



Integrated home-gardening and community-based growth monitoring activities to alleviate vitamin A deficiency in a rural village in South Africa

Mieke Faber is a Specialist Scientist and Spinnler Benadé the Director of the Nutritional Intervention Research Unit of the Medical Research Council of South Africa.

Food security exists when all people at all times have both physical and economic access to enough safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 1996). Home gardening can contribute to household food security by providing households with direct access to food that can be harvested, prepared and consumed by household members, often on a daily basis (Marsh, 1998).

In South Africa, one in three preschool children presents serum retinol concentrations below 20 µg/dl (SAVACG, 1996), the great majority of children consume a diet deficient in energy and of poor nutrient density, and only one out of four households appears to be food secure (NFCS, 2000).¹ Children from rural areas are the most affected.

The dietary intakes of economically and socially deprived communities in developing countries usually consist of plant-based staple foods, while fruits, vegetables and animal products are seldom consumed. These communities are thus predisposed to vitamin A deficiency (VAD). Even if active promotion campaigns to increase the intake of foods rich in vitamin A were begun, the effect would be limited, because animal foods cost more and most yellow/orange fruits and vegetables and dark-green leafy vegetables are unavailable. Yellow/orange fruits and vegetables and dark-green leafy vegetables do not contain vitamin A as such, but they do contain beta-carotene and other carotenoids that the human body can

¹ Low concentrations of serum retinol are associated with vitamin A deficiency.

convert to vitamin A. The local production of these fruits and vegetables could potentially provide households with direct access to foods rich in beta-carotene.

Food-based approaches to addressing malnutrition should include educational input (Low, Walker and Hijmans, 2001). Home-garden interventions are most effective when combined with promotional and educational interventions (Ruel and Levin, 2000). Strategies combining information, education and communication are needed, and these should be combined with community mobilization and agricultural inputs (de Wagt, 2001). In a pilot study in a rural village in KwaZulu-Natal (South Africa),

the area except for a mobile clinic that was scheduled to visit the area once or twice a month. The poor transport system made it difficult for the mothers to attend the nearest clinic, which was approximately 18 km away. In 1995, the lack of health facilities within the area prompted the establishment of community-based growth-monitoring activities (Faber, Oelofse and Benadé, 1998). Community-based growth-monitoring sessions were hosted in households. Families made their homes available on a voluntary basis, once a month, to serve as growth-monitoring points. The growth-monitoring activities were carried out by nutrition monitors (local people specifically trained for the project).

Training of the nutrition monitors for the agricultural activities

Four nutrition monitors and the headmaster of the local school were trained by the Agricultural Research Council (ARC) during a five-day training course. The course addressed theoretical and practical aspects of vegetable production such as soil preparation, fertilizers (including top-dressing), planting and sowing dates, plant spacing, irrigation, crop rotation, cultivar choice, weeding, maintenance, pest and disease management and harvesting. For the first year after the initial training, further on-the-job training was provided by an adviser from the ARC who visited the

Although the gardens focused on vegetables that were rich in beta-carotene, there was an additional benefit as the intake of various other nutrients such as calcium, iron, riboflavin and vitamin C also increased, thereby improving the overall quality of the diet

community-based growth-monitoring activities were used as a platform for the promotion of a home-gardening project that was funded by Thrasher Research Fund. Growth-monitoring points within the village were used as training centres for agricultural activities.

The aim of the study was to determine whether the home-gardening project could result in better maternal knowledge regarding vitamin A nutrition, improved dietary intakes of yellow/orange and dark-green leafy vegetables, and higher serum retinol concentrations in children aged two to five.

Study population

The study was conducted in Ndunakazi, a mountainous rural village approximately 60 km northwest of the coastal city of Durban in KwaZulu-Natal. Most of the population were of low socio-economic status. There were no health facilities in

Extensive micronutrient deficiencies were shown to be prevalent in this community, with 46 percent of preschool children showing serum retinol concentrations below 20 µg/dl (Oelofse *et al.*, 1999). Although some crops rich in vitamin A (pumpkin and *imifino* [a local term for a collection of wild-growing, dark-green leafy plants resembling spinach]) were produced locally, the quantity grown and eaten was low (Faber, Smuts and Benadé, 1999). In an attempt to address the VAD in the area, the community-based growth-monitoring activities were integrated with a home-gardening project. The growth-monitoring sessions were used to promote the production and consumption of yellow/orange fruits and vegetables and dark-green leafy vegetables, and served as demonstration and training centres for agricultural activities.

area during critical production phases in the vegetable production season.

Demonstration gardens

A demonstration garden measuring 10 m x 10 m was established at each of the nine growth-monitoring points in the village. The following crops were planted: butternuts, carrots, orange-fleshed sweet potatoes and spinach; each garden also contained a pawpaw tree. The demonstration gardens served as training centres for all the mothers attending the growth-monitoring sessions. On the day of growth monitoring, all mothers attending the session were taken to the demonstration garden, where a nutrition monitor promoted agricultural activities and gave demonstrations. The mothers were given the opportunity to practise what they learned under the supervision of the nutrition monitor. They were encouraged to plant beta-carotene-rich

vegetables at home, in addition to any existing crops. Staggered planting, cyclic production and crop rotation were encouraged to ensure an adequate supply of these vegetables throughout the year.

Promotion

At the growth-monitoring points, the production of yellow/orange fruits and vegetables and dark-green leafy vegetables at the household level was promoted, and daily consumption of these crops was strongly recommended. Nutrition education focused on the relationship between vitamin A and the health of children, the identification of foods rich in vitamin A, cooking methods, and the importance of a home garden as a source of foods with high levels of vitamin A. Using grated carrots and adding small quantities of fat to food were recommended. The mothers were taught to mash the vegetables for the smaller children. As part of the promotion, vegetables from the demonstration gardens were cooked and served to all children attending the growth-monitoring sessions. As most of the mothers were not familiar with these vegetables, this activity was used to introduce both the mothers and children to these vegetables, teach them various preparation methods and give the

mothers the opportunity to observe their children eating and enjoying these new foods. This third activity also served as motivation for the mothers to plant and prepare the vegetables at home.

Orange-fleshed sweet potato

One of the crops that was promoted and planted in the Ndunakazi village was an orange-fleshed potato. South Africa is one of the five partner countries of the Vitamin A for Africa (VITAA) initiative, which is dedicated to alleviating VAD in sub-Saharan countries through the use of orange-fleshed sweet potatoes (The VITAA Partnership, 2001). Certain varieties of orange-fleshed sweet potato have sufficient beta-carotene content to be considered good sources of provitamin A (Low *et al.*, 1997), and can therefore potentially make a significant contribution towards a food-based approach to addressing VAD (Low, Walker and Hijmans, 2001). Based on agronomic, technological and acceptability considerations as well as the high beta-carotene content, the cultivar "Resisto" was chosen for the study in the Ndunakazi village. Laboratory analysis showed that this cultivar contains about 1 750 retinol equivalents per 100 g of cooked portion (unpublished data).

Participation

Within 20 months, 126 project gardens, representing approximately one-third of all households, had been established at the household level. Although the gardens had been promoted through the growth-monitoring activities concerning younger children, the entire population participated, even though approximately half of the project gardens belonged to households without preschool-age children. The most serious concern that arose was the destruction of unfenced and poorly fenced gardens.

Evaluation of the project

The effects of the home-gardening project on maternal knowledge regarding vitamin A nutrition and on dietary intake and vitamin A status of children aged two to five were evaluated through two cross-sectional surveys. The first survey was carried out at baseline and the second one 20 months later. A neighbouring village that fell under the same tribal authority served as the control village. The control village had community-based growth-monitoring activities, but no household food production or promotion project.

Effect on maternal knowledge

The home-gardening project included a strong nutrition education component, which was developed using a participatory approach. This resulted in an improvement in maternal knowledge about vitamin A nutrition. There was a difference between mothers in the experimental village and those in the control village after 20 months of intervention. Most of the mothers in the experimental village could name at least three food sources of vitamin A, related the colours yellow/orange and dark-green with vitamin A-rich crops and could name at least one symptom related to VAD (Faber *et al.*, 2001a).

Effect on dietary intake

Before implementation of the home-gardening project, the children in this



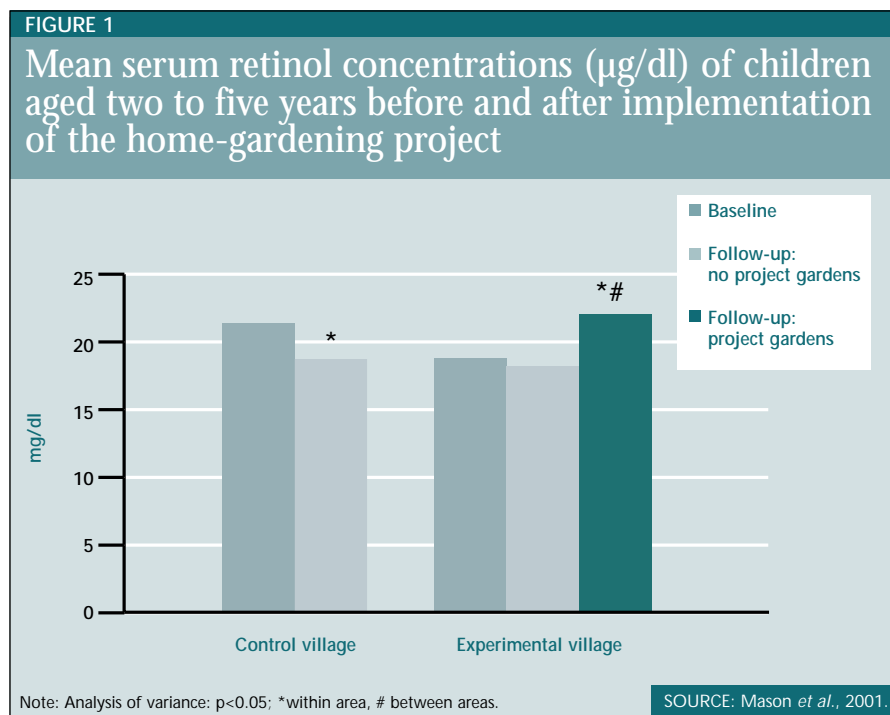
PHOTO: M. Faber

Mothers practise planting under the supervision of a nutrition monitor

rural village consumed a cereal-based diet, and the staple foods were *phutu* (a traditional stiff porridge in some South African diets made with maize meal), bread and rice. The diet lacked variety. The intake of foods rich in vitamin A and beta-carotene was low, resulting in a median vitamin A intake of 35 percent of the recommended dietary allowance (Faber, Jogessar and Benadé, 2001).

The home-gardening project added variety to the diet and did not replace a major component of fruits and vegetables previously consumed (cabbage, banana, orange). The intake of dark-green leafy and yellow/orange vegetables increased, resulting in a significant increase in dietary vitamin A intake, with at least 85 percent of the vitamin A coming from fruits and vegetables rich in beta-carotene (Faber, Venter and Benadé, 2002). However, seasonal variations in the availability of yellow/orange and dark-green leafy vegetables resulted in fluctuations in dietary vitamin A intake (Faber *et al.*, 2001a). Although the gardens focused on vegetables that were rich in beta-carotene, there was an additional benefit as the intake of various other nutrients such as calcium, iron, riboflavin and vitamin C also increased (Faber, Venter and Benadé, 2002), thereby improving the overall quality of the diet.

The impact of the food production project was seen mainly in the consumption of vegetables, which were well accepted. For children from households with project gardens, these gardens were the main source of butternuts, carrots, spinach and orange-fleshed sweet potatoes. There was a spillover effect to households without project gardens. Although some mothers opted not to have a project garden, many of them realized the nutritional benefits of these fruits and vegetables and negotiated with family, friends and neighbours to obtain some of this food for their children. Butternuts also became available in the shops as a result of the awareness created by the project. The project also resulted in an increased



consumption of locally produced *imifino* and pumpkin, two vegetables that were promoted but not planted in the project gardens because they were already grown locally.

Effect on vitamin A status

The vitamin A status of children aged two to five was assessed in terms of serum retinol concentrations, as shown in Table 1. The data for the two villages were analysed with a two-factor analysis of variance with interaction, including area (experimental and control) and time (baseline and follow-up) as the main effects. Means were compared individually, first between the two areas at a specific time (baseline and follow-up), and then over time within an experimental and control area by using a t-test (see Figure 1).

At baseline, children in the control village had a higher mean serum retinol concentration than children in the experimental village. This result was unexpected, as primary school children in the two villages had comparable mean serum retinol concentrations ($\pm 20.6 \mu\text{g/dl}$) (M.E. Van Stuijvenberg, personal communication, 2000) and one would assume that the serum retinol concentrations of children aged two to five would also be comparable. In the control village, poor coverage of the growth-monitoring project at the time of the baseline survey (the growth-monitoring sessions were used to recruit) and poor compliance (31 percent of children who were recruited did not attend the blood-test session for unknown reasons) probably caused the sample to be biased towards children who

TABLE 1

Mean serum retinol concentrations: mean (standard deviation)

	SERUM RETINOL ($\mu\text{g/dl}$)			
	BASELINE	FOLLOW-UP		
Control village	(n = 58) 22.9 (5.8)	(n = 111) 20.8 (5.4)		
Experimental village	(n = 107) 20.9 (6.3)	All children (n = 110) 20.8 (5.4)	Without gardens (n = 27) 20.6 (5.7)	With gardens (n = 83) 23.9 (6.0)



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Community members and a nutrition monitor working in one of the project gardens

were better cared for. At baseline, there was little incentive for mothers in the control village to participate in the survey, while at follow-up, awareness had been created and they knew that the home-gardening project would be extended into

collecting data through a cross-sectional survey and then comparing households with and without gardens (Kiess *et al.*, 1998). When using this approach for the present study (using analysis of variance and Tukey post hoc analysis), the positive

concentration of children in the experimental village from households without a project garden was similar to that of the children from the control village.

In the experimental village, the home-gardening project resulted in a significant improvement in vitamin A status (chi-square, $p < 0.05$), with the prevalence of low serum retinol concentrations ($< 20 \mu\text{g}/\text{dl}$) decreasing from 58 percent at baseline to 34 percent after implementation (Faber *et al.*, 2002b).

Effect on growth

At baseline, stunting (chronic under-nutrition) was more prevalent than either underweight or wasting (acute undernutrition) in both villages. Approximately 20 percent of the children were stunted. There was no significant difference in any of these measures of malnutrition between the two villages, either at baseline or at follow-up. The gardens did not affect the anthropometric status of the children.

A very important outcome was the sense of empowerment they gained by understanding what made their children healthy and how they could check the children's health, and by the skills they had acquired to produce food to achieve this objective

their village soon afterwards. At follow-up, the mean serum retinol concentration was significantly lower ($p = 0.0148$) than at baseline, and similar to that observed in primary school children (M.E. Van Stuijvenberg, personal communication, 2000).

After implementation of the home-gardening project, the mean serum retinol concentration of children in the experimental village was significantly higher than at baseline ($p = 0.0078$) and compared with that of children from the control village ($p = 0.0050$).

In Bangladesh, the impact of a home-gardening programme was assessed by

effect of the home-gardening project within the experimental village was reflected in the significantly higher ($p = 0.0197$) mean serum retinol concentration of those children from households with project gardens ($n = 83; 23.9 \pm 6.0 \mu\text{g}/\text{dl}$) as compared with those children from households without a project garden ($n = 27; 20.6 \pm 0.5.7 \mu\text{g}/\text{dl}$). These results suggest that access to a supply was more important than education without ready access, as all the caregivers in the experimental village had been exposed to the nutrition education, regardless of whether they had a project garden or not. The mean serum retinol

Maternal attitude

Maternal attitude was determined using interviews and focus-group discussions. Mothers who were interviewed had a positive attitude towards the home gardens because they had become more aware of their health benefits. They appreciated the fact that they no longer had to buy vegetables, and they associated the home-gardening project with poverty alleviation.

The qualitative evaluation of maternal attitude was carried out by conducting focus-group discussions with four groups of participating mothers. This part of the study was handled by the Child

If the community does not feel that it owns the project, the project will not be successful

Development Programme of the University of Natal, which had not been involved in the project. The decision to use an outside organization for this step was taken because it was argued that the mothers would find it easier to voice criticisms regarding the project and be more willing to speak freely to an independent group.

The participants were favourable about the project. According to them, they had acquired information about nutrition and child health, as well as agricultural skills. A very important outcome was the sense of empowerment they gained by understanding what made their children healthy and how they could check the children's health, and by the skills they had acquired to produce food to achieve this objective. The close proximity of the gardens to their homes was appreciated, as they had easy access to the vegetables. There was a strong perception that their children's health had improved because of the vegetable gardens.

Sustainability

The project was a small research study and, for its duration, planting material and some equipment were supplied free of charge. During the focus-group discussions it emerged that the community members felt that they were dependent on the project leaders to maintain the project. However, the project is still running two years after the evaluation, despite the fact that the number of staff and the input of the project leaders have reduced dramatically. During the past two years, the role of volunteers in the project has increased. The community has set up a system to obtain planting material at an affordable price. A sustainable plan for obtaining proper fencing still needs to be established. The project leaders visit the

area every three months to provide guidance where needed.

Community involvement is crucial for sustainability. In the Ndunakazi village, the principal of the primary school acts as project manager on a voluntary basis. He is supported by a health committee and a garden committee selected by the community. The project has obtained the support of prominent figures in the community, such as the chairperson of a prominent women's organization, the traditional healer and the school governing body.

Strengths of the project

The strengths of the home-gardening project were (1) the involvement of the community, in particular the women, in various aspects of the project; (2) the awareness of vitamin A malnutrition created through the education component and (3) its integration with community-based growth-monitoring activities, which resulted in a multidisciplinary project that included primary health care, agriculture, nutrition and education activities.

Concluding remarks

In South Africa, various previous attempts to establish gardening projects have been unsuccessful (Strachan, 1999). An important lesson has been learned from these failures: if the community does not feel that it owns the project, the project will not be successful. The community was involved in the design, implementation, monitoring and evaluation of the home-gardening project described in this article. The people's involvement empowered them to become more self-reliant, and ensured their ownership of the project and enabled it to be established within local conditions and cultures. The project adapted local conditions and gardening practices,

making it viable in the rural African context.

Gardening is not a new concept for rural South African communities. However, the variety of crops planted is limited and mainly restricted to maize, which is the staple. In order to change gardening practices in the experimental village, a strong education and promotion campaign was needed. As nutrition education was already an integral part of the growth-monitoring activities, the integration of the home-gardening project into the community-based growth-monitoring activities seemed logical. The home-gardening project therefore did not function in isolation, and the multidisciplinary project brought together agriculturists, nutritionists and the community.

In South Africa, the Integrated Nutrition Programme introduced by the Department of Health in 1995 facilitates a coordinated intersectoral approach to solving the country's nutritional problems. One of the main areas of emphasis is control of micronutrient malnutrition through food diversification, among other methods, with emphasis on the three main nutritional deficiencies of public health significance in the country and including VAD (Integrated Nutrition Programme, 2002). This study showed that locally produced vegetables can provide households with direct access to foods rich in beta-carotene, and that home gardens can make a valuable contribution towards vitamin A intake and, ultimately, the alleviation of VAD. It is envisaged that incorporating aspects of this study into the Integrated Nutrition Programme will increase the dietary availability and therefore consumption of foods rich in vitamin A for populations at risk.

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Integrated home-gardening and community-based growth monitoring activities to alleviate vitamin A deficiency in a rural village in South Africa

HOME GARDENS CAN CONTRIBUTE to household food security by providing people with direct access to food that can be harvested, prepared and consumed. This small pilot study was carried out in a rural village in South Africa which showed a high prevalence of vitamin A deficiency. The project focused on the production of yellow/orange fruits and vegetables and dark-green leafy vegetables because they are good sources of beta-carotene, which is a precursor of vitamin A. Community-based growth monitoring activities were used as a platform to promote the home-gardening project. Growth-monitoring points within the community were used for nutrition education and as training centres for agricultural activities.

Maternal knowledge regarding vitamin A nutrition improved. The home-gardening project resulted in an increased intake of yellow/orange and dark-green leafy vegetables, although a seasonal effect was observed. This increase had a positive effect on the vitamin A status of the children, as reflected in the higher mean serum retinol concentrations. The community's attitude towards the project was positive. A most important outcome was the sense of empowerment gained through a better understanding of what makes children healthy, how to check their health and an acquisition of the skills to produce food to achieve this objective.

The strengths of the home-gardening project were (i) involvement of the people, women in particular, in various aspects of the programme; (ii) awareness of vitamin A malnutrition, created through the education component; and (iii) integration with community-based growth-monitoring activities, which resulted in a multisectoral community project containing primary health care, agriculture, nutrition and education activities.

In conclusion, the home-gardening project produced a favourable effect on maternal knowledge, dietary intake of yellow/orange and dark-green leafy vegetables and serum retinol concentrations. The project adapted local conditions and gardening practices, making it viable in the rural African context.

Potagers familiaux et activités communautaires de surveillance de la croissance: une approche intégrée de la lutte contre les carences en vitamines A dans un village rural d'Afrique du Sud

LES POTAGERS FAMILIAUX CONTRIBUENT à la sécurité alimentaire des ménages en fournissant aux gens un accès direct à des aliments qui peuvent être récoltés, préparés et consommés. Cette petite étude pilote a été réalisée dans un village rural d'Afrique du Sud caractérisé par une forte prévalence de carence en vitamine A. Le projet s'est concentré sur la production de fruits et légumes jaunes et oranges et de légumes à feuilles vert sombre, qui sont naturellement riches en bêta-carotène, précurseur de la vitamine A. Les activités communautaires de surveillance de la croissance ont contribué à promouvoir la création de potagers familiaux. Les points de surveillance établis dans le village ont servi aux activités d'éducation nutritionnelle et de formation aux travaux agricoles.

Les connaissances des mères sur l'importance de la vitamine A se sont améliorées. Le projet de création de potagers a entraîné une augmentation, bien que saisonnière, de la consommation de légumes jaunes et oranges et de légumes à feuilles vert sombre, ce qui a eu un effet positif sur les apports en vitamines A des enfants, comme en témoigne la hausse de la rétinolémie moyenne relevée parmi eux. Les villageois ont accueilli le projet favorablement. Une des principales retombées du projet a été de les responsabiliser en les aidant à mieux comprendre comment avoir des enfants en bonne santé, s'assurer de leur bon état de santé et à acquérir les compétences nécessaires pour produire à cette fin les aliments dont ils ont besoin. Les atouts du projet sur les potagers familiaux étaient: i) la participation des villageois, et notamment des femmes, à diverses composantes du projet; ii) la sensibilisation de la population à la malnutrition due aux carences en vitamine A, par le biais de la

composante Education du projet; et iii) l'intégration du projet aux activités communautaires de surveillance de la croissance, qui a débouché sur un projet communautaire multisectoriel axé à la fois sur les soins de santé primaires, l'agriculture, la nutrition et l'éducation.

Le projet de création de potagers a influé favorablement sur les connaissances des mères, la consommation de légumes jaunes/oranges et de légumes à feuilles vert sombre et la rétinolémie de la population. Le projet a su s'adapter aux conditions et aux pratiques agricoles locales, et a pu ainsi s'inscrire durablement dans le contexte rural africain.

Horticultura familiar integrada y actividades comunitarias de control del crecimiento para aliviar la carencia de vitamina A en una aldea rural de Sudáfrica

LA HORTICULTURA FAMILIAR PUEDE FAVORECER la seguridad alimentaria al facilitar a la población un acceso directo a alimentos que se pueden recolectar, preparar y consumir. Este breve estudio experimental se llevó a cabo en una aldea rural de Sudáfrica en la que la carencia de vitamina A tenía una elevada prevalencia. El proyecto se centró en la producción de frutas y hortalizas de color amarillo y naranja y de hortalizas de hoja verde oscuro, porque son una fuente importante de beta-caroteno, precursor de vitamina A. Las actividades comunitarias de control del crecimiento se utilizaron como plataforma para promover el proyecto de horticultura. Se utilizaron puntos de control del crecimiento en la comunidad con miras a la educación nutricional y como centros de capacitación para las actividades agrícolas. Fue posible mejorar el conocimiento materno sobre la nutrición respecto de la vitamina A. El proyecto de horticultura familiar dio lugar a un aumento de la ingesta de hortalizas de color amarillo/naranja y de hoja verde oscuro, aunque se observó un efecto estacional. Este hecho tuvo efectos positivos sobre el estado de los niños en relación con la vitamina A, como se refleja en el aumento de la concentración media de retinol en suero. La actitud de la comunidad ante el proyecto fue positiva. Uno de los resultados más importantes fue el sentimiento de seguridad adquirido al conocer mejor qué es lo que asegura la salud de los niños y cómo se puede verificar, así como la adquisición de la capacidad necesaria para producir alimentos que permitan conseguir ese objetivo.

Los elementos positivos del proyecto de horticultura fueron *i)* la participación de la población, en especial las mujeres, en distintos aspectos del programa; *ii)* la concienciación sobre la malnutrición por carencia de vitamina A, que se fomentó mediante el componente de educación; y *iii)* la integración con actividades comunitarias del control del crecimiento, que se tradujo en un proyecto comunitario multisectorial que comprendía actividades de atención primaria de salud, agricultura, nutrición y educación.

En conclusión, el proyecto de horticultura tuvo consecuencias favorables sobre el conocimiento materno, la ingesta en la dieta de hortalizas de color amarillo/naranja y de hoja verde oscuro y la concentración media de retinol en suero. La ejecución se adaptó a las condiciones y prácticas hortícolas locales y ello aseguró la viabilidad del proyecto en el contexto rural africano.