas. Despite all diverse interventions, the consumption of green leafy vegetables and milk and milk products were found to be below the RDI levels. There is an urgent need to envisage an integrated nutrition and health program for all vulnerable groups, focusing on the role of gender. CBO-wise analysis of the consumption patterns highlighted the need for location-specific interventions matching to the needs and preferences of the communities. This model strategy can be replicated in all coconut growing areas to test on how local communities can achieve higher on-farm income and food and nutritional security through capacity building and adoption of different cost-effective interventions as per the comprehensive strategic plans.

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References

- Amarasinghe, U. A., Shah, T. & Singh, O. P. (2007). *Changing consumption patterns: Implications on food and water demand in India*. IWMI Research Report 119. Colombo, Sri Lanka: International Water Management Institute. doi:10.3910/2009.119.
- Caouette, D., Taylor, S., Trowell, C. & Buckles, D. (2002). *Making the Connections: Small Scale Agriculture, Food Security and Nutrition*. Research into the Effectiveness of Sustainable Agriculture Projects. Discussion Paper by the NGO Food Security Program Effectiveness Group. URL http://www.interpares.ca/en/publications/pdf/making_the_connections.pdf.
- Drescher, L. S., Thiele, S. & Mensink, G. B. M. (2007). A New Index to Measure Healthy Food Diversity Better Reflects a Healthy Diet Than Traditional Measures. *Journal of Nutrition*, 137, 647–651. URL <http://jn.nutrition.org/content/137/3/647.abstract>.
- Nandakumar, T., Ganguly, K., Sharma, P. & Gulati, A. (2010). Food and Nutrition Security Status in India: Opportunities for Investment Partnerships. ADB Sustainable Development Working Paper Series; No. 16.
- National Nutrition Monitoring Bureau (1991). NNMB-Report of Repeat Surveys 1988-90. NNMB Reprints, National Institute of Nutrition (NIN), Hyderabad, India.
- Nawani, N. P. (1994). Indian experience on household food and nutrition security. Regional Expert Consultation, FAD-UN Bangkok (Thailand), FAO Corporate Document Repository. URL <http://www.fao.org/docrep/X0172E/X0172E00.htm>.
- Radhakrishna, R. & Ravi, C. (1992). Effects of Growth, Relative Price and Preferences on Food and Nutrition. *Indian Economic Review*, 27, 303–323. URL <http://econpapers.repec.org/RePEc:dse:indecr:v:27:y:1992:p:303-323>.
- Radhakrishna, R. & Reddy, K. V. (2004). Food Security and Nutrition: Vision 2020. Background Papers: Vision 2020, Planning Commission, Government of India. URL http://planningcommission.nic.in/reports/genrep/bkpap2020/16_bg2020.pdf.
- Rao, C. H. H. (2000). Declining Demand for Food grains in Rural India: Causes and Implications. *Economic and Political Weekly*, 35(4), 201–206. URL <http://www.jstor.org/stable/4408846>.
- USAID (1992). Policy Determination 19: Definition of Food Security. United States Agency for International Development, April 13, Washington, D.C. URL <http://www.usaid.gov/policy/ads/200/pd19.pdf>.