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Tuskegee University

Founded by Booker T. Washington

International Programs

November 24, 1987

Mr. Floyd O'Quinn
University Relations Office
S&T/RUR
Room 309 SA 18
Agency for International Development
Washington, DC 20523

Dear Floyd:

Attached please find the final report for the project, "Influences of A Nutrition Intervention Program On Malnutrition In 0-59 Month Olds". You will note that the report itself has focused in on 12-35 month olds as numbers of malnourished children in the younger (0-12 months) and older (36-59 months) groups were relatively fewer.

We are presently contemplating a follow-up proposal as outlined in the recommendations and conclusions. Please let me know what you think.

Happy holidays.

Sincerely,

Janice R.

Janice Rankins. Director
International Food and
Nutrition Center

Att.

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Tuskegee, Alabama 36088

INFLUENCES OF REHABILITATION INTERVENTIONS ON MALNUTRITION OUTCOMES IN 12 - 35 MONTH OLDS IN JAMAICA

by

Jenice Rankins (Ed.D.), Director,
International Food and Nutrition Center
Tuskegee University
Tuskegee, AL 36088

and

Kathleen Rainford (M.S.), Director
Nutrition and Dietetics Division
Ministry of Health, Jamaica

ABSTRACT

A focused problem-specific nutrition education approach to the rehabilitation of malnourished weaning age children works. The nutrition education strategy used was small group sessions with one-on-one follow-up. Nine month mean weight gain of Group B (nutrition education) children in this study was 50-100% more than the weight gain of their Group A (container garden) and Group C (income) counterparts. Actually the mean Group B gain of 2.6 $\pm$ .41 and 2.3 $\pm$ .25 kgs for the nine month period expressed on a monthly basis is 277 gms and similar to expected monthly gain (226 gms) for this age group. Nine month mean gains for the other two groups (A and C) were similar to each other and averaged 1.4 kg, which, expressed on a monthly basis, is 155.5 gms and substantially below the expected value. The superior gain of the nutrition education group is further substantiated by improvements in their Gomez classifications as compared to the other two groups. After the nine month study period, 43 Group B children had achieved normal or Grade I Gomez classifications vs

INTRODUCTION

Jamaica, with an area of 4,400 square miles, is the third largest of the Caribbean Islands. It lies 90 miles south of Cuba and 100 miles west of Haiti. The island is 150 miles long and 50 miles at its widest point. The topography is dominated by magnificent mountain ranges, the main range running east to west, reaching the summit peak of Blue Mountain which soars to 7,402 feet high near the eastern end of the island. The coastal plains, averaging 10 miles in width and containing fertile soil for main agricultural crops, is the location for most of the principle towns. The hills, except for certain rocky and barren regions, are mostly thickly wooded with many rivers and streams. Approximately 47% of the land is used for agricultural purpose. Average rainfall is about 80 inches annually with peak rainy seasons between August and November. Jamaica has a population of 2.1 million and is divided into 14 parishes. This study took place in the Parish of St. Catherine.

As a developing country, Jamaica has an unemployment rate of approximately 23.6% (1). Among the employed, the majority has comparatively low incomes. Studies have shown that there is a general shortfall of adequate intake of food among the lower socioeconomic group resulting in energy deficiency and,

to a lesser extent, protein (2 and 3). Of special importance are children under five years, as nutritional deprivation is usually more severe and is often associated with infectious diseases resulting in fairly high incidence of mortality. The primary concern is protein energy malnutrition, a major public health problem among pre-school children.

Interventions have been employed in an attempt to rehabilitate such children. Jamaica faces economic hardships just as does other developing countries and needs to employ the most efficient interventions. It is, therefore, important for planners to identify the most cost effective interventions for rehabilitating malnourished children.

The purpose of this study is to contribute towards policy decisions to combat malnutrition in children by demonstrating relative effectiveness of three common interventions.

The objective of the study is to determine and compare the influence of supplementary income, nutrition education and container gardening on the nutritional status of malnourished children.

LITERATURE REVIEW

Prevalence of Malnutrition

The most recent national study (1985) of the nutritional status of children 0-59 months, revealed that 8% were moderately to severely malnourished by the

Gomez classification of weight for age (4). The study reported that "parishes on the south side of the island generally showed higher levels of malnutrition than those on the north side." Prevalences of malnutrition in St. Catherine (14.3%), St. Elizabeth (22.3%), and Westmoreland (9.5%) were substantially higher than the national average. The findings of this survey were similar to those of an earlier national nutritional status study conducted in 1978, whereby 7.8% of the 0-59 month olds were malnourished also using the Gomez weight for age classification (5).

Rehabilitation Interventions

Nutrition education, income generation and family gardens have often been sited as strategies for combating malnutrition in children. While a few studies have been carried out to show effectiveness of specific interventions on rehabilitating malnourished children, those showing relative effectiveness of different interventions are virtually non-existent.

Nutrition Education: One study (6) reported successful nutrition education outcomes in a rural Jamaican parish where prevalences of childhood malnutrition and mortality were relatively high. In this study, local residents were recruited and trained as community health aides to identify malnourished pre-school children and to provide nutrition education and supplements to those found to be malnourished.

Evaluation, after two years, revealed a significant decline in Protein Energy Malnutriton (PEM). The PEM declined from 10.9% in 1973 to 5.9% in 1974 in one study area and from 13% in 1974 to 6.6% in 1975 in another. A more substantial decline occurred in the severely malnourished groups (weight/age <60% of the Harvard Reference Standard) in both areas. In one case, PEM declined from 1.1% to 0.4% and in the other it was 1.5% to 0.06%. Major factors in the declines in PEM have been attributed to ongoing anthropometric monitoring, early identification and referral of children in need of treatment as well as nutrition education, better hygiene and, improved use of available resources (Standard Errors of measurement and levels of significance were not reported in this study).

In a second nutrition education study which was said to be successful (7) and where childhood malnutrition was reportedly high, specific interventions were not reported. According to the author, because there had been little success in reducing the prevalence of malnutrition by existing nutrition education methods, a new approach was taken which placed emphasis on the involvement of parents, especially those with low weight babies. Reported success was attributed to frequent meetings, close surveillance of children, and the support and guidance

offered to the mothers.

Many researchers feel that traditional nutrition education approaches have accomplished little. It is suggested that even though mothers may retain information, if it is not targeted to their particular needs it may not be effectively used. On the other hand, it is agreed that nutrition education messages, which focus on identified problems and approaches to their solution, are more likely to have positive outcomes.

Income: Relationships between income and food availability are well established (8, 9, 10, 11). This has been substantiated also in a high-risk parish in Jamaica where it was reported that undernutrition was partially due to inadequacy of household food resources (12).

Another study showed that an income related activity had an impact on nutritional status in a depressed area of rural Jamaica (13). There were high levels of malnutrition and no visible income among community members. The project sought to increase earning power through goat rearing and milk production. Each mother with a malnourished child was given a goat. A ram, bought by the project, served as sire. Training was carried out in goat rearing and mixed cropping. Health sessions included infant feeding and hygiene. A 40% improvement in nutritional status of children over

a 12-month period has been reported.

The national average for food expenditure as a proportion of income is 58% (14). However, the lower socioeconomic group (60% of the population) receives only 22% of the total income and accounts for only 28% of the national expenditure on food.

Family Gardens: Family gardens have become a relatively common intervention for high risk groups in developing countries. Even though several garden projects have been undertaken in Jamaica, reports on their outcomes are not readily available. Often gardening projects are linked with health interventions and are targeted toward reducing the incidence of PEM among children aged 0-5 years. A good example were the health-agriculture linkage projects (1982-1985) in Kenya, Tanzania, Philippines, Haiti, St. Lucia, Honduras, and Zimbabwe (15).

Reportedly, these health-agriculture linkage projects have generally produced outstanding results in terms of food production, clinic attendance, spreading gardening technologies, malnourished children served, community involvement, improving environmental sanitation, increasing family income, etc. Even though malnourished children 0-59 months were the main focus of all seven of the projects, only Haiti actually reported quantitative improvements in nutritional status of this population group. According to the

report from Haiti, the weight gain rate of malnourished children in their program was over 30% higher than the average gain rate of normal weight children their age.

Home gardens in Indonesia, Thailand, and Philippines produced mean crop yields of 1.00-1.21 kgs/day and supplied over 100% RDA for vitamin A and C; and 15.6-26.0%, 44.8-50.3%, and 35.1-82.9% of RDAs for protein, calcium and iron, respectively (16).

For those who have no land or whose land is severely limited, food plants can be grown in containers. Type of container and its location in relation to the sun, soil type and quantity, plant care, insects and diseases, harvesting practices and choice of plants, will all influence container yield. Even though leaf vegetables, spices and condiments, legumes, fruit vegetables, roots and tuber crops can be successfully grown in containers, leaf vegetables and spices provide the best ongoing yields. It has been estimated that a family of four, producing food in 100 1-gallon (4 liters) containers could produce 100% of vitamin A and C needs and 20% of protein needs (17).

Aside from the present study, container gardening has not been significantly undertaken, on a project basis, in Jamaica.

DESCRIPTION OF THE STUDY AREAS AND SAMPLES

The communities in which the study was carried out, Central Village, Tawes Pen and Christian Pen are

low income suburban communities with similar environmental conditions.

Central Village is a highly populated village situated about three miles east of Spanish Town. Unemployment is high in the area. There is little or no scope for agricultural activities especially on the northern side, an area which is virtually all rock. A few major industries have been recently established, intermittently, in the eastern section of the village, but these provide only limited employment for the villagers. The village had been without health services for many years. The recently opened health center is very short staffed and is unable to adequately meet the health needs of the community. Sanitary conveniences are lacking in many homes. Central Village is divided almost equally by the Kingston to Spanish Town main road. The residents on the northern and southern divisions are of opposite political persuasion: this makes it very difficult to establish a spirit of cooperation in the community.

Tawes Pen lies to the west of Spanish Town. It is comprised of small districts such as Saint Johns Road and Ellerslie. Unemployment is high. Housing in the area is of a low standard and multiple households are commonly seen in one building. Sanitary conveniences are also lacking in many homes. The area is served by the Villa Nova Health Center.

Christian Pen is a suburban area about six miles to the south east of Spanish Town. It encompasses a few other small districts such as Caymanas Bay, Glade and Watson Grove. The area is very depressed with a high rate of unemployment. A small number of young people find employment at the Caymanas Park Race Track and at a small sawmill apart from which there are no industries nor agricultural operations. Part of the Caymanas Sugar Estates occupy the northern boundary and a few of the older people find employment on the sugar cane plantation. Physical anemities are grossly lacking in the area and garbage disposal is nonexistent. Very few homes have toilet facilities and the open lands are used by many as sanitary conveniences. This area is served by Christian Pen Health Center.

The study groups were obtained from mass house to house weighings of 1,000 children in Christian Pen (Group A: Container Garden Community), 873 children in Tawes Pen (Group B: Nutrition Education) and 1,000 children in Central Village (Group C: Income).

METHODOLOGY

Study Design

Field research aides employed by the project conducted house-to-house weighing of children 0-59 months. In Christian Pen, 94 children falling in Gomez II and III were enrolled in the gardening group (A); in

Tawes Pen 100 children in Gomez grades II and III were enrolled in the nutrition education intervention group (B); and 94 children falling in Gomez II and III were enrolled in the income generating group (C). A questionnaire was administered for each child enrolled. Data collected included socioeconomic characteristics of the mother; and age and feeding history of the child. The interventions extended over a 14 month period and included the activities described below.

Income Generating Intervention. Mothers or guardians of malnourished children in this intervention earned a supplementary income by meeting for two consecutive days per month to make garden containers from 45 gallon drums. Drums were cut horizontally and cut edges turned in. Five holes were made in the bottom of each container to facilitate drainage. Training and supervision were done by a garden container trainer recruited from the community. The participants were paid 45 J$ per month and an additional 10 J$ lunch allowance. The total stipend received represented 22.9% of the minimum wage in Jamaica. Each enrollee recorded and submitted a list of all items purchased with the income earned.

Nutrition Education Intervention. This intervention consisted of two components, a site component and a home component. In the site component an average of 17 mothers gathered at a time, in a group

setting, in a central location. Nutrition sessions ranging from 1 1/2-2 hours in length were conducted by an experienced nutritionist on a bi-monthly basis. Teaching methods used were, lecture/discussion and audio-visuals; topics covered were, advantages of breast feeding, breast feeding techinques, feeding the young child four months to one year, feeding the young child one year and over, how to protect the child from diarrhea, and sanitation.

The home component entailed follow-up visits to reinforce messages delivered at the group sessions. Field research aides visited mothers at their homes twice per month to reinforce nutrition education messages and monitor feeding behavior.

Container Garden. This intervention also consisted of a site component and a home component. In the site component an average of 12 mothers gathered in a central location for a group training session ranging from 1 to 1 1/2 hour in length. The training sessions were conducted by an agricultural expert and teaching methods included lecture/discussion and demonstrations. Topics covered were, container drainage requirements; container protection and placement in the yard; amount of soil and depth; seeding; fertilizing; pest and disease control; expected yield for plants; and, harvesting.

The home component entailed planting in four

drum halves, sweet potatoes, callaloo, red peas and carrots. Trained field research aides visited mothers to supervise the planting of the crops and returned twice per month to assist and monitor plant growth and harvesting.

An overall limitation in the design of the study was that enrollment occurred ongoingly between February 1986 and January 1987, thus, rehabilitation interventions did not begin at the same time for all the children. As a result, the numbers of children within the different groups at nine months of study, depended mainly upon whether or not they had been enrolled early enough to have participated for nine months. The container garden group (A) was particularly affected because for the Group A FRAs assigned gardening responsibilities delayed rates of enrollment.

Also, with respect to the container garden group, intervention onset was delayed until gardens produced and production fell short of expectations.

Conditions could not be established to achieve a true control group in the study. However, common intervening variables were contolled for in the final analysis of the results.

Statistical Analysis

A menu driven data base management system was custom designed for the maintenance of nutritional data

records for each participant's response to the various questionnaires. The data base management system required use of 640K RAM and two 5 1/4" floppy disk drives and MSDOS, IBM PC compatable microcomputer.

The data were subjected to an analysis of variance and Chi Square test as outlined by Steel and Torrie (18). Where appropriate, means were compared using the Duncan's multiple range test. These test were facilitated by the use of a modified version of the MMSTAT (19) package of the Tuskegee University academic computer system and a Model 138 Zenith microcomputer.

RESULTS

A total of 2,873 children between the ages of 0-59 months were weighed during the enrollment period of this study (February 1986 thru January 1987). According to the Gomez growth monitoring system and using weight for age as an indicator, 2,586 (90%) of the children were normal ($\geq$ 90%) or mildly malnourished (90-75%: Grade 1): 269 (9.4%) were moderately malnourished (75-61%: Grade II) and 18 (.6%) were severely malnourished (<60%: Grade III); Table 1.

Of the total 287 Grade II and III children in the study group, 93 were from community A: Backyard Garden: 100, community B: Nutrition Education: and 94 were from community C: Income Generation. Grade III children were relatively few, representing 1, 11 and 6

of the 287 malnourished children in communities A, B, and C, respectively (Table 1).

The mean initial weights of the children are shown in Table 2. The mean weight of Group C (income) of 8.6 ± 3.8 kgs was significantly higher ($P<.05$) than the mean weights of Group B (nutrition education), 7.6 ± 3.80 kgs and Group A (container garden), 7.8 ± 3.96 kgs.

Within all three groups, most of the malnutrition occurred during the mid-weaning age period (Tables 3 and 4). Nearly half (127, 44%) of the Gomez grade IIs and IIIs were concentrated within the children 12-23 months of age; 75 (26%) of the malnourished children were 24-35 months old. Actually these two groups combined represented 71% of the total malnourished 0-59 month old children. The two age groups preceding (6-11 month olds) and following (36-47 month olds) included 31 (11%) and 22 (8%) of the Grade IIs and IIIs. There were relatively few malnourished children in the age groups 0-6 months (14, 5%) and 48-59 months (15, 5%).

As also shown in Tables 3 and 4, the mean initial weights within each of the age categories were similar for all three intervention communities (A, B, and C).

Table 5 summarizes Gomez weight for age grade changes for 246 (86%) of the original 287 malnourished

children with nine month follow-up weights for each intervention group. Overall, 58 of the 246 (24%) the children achieved normal or Grade I weights after nine months of study. The remaining 188 (76%) remained in Gomez Grades II (184 children) and III (4 children). It is important to note however, that 43 (74%) of the children who improved to Grade I or normal, received the nutrition education intervention. Only 14 (16%) of the 88 children in the income group and one child among the 60 in the container garden group had normal or Grade I nine month follow-up weights for their ages.

Mean weight gain nine months after enrollment into the study is shown in Table 6 for each of the intervention groups. The nutrition education groups weight gain of 2.14 $\pm$ .22 kgs was significantly greater ($P < .01$) than was the gain of 1.45 $\pm$ .25 kgs and 1.20 $\pm$ .30 kgs in the income and container garden groups respectively.

Table 7 includes mean weight gains for the mid-weaning period (12-23 and 24-35 months) after nine months of intervention for the three study groups. Mean weight gain of children in the nutrition education intervention (Group B) for both the 12-23 month olds (2.2 $\pm$ .29 kgs) and the 24-35 month olds (1.74 $\pm$ .26 kgs) were significantly higher ($P < .01$) than the mean gains of their respective age groups who received container garden (Group A) or income (Group C)

interventions. For 12-23 and 24-35 month olds mean gain after nine months for Group A was 1.19 ± .43 and .67 ± .48, and 1.57 ± .25 and 1.13 ± .34 for Group C.

The higher nine month mean weight gain noted for the 12-23 and 24-35 month olds in Group A was also evident (P <.01) for the six month study period (Table 8). Children 12-23 and 24-35 months old in the nutrition education group gained 1.7 ± .25 kgs and 1.5 ± .26 kgs, respectively. Respective mean gains in Group A and Group C were .80 ± .44 kgs and 1.2 ± .38 kgs for the 12-23 month olds; and .43 ± .31 kgs and 1.0 ± .33 kgs for the 24-35 month olds.

The 12 month mean weight gains for these two age groups are shown in Table 9. Again, it is apparent that weight gains were significantly greater for the nutrition educaion group (12-23 month olds: 2.6 ± .41 kgs vs 1.4 ± .48 and 1.6 ± .46 kgs, P <.01; and 24-35 month olds: 2.3 ± .25 vs 1.1 ± .69 and 1.5 ± .61 kgs, P <.05).

The difference (P <.05) in weight gain observed with the nutrition education group occurred during the first six months (enrollment to month 6) of intervention (Table 10). During the second six month period (month 6 to month 12) mean weight gains were similar for the three groups

DISCUSSION

The elevated prevalence of moderately to

severely malnourished 0-59 month olds (10%) observed in this NIM study Parish of St. Catherine, Jamaica, compared to the national average is in agreement with the national survey findings. Likewise, that malnutrition in Jamaica is characterized by moderate rather than severe conditions is further established here. The results also support reports from Jamaica and around the world which rank weaning age children (12-35 months) at highest risk.

NIM is based on the premise that an interpersonal and problem-specific nutrition education approach, supplementary income and family gardens can reduce childhood malnutrition. The study clearly showed that malnourished children from the nutrition education intervention group gained significantly ($P < .01$) more weight than did children from the container garden and income groups. This difference was not merely due to random age differences within the groups as demonstrated from comparisons for the same age groups between interventions.

12-23 and 24-35 month olds gained significantly more weight over 9 month, 6 month and 12 month study periods than did their income and container garden counterparts ($P < .01$ or $P < .05$). This higher weight gain observed in the nutrition education group occurred during the first six months of intervention as weight gain in the second six months was not significantly

different between the groups.

We are unable to say to what extent nutrition education itself was responsible for the differences in weight gain between the groups as it was not possible to run a control group for the study. However, based on the homogeniety of the group, with respect to other common intervening demographic variables, it is our contention that nutrition education was the determining factor.

Furthermore, in comparing the relative effectiveness of the different interventions, the following questions surface:

a. Were the nutrition education messages relevant, understood and practiced with the study children?

b. Was the income generated sufficient to have a significant effect on food purchases for the study children?

c. Were the container garden yields sufficiently adequate to significantly contribute to the nutritional requirements of the children?

There is no question that the nutrition education program was sound. It was carried out by a qualified local nutritionist and drew upon the extensive experiences of the Nutrition Division of the Ministry of Health. Sessions were well attended and post-test

scores indicated that mothers and field research aides (FRAs) comprehended the lessons. In addition, reports of follow-up reinforcement and observation during home visits by the research aides generally noted positive changes in infant feeding behavior.

Likewise, the monthly income of Group C was sufficient to purchase enough supplementary food to impact on weight gain in this group. Actually, the 55 Jamaican dollars (J$) earned per month represents approximately 20% of the minimum wage in Jamaica. The total estimated cost for a low cost menu for a family of five in Jamaica was 20.35 (J$)/day or 610.50 (J$)/mo in 1986. However, there is always the likelihood that the monies will be used for some non-food items; and even if only food is purchased, its not likely that it will be reserved completely for the malnourished child. Records of Group C purchases indicated that 52% of the 45 J$ was spent on food.

What the same proportion of other earned items.

The container gardens were intended to supplement the malnourished child's diet, providing $\geq$ 10% of energy needs and approximately 1/3 or more of his RDA for protein, vitamin A and iron. Expected yield per 45 gallon drum, half for sweet potatoes, cowpeas and carrots, was 5 lbs per harvest or 10 lbs in total as two drum halves were provided for each crop; and three harvests were projected for the 14 month study period. Callaloo was to be available ongoingly

to provide a minimum of 3, 2 oz servings/week or approximately 30 lbs were projected over the 14 month period. If project expectations had been realized, container gardens would have provided the following key nutrient contents:

		Key Nutrients Contents[1]			
Container Crops	Amount (lbs)	Energy (kcals)	Protein (gms)	Vitamin A (R.E.)	Iron (mg)
Sweet potatoes	30	15,510	231	322,793	96
Cowpeas	30	15,660	1,089	1,622	231
Carrots	30	4,230	123	433,000	81
Callaloo*	30	3,120	408	331,291	30
Total		38,520	1,851	1,088,706	438
9 Mo RDAs[2] for 12-35 mo olds		351,000	6,210	108,000	270
% RDA supplied		11	29	>100%	>100%

Unfortunately, container gardens fell far short of expectations.

Sweet potato crops failed, generally providing 0 to one harvest and no more than a 2 lb yield over the whole study period. Peas fared a little better overall with about 3/4 of the group reporting crop yields, though quite minimal; only five mothers reaped

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1 USDA Agriculture Handbook No. 456, Nutritive Value of American Foods, 1975.

2 National Research Council, Recommended Dietary Allowance 9th Edition, 1980.

* Spinach values have been used for callaloo.

3 lbs or more and peas were harvested only once during the study period. Though not sufficient to influence significantly nutritional status, carrot yields were better with 12 mothers reporting harvests of 4-9 lbs and about 1/4 reported 2-3 harvests. Relatively speaking, mothers were most successful with their callaloo container crops. Though ranging in quantity from $\leq$ 3 lbs (n = 54) to 22 lbs (n = 7), 71 mothers reaped callaloo; 26 mothers reaped 2 or more harvests. Upper levels of production reported for peas, carrots and callaloo for the best combined garden crops met <2% RDA for energy and protein due to poor yields for peas and, for energy sweet potatoes. Vitamin A and iron contents in the best garden combinations met 1/3 or more respective RDAs because of better crop yield for callaloo and carrots.

These results are in conflict with other reports for container garden yields in the tropics (USDA, 1981). There were several factors which impeded progress in this area: first plantings failed due to a dry spell; replanted crops were later destroyed by floods; domestic animals (goats and chickens primarily) often invaded garden areas; water was not conveniently located nearby; and many mothers just lacked interest and could not be motivated to regularly take care of the garden plants.

SUMMARY AND CONCLUSIONS

Where resources are sufficiently adequate to result in improved management for improved nutritional outcomes, nutrition education is the better investment choice. With gardening and income interventions there is always the risk of resource diversion to other family members, low-nutrition foods or even non-food commodities. In such instances rehabilitation of the intended malnourished child is delayed or even prevented.

In addition, where rehabilitation will depend on crop production, it is unrealistic to plan for immediate effects as growing season care and weather will all influence when and how much food will be available to the child.

These findings have important implications for developed as well as developing countries. However, to fully evaluate the potential impact of nutrition education, answers to at least two questions are needed:

1. What is the lasting impact of the nutrition education intervention? and,
2. Will nutrition education produce similar effects in other high risk communities?

Additional research is required to answer these and other questions.

RECOMMENDATIONS

An immediate recommendation is a broad-based dissemination of these results to appropriate agencies and organizations. This will be initiated through a Caribbean Conference on the subject in the Spring - 1988.

Also, additional applied research is recommended to further substantiate and expand upon the findings of this study. There is a need to develop rapid and accurate mechanisms for identifying high nutritional risk communities where nutrition education efforts are most likely to succeed. This will require the establishment of a mechanism to rapidly and reliably determine the extent to which food resources management can be improved to rehabilitate malnourished weaning age children in the family. In families where maximum food resources management will not result in sufficient nutrition for the malnourished child, nutrition education without food resources supplementation will not be successful.

Research efforts should be directed toward establishing the effectiveness of nutrition education for both rehabilitation and prevention of malnutrition in weaning age children.

Based on the results of this study and the research needs summarized above, the following

recommendations are made:

1. Monitor the nutritional status of Group B children (nutrition education) in the 12-35 month old age range whose nutritional status improved and did not improve over the next two-year period to measure the long-term impact of nutrition education.
2. Identify new malnourished children in a second high risk parish (Westmoreland) and measure influences of problem-specific nutrition education on their rehabilitation.
3. Identify families among those with malnourished children in communities A (container garden) and C (income) with the least food resources and test the effects of nutrition education supplemented with income toward rehabilitating these children.

In the meanwhile, these results should send an important message to policy makers about the potential value of giving nutrition education priority consideration in planning food and nutrition programs.

Table 1. Summary of prevalence of malnutrition by study intervention communities

Intervention Communities	Group	No.	Gomez[1] Classifications N[a] or Grade 1[b] No.	(%)	Grade 2[c] No.	(%)	Grade 3[d] No.	(%)
Christian Pen	A	1000	907	(90.7)	92	(9.2)	1	(.1)
Tawes Pen	B	873	773	(88.5)	89	(10.2)	11	(1.3)
Central Village	C	1000	906	(90.6)	88	(8.8)	6	(.6)
Total (%)		2873	2586	(90)	269	(9.4)	18	(.6)

[1] Gomez weight for age growth monitoring system uses the median value for the Boston population as a standard and derives the following Classifications:

[a] Grade normal (n: $\geq$ 90%)

[b] Grade I (mildly malnourished: 90-75%)

[c] Grade II (moderately malnourished: 75-61%)

[d] Grade III (severely malnourished: $\leq$ 60%)

Table 2. Mean initial weight of children by intervention group

Interventions	Groups	Number	Mean[1] weight (kgs)
Container garden	A	93	7.8 ± 3.96[b]
Nutrition education	B	100	7.6 ± 3.80[b]
Income	C	94	8.6 ± 3.80[a]
Total		287	

[1] Mean ± S.D.

[ab] Any two means with the same superscript are not significantly different at $P<.05$ level of probability using the Duncan's multilple range test.

Table 3. Summary of initial weight and age of younger children by intervention group

Interventions	Groups	Age (months) 0 - 5 No.	Mean[1] Weight (kgs)	6 - 11 No.	Mean Weight (kgs)	12 - 23 No.	Mean Weight (kgs)
Containe_ garden	A	6	(3.7 ± .88)[a]	8	(5.6 ± 1.63)[a]	42	(7.6 ± 1.69)[a]
Nutrition education	B	4	(4.0 ± .95)[a]	14	(6.3 ± 2.27)[a]	43	(7.3 ± 2.37)[a]
Income	C	3	(3.9 ± 2.3)[a]	9	(6.0 ± 1.81)[a]	32	(7.5 ± 1.99)[a]
Total		14		31		127	

[1] Mean ± S.D.

[a] Any two means with the same superscript are not significantly different at P<.05 level of probability using the Duncan's multiple range test.

Table 4. Summary of initial weight and age of older children by intervention group

Interventions	Groups	Age (months) 24 - 35 No.	Mean Weight (kgs)[1]	36 - 47 No.	Mean Weight (kgs)	48 - 59 No.	Mean Weight (kgs)
Container garden	A	23	(9.1 ± 2.12)[b]	10	(10.0 ± 2.40)[a]	1	(10.9 ± 0)[a]
Nutrition Education	B	28	(9.1 ± 1.70)[b]	5	(10.1 ± 2.56)[a]	11	(11.3 ± 3.2)[a]
Income	C	24	(9.5 ± 1.71)[ab]	12	(10.5 ± 1.95)[a]	3	(10.9 ± 2.0)[a]
Total		75		22		15	

[1] Mean ± S.D.

[a] Any two means with the same superscript are not significantly different at $P<.05$ level of probability using the Duncan's multiple range test.

Table 5. Summary of Gomez[1] weight for age grade changes of children between program enrollment and at 9 month follow-up as influenced by intervention group

Interventions	Groups	Study Periods Initial (No.)	9 Mos (No.)
Containter garden	A		
N[a] or Grade I[b]		(--)[2]	1
Grade II		92	58
Grade III		1	1
Total		93	60
Nutrition Education	B		
N or Grade I		(--)	43
Grade II		89	54
Grade III		11	1
Total		100	98
Income	C		
N or Grade I		(--)	14
Grade II		88	72
Grade III		6	2
Total		94	88

[1] Gomez weight for age growth monitoring system uses the median value for the Boston population as a standard and derives the following Classifications:

[a] Grade normal (n: $\geq$ 90%)

[b] Grade I (mildly malnourished: 90-75%)

[c] Grade II (moderately malnourished: 75-61%)

[d] Grade III (severely malnourished: $\leq$ 60%)

[2] (--) Normal and Grade I children were not enrolled into the program.

Table 6. Mean 9 month weight of children by intervention group

Interventions	Groups	Number	Mean[1] weight gain (kgs)
Container garden	A	60	1.20[b] ± .30
Nutrition education	B	97	2.14[a] ± .22
Income	C	88	1.45[b] ± .25
Total		245	

[1] Mean ± S.D.

[ab] Any two means with the same superscript are not significantly different at $P<.05$ level of probability using the Duncan's multiple range test.

Table 7. Summary of weight gain of children during 9 month study period as influenced by study intervention and age

		Age (months)			
		12 - 23*		24 - 35**	
Interventions	Groups	No.	Mean[1] Wt. Gn. (kgs)	No.	Mean Wt. Gn (kgs)
Container garden	A	28	1.19 ± .43[b]	16	0.67 ± .48[b]
Nutrition education	B	43	2.22 ± .29[a]	28	1.74 ± .26[a]
Income	C	27	1.57 ± .25[b]	24	1.13 ± .34[b]
Total		98		68	

[1] Mean ± S.E.

[ab] Any two means within the column with the same superscript are not significantly different at P<.05 (*) or P<.01 (**) level of probability using the Duncan's multiple range test.

Table 8. Summary of weight gain of children during 6 month study period as influenced by study intervention and age

		Age Months			
		12 - 23		24 - 35	
Interventions	Groups	No.	Mean[1] Wt. Gn. (kgs)	No.	Mean Wt. Gn. (kgs)
Container garden	A	22	.80 ± .44[c]	9	.43 ± .31[c]
Nutrition education	B	38	1.7 ± .25[a]	30	1.5 ± .26[a]
Income	C	16	1.2 ± .38[b]	16	1.0 ± .33[b]

[1] Mean ± S.E.

[ab] Any two means within the column with the same superscript are not significantly different at $P<.01$ using the Duncan's multiple range test.

Table 9. Summary of weight gain of children during 12 month study period as influenced by study intervention and age

		Age (months)			
		12 - 23*		24 - 35**	
Interventions	Groups	No.	Mean[1] Wt. Gn. (kgs)	No.	Mean Wt. Gn (kgs)
Container garden	A	22	1.4 ± .48[b]	9	1.1 ± .69[b]
Nutrition education	B	33	2.6 ± .41[a]	32	2.3 ± .25[a]
Income	C	15	1.6 ± .46[b]	14	1.5 ± .61[b]

[1] Mean ± S.E.

[ab] Any two means within the column with the same superscript are not significantly different at P<.05 (*) or P<.01 (**) level of probability using the Duncan's multiple range test.

Table 10. Summary of weight gain of children during first and second six month period as influenced by study intervention

		Weight Gain (kg)			
		First 6 Months		SECOND 6 MONTHS	
Interventions	Groups	No.	(Mean[1] ± S.E.)	No.	(Mean ± S.E.)
Container garden	A	41	$.70 \pm .26^{cA}$	20	$.86 \pm .35^{aA}$
Nutrition Education	B	82	$1.8 \pm .20^{aA}$	71	$.75 \pm .15^{aB}$
Income	C	56	$1.2 \pm .26^{bA}$	34	$.72 \pm .38^{aB}$

[1] Mean ± S.D.

abc Any two means between the columns with the same lowercase superscript are not significantly different at P<.05 using the Duncan's multiple range test.

AB Any two means between the rows with the same uppercase superscript are not significantly different at P<.05 using the Duncan's multiple range test.

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