RELATIONSHIP OF FAMILY HOMEGARDENS TO THE NUTRITIONAL STATUS AND WORK PERFORMANCE OF FARM WOMEN IN THE DOMINICAN REPUBLIC

by

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"FOR WITH GOD NOTHING SHALL BE IMPOSSIBLE"

(Luke 1,37)

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INTRODUCTION

> "Malnutrition is a state in which the physical function of an individual is impaired to the point where she or he can no longer maintain an adequate level of performance of such things as physical work, resting or recovery from the effects of disease, maintaining an adequate level of growth or the processes of pregnancy or lactation." (Payne, 1985)

Like most of the countries found in the tropical and subtropical belt around the equator, the Dominican Republic, faces the problem of malnutrition. Malnutrition as well as undernutrition, which can be defined as a state of diminished body stores where physical and clinical signs are not yet visible, were considered for a long time to be of monocausal origin. Nowadays it is accepted they are problems of many physical factors, highly interwoven with an individual's background, environment and social behavior: a problem imputable to inequality of resources, poverty and social discrimination. Therefore there will not be but one solution to overcome this detrimental situation.

Nutrition is central to survival and is a critical factor for the individual's well-being and capacity to function in society. A failure to meet food requirements leads to weight loss, diminished ability to cope with infections and stress of any kind, to work, to raise and educate healthy children and to enjoy life. To avoid

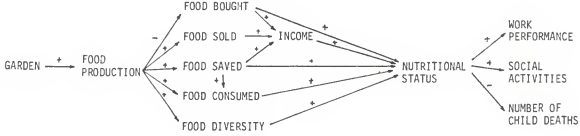
malnutrition or improve an ill nutritional status, the ability to do physical work in the fields and crops, or pursue paid labor, must be secured.

Since, in most third world countries, it is the mother who is in charge of looking for food and of the diet itself, her health is particularly important for the well-being of the whole family. Besides a host of chores and tasks in and around the house, which normally outnumber those done by the men, she must still be able to do physical work required on their land. "The returns must be sufficient, not only to secure the immediate food needs, but to sustain productivity over long periods, and to survive through bad years as well as good" (Payne, 1985).

One starting point for the interruption of this vicious cycle of malnutrition in which most of those families are involved is to increase food production. But cash cropping is not the solution as the past has taught, since the income mostly ends up in the hands of the husbands, who are not responsible for the provision of food. On the other hand, a small plot near the house, a home garden, where those vegetables are grown that are otherwise purchased on the market, would not only enrich the diet with the necessary vitamins and minerals (those are normally lacking since fields mostly yield staple foods), but would also help to save money. The surplus production should instantly increase the consumption as well as render some articles for sale on

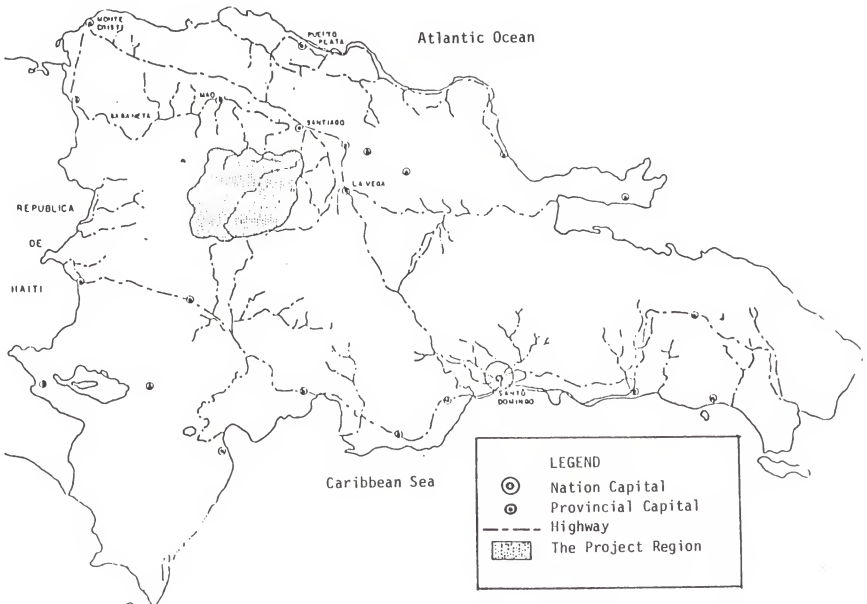
the market. Thus income can be generated that a) furthers a more balanced diet if it is spent on food, or b) betters the living conditions when invested in house, cooking, sanitary and other facilities.

The more food there is to be distributed, the better the nutritional status and health of all family members should become, evident in a decreased infection and infant mortality rate. Women and their work performance thus become the center point in the process of overcomming the problem of mal- or undernutrition since they are the ones dealing with everything concerning nutrition.



This study examines the relationship between a home garden and the nutritional status of the farm women and their work performance. The mechanism through which the nutritional status might be influenced by the presence of a garden will also be analysed.

MAP: Geographical location of the Sierra in the Dominican Republic



LITERATURE REVIEW

The Dominican Republic

The Dominican Republic is the second-largest island in the Caribbean. It lies between the 17^{o} 39' and 19^{o} 50' north latitude and the meridians 68^{o} 20' and 74^{o} 30' west of Greenwich. Columbus named it Hispaniola when he fist landed there in 1492. 'The Land of Mountains', which is the translation for its Indian name Quisquaya, is bordered by the Atlantic Ocean to its north, the Caribbean in the south, Haiti to its west, and by the Mona passage with Puerto Rico to the east. Nowadays slightly over 5.9 million people inhabit its area of 48,739 kilometers, almost the size of Ireland. As one of the most mountainous countries in the West Indies, with an annual growth rate of 2.3% and a density of 102.6 people/square kilometer, the problems the Dominican Republic faces already may be aggravated in future. Of the total land area only 25.9% is considered arable land, 20.2% are forests, 23% permanent meadows and pastures, and the remainder is used in other ways (Statistical Abstracts of Latin America, 1987; Kurian, 1987; Wilkie and Lorey, 1987).

Two principal mountain ranges running from east to west are the Northern Cordillera and the Central Cordillera. Together with other ranges they cover over 3/5 of the

republic. The red lateric and limestone soils of the steep mountains restrict agricultural production to a few small valleys and foothills. Several large irrigation projects using the water of the Rio Yaque del Norte made the otherwise dry and barren Cibao Valley (150 miles long, 10-30 miles wide) one of the most fertile districts in the Caribbean. Fostered by a humid and hot climate, large stands of mahogany, oak, ebony and other tropical hardwoods are spread over the mountains. The temperature of the island averages 25^{o} C, seldom exceeding 32^{o} C in the summer or 16^{o} C during winter time. Rainfall ranges from 2540 millimeters in the ocean-facing north-east to 760 millimeters in the far west (The Diagram Group, 1985).

The population today is descended primarily from so called "Christianized slaves" imported from Spain in 1502 after the conquistadores had managed to annhilate the aboriginal Taino Indians within little more than 25 years and had deprived themselves of laborers that they needed on their sugar, banana, and coffee plantations. Today about 70% of the population are Mulattos (of mixed White-Negro origin), 16% are Whites, and 11% are Negroes of African descent. Spanish is the official language, and more than 90% of the people are Catholic (Gale Research Company, 1984; Kurian, 1987).

The Dominican Republic has the second largest population in the West Indies. Over 55% of its people live

in cities, most of which are concentrated in the fertile northern area called the Cibao. International migration was discouraged by Rafael Trujillo's regime but was relaxed when he was assassinated after 30 years of cruel dictatorship resulting in a heavy influx of relative young people into the big cities in the 70's. On the other hand, there was a net loss in migration registered in the sixties through the mid seventies because of uncontrolled emigration to the United States. New York is now believed to contain the second largest Dominican population in the world. This large group of expatriate Dominicans repatriates millions of dollars annually to relatives on the island (The Diagram Group, 1985; Brooks, 1986).

In the past two centuries the population has suffered many hardships and changes. After having been the jumping off point for the Spaniards to the New World, they ceded a portion in the west of Hispaniola to France, which became the Republic of Haiti. Haitians conquered the whole island in 1822. But Juan Pablo Duarte drove them out again and established Dominican independence in 1844. Since then the people have been mostly ruled by military dictators. Rafael Trujillo, who was dictator from 1930-61, had the longest rule. Under the present constitution of 1966, whose implementation was interrupted by an US invasion in 1965, the Dominican Republic has become a stable, multiparty, progressive democracy with an independent executive,

legislative and judicial branch. In 1985 the country faced its most serious international crisis since the devastating civil war in 1965. The country has become a sad example of how mounting foreign debt ($2.655 billion in 1984), crippling trade balance, worsening unemployment (over 40% in 1987), and government-imposed austerity measures (influenced by the International Monetary Fund (IMF)) can divide a society and threaten the political institutions. Severe economic malaise, restrictive international bailout programs, stringent government policies, violent uprisings staged by the urban poor are just some of the problems President Salvador Jorge Blanco is dealing with at present (Lowenthal, 1987).

The Dominican Republic is a typical import country with a trade balance deficit of $489,6 million. It relies mainly on "King Sugar" as a revenue generator (31% of total export), as well as on vasic commodities including gold/silver alloys, nickel, coffee, cocoa, and tobacco, which are also subject to price fluctuations on the world market in a situation of chronic world over production. Main imports are fuel (34%), manufactured goods (28%), machinery (19%) and foods, especially wheat and maize. In 1987 85% of the export income was needed to pay for the foreign debt. The remaining foreign exchange is woefully insufficient to pay for the burgeoning health, education, and welfare needs of the population. An infant mortality

rate of 73 per 1000 life births is one of the highest in Latin America. Deaths of children under 5 years was 31.7% in 1984, mostly due to childhood diseases, infectious and parasitic diseases, measles, protein calorie malnutrition (PCM), and meninghitis. A lack of physicians (2.5/1000 inhabitants) aggravates this situation even further (Wilkie, 1987; Demographical Yearbook, 1988). Expansion of the agribusiness sector, export diversification, tourism, increased investment in rural health and education, and in agricultral infrastructure are attempts by the government to develop the country and to alleviate those problems (Kurian, 1987; Wilkie and Lorey, 1987).

Plan Sierra

> "Within the presently fragile ecological system, as the one prevailing in the zone, where there is a relatively high population density, the existence of an efficient use of the family income is absolutely important, as is the availability of social services already offered, and an appropriate use of all of the resources we have at hand, if we want to improve the standard of living of the people and the area in a significant way."
> (Blas Santos, 1982)

Plan Sierra is a dual purpose project aimed at stopping soil erosion and raising the standard of living in an area in the Northwest of the Dominican Republic recognized for its environmental degradation due to poor soil management and poverty. It was established by the Dominican government

in 1979. This integrated rural development project is located in a mountainous region southwest of Santiago de lo Cabellos, Dominican Republic. Its area of about 750 square miles is inhabited by approximately 120,000 people. The main objectives of the project are to stop erosion, conserve the region's natural resources, and to improve the standard of living for the people. Among the residents of the Plan Sierra the absolute poverty rate, i.e. 'having too little to live, but too much to die', exceeds 40%. Agriculture - intended by the government to provide more than 70% of the needs for foreign currency - has not been able to grow enough to feed the population. A study carried out in 1982 (Smith et al., 1982) revealed that although the incidence of moderate and severe malnutrition in the Plan Sierra region was lower than expected (only 12.3% of the children were less 75% of the National Center for Health Statistics growth charts (NCHS)), some chronic undernutrition does exist. Neuman (1979) even went so far as to talk of severe malnutrition, if the heights were compared to the standards. As stated by Blas Santos: "For the typical countryman the main and immediate everyday subsistence problem is food and health" (Santos,1982).

This area was unpopulated until the beginning of this century, when the first groups of settlers went there to escape Haitian invasions. Without having any experience of mountain living, they started slash-and-burn agriculture,

which includes grazing, crafts such as weaving of palm leaves, and selling their labor to the lumber camps and nearby coffee plantations. Most of the families have access to little land. Much of the land is in the hands of absentee landlords and distributed unequally.

The data analyzed here is drawn from a part of the Plan Sierra, called La Celestina, which mainly belongs to the Mera family. A member of this elite family is the wife of the former president, Jorge Blanco. This area is the most arid, scarcely populated, and underdeveloped part of the Plan Sierra. Agriculture is a mainstay for the people living here. Traditionally there were no organized groups and no attempts to introduce gardens had been made. The men's contribution to the household is from the the conuco (subsistence plot), where they grow yucca or casava, some pigeon peas, beans, and maize, and from selling their labor. Women's tasks not only encompass the usual household chores and child care, but also weaving, preparing three meals per day, husking and milling coffee, carrying water, looking for and carrying wood, shopping for the few articles that are purchased, and washing once a week, which involves carrying wood and water, boiling clothes, scrubbing them, and laying them out to dry. Raising a variety of small animals, especially hogs, contribute to the women's income. When swine fever hit the entire island of Hispanola in 1978, the eradication of all the hogs meant a great loss of a major source

of savings. Some women, though, had adopted gardens and produced tomatoes, cabbage, onions, carrots, leaf lettuce, beets, and radishes, which helped alleviate the situation. A survey conducted by Flora and Santos (1984) indicated that most of the families generated income through female artisan work, male wage labor, and the produce of the conuco (casava, beans, wood but also sugar cane, and cut fodder), while some sold cattle, goats or oregano. Cash aid from relatives residing in urban areas of the Dominican Republic or in the United States also played an important role in nearly a quarter of the households. Cash income was low, but so were expenditures.

Though the land is officially held by the Mera family, many of those who squatted there for some decades already consider themselves as owners. The amount held by those households is usually larger if the woman is engaged in handicrafts (Flora and Santos, 1984).

Malnutrition and its Impact on Work Performance

> "If we believe that malnutrition is a state of impaired physical function in which adequate performance cannot be maintained, we have to be concerned about increasing food consumption so that normal function can be restored"
> (M. Smith, 1986)

Undernutrition, which is primarily a lack of energy, is unquestionably one of the main reasons for the poor work efficiency often cited in underdeveloped countries. This

deteriorating working capacity begins with an insufficient food supply in early childhood. It appears to have a lifelong effect (Spurr and Reina, 1985; Satyanarayana, et al., 1979; Satyanarayana, 1985). Mal- or undernutrition, manifested by growth faltering in children, results in small, less productive adults (Viteri, 1971). The reason can be found in physiological adaptations that take place as the body tries to cope with persisting energy and food shortages. The adaptation process first slows down the basal metabolic rate (BMR). But as the BMR is 'turned down' to make the whole system run more efficiently, it also becomes less functional. The body starts wasting or using up fat deposits. After these are depleted, the body breaks down protein or muscle tissue. This can even go so far in severe undernutrition as to break down immunoglobulines, thus increasing the prevalence of infections and disease, which have a negative effect on work performance and productivity. An ill person will till a field less efficiently, will thus harvest less, thereby diminish food intake and income from selling produce on the market. Poor health status will be aggravated.

Studies have shown that there is a depression in VO_2 max related to the severity of the nutritional deprivation (Spurr and Reina, 1985; Barac-Nieto et al., 1978). The 'wasting' observed in medium and severe undernutrition not only accounts for a dwindling of muscle mass but also for

the depression of hemoglobin values (< 10 g/100 ml). They are both evidence that the body has used up all its stores and is now recruiting visceral protein for its energy supply. Since muscle activity as such depends on and can be determined by VO_2 max, a lowered oxygen carrying capacity of the blood is detrimental for work performance. Chronic malnutrition leads to growth faltering and to less muscle mass. Therefore, one can conclude that work capacity is related to body size and composition, and that there is a relationship between nutritional status and productivity (Spurr, 1983). As there is an adaptation by the body to a lower absolute level of energy expenditure in times of constant nutrient deprivation and also a set VO_2 max (ca. 40% VO max) at which work tasks can be sustained for an 8 hour work day, the level of productivity must drop, because VO_2 max is reduced if food intake is too low.

Most less developed countries are found in tropical and subtropical climates, providing them with two seasons: a dry season where energy is required for household chores and herding, and a wet season which is a period of peak energy expenditure, since soil preparation, planting and harvesting are carried out then, most of the time as tasks of women. These seasonal labor demands are often severely impaired by malnutrition. The weeks right before harvest are often times of food shortages. Therefore the work must be accomplished partly at the expense of body energy stores, leading to a

state of undernutrition. That is particularly detrimental if the previous season did not allow the individual to replenish empty body stores because of insufficient food production (Payne, 1985). Thus weakened, the individual is less likely to meet peak labor demands. Work performance drops, and with it productivity, as energy needs cannot be fulfilled. So even the new crop yield is endangered and might again render too little to overcome the induced weight losses. Such wasting stages lead to a host of other far-reaching factors exacerbating malnutrition not only of the mother but her newborn and the rest of the family (Popkin, 1986; Staudt, 1979; Sai, 1985). The results are particularly acute when experienced by women in childbearing age, who are the ones not only responsible for household and child-rearing but also for cooking, gathering fire wood, fetching and carrying water, often from remote areas, tilling the fields, weeding, harvesting, selling produce, and herding small animals. If productivity and food intake are decreased at the same time that energy expenditure is elevated, pregnant women will face an impaired nutrient, vitamin, and mineral intake which leaves them in a poor nutritional status. Their offspring will most likely be born with low birth weight and too small for its age. Even the brain might be affected. Additionally, those women will not be able to provide sufficient quantity or quality of breast milk. The milks content of vitamins, minerals, and

immunoglobulin A is mostly lowered on a malnourished mother, leaving infants with a poor immunological capacity and more liable to diseases and infections. Morbidity and mortality rates increase when raised energy requirements cannot be satisfied (Coovadia, 1985; Grantham-McGregor, 1985).

Since not only the child but the whole family is exposed to a higher infection rate due to an impaired nutritional and health status, a vicious cycle evolves. The family members are not able to cope with seasonal labor peaks. The harvest will render less for consumption and market. Less income, which might have filled the 'food gap' by additionally purchased goods, is generated. Poverty and malnutrition are aggravated.

Nutritional improvement, especially during childhood, is therefore a kind of human capital investment which results in higher lifetime earnings and may be associated with upward social and occupational mobility during adulthood (Spurr and Reina, 1985).

Home Gardens

Enhancing food production has often been tried to solve the problem of malnutrition. The "green revolution" introduced in the mid-1960s was one of those attempts. High yielding varieties of crops --mainly wheat and rice-- developed through genetic engineering (plant breeding) were

promoted, together with an extensive use of water for crop irrigation, insecticides, herbicides, and fuels. Credit was made available to the farmer to buy the enormous amounts of fertilizer and other inputs required by the new varieties. However this approach hardly ever solved the hunger problem, partly because the taste after preparing those newly introduced foods was unfamiliar (Evensen and Standal, 1984). Instead of enriching the diet of farmers, the crops were grown only for cash. This development strategy was based on helping the community to earn more money and produce for the national market economy (Pacey, 1979). The rationale was that the surplus income would be used for 'extra food' purchases. In reality it was more likely spent on needs other than food, or, if food was purchased, the locally-based balanced diet was replaced by highly refined Western products which have a higher prestige value (Dewey, 1979). Often peasants also have to pay more for the previously produced foods, since they are no longer grown locally. Further, in most countries, income generated by cash crops is controlled by the men, who are not in charge of the provision of food.

Concentrating on a limited number of crops that are most salable, the variety and diversity of the traditional diet suffered. In certain Asian countries, for example, the production of protein-rich legumes declined with the introduction of high-yielding varieties of basic grains

(Evensen, 1984). In addition, wild vegetables and berries contributing to the diet's diversity also disappeared with the clearing of forest and bush. Further social, ecological, economical, and dietary effects of cash cropping are well summarized by Dewey (1979).

Home gardens as such have a long history. They are mentioned in documents over 2000 years old (The Code of Hammurabi, Greek and Roman writers, Genesis 2,8-17). Carefully managed, they served two purposes: productivity and aesthetic appeal. They supplied the urban markets with fresh produce, as they still do today. Like in those ancient days, they evolve on ground unsuited for agriculture, nevertheless yielding considerable amounts of food on relatively small area. And no sophisticated machinery, no World Bank loans are required.

Directly providing food, gardens help overcome periods of crop failure or disruption of food flows, and they supply nutrition not available from field agriculture. As McCulloch and Futrell (1984) in their study on the effect of cropping systems on the health of women and children in Southern Honduras demonstrated, a weekly surplus consumption of 1 lb carrots, 1 lb broccoli, 1 lb red and green peppers, 1 lb yucca leaves, and 2 lbs tomatoes produced in a small vegetable garden can add considerable amounts of ascorbic acid, thiamine, and vitamin A to a subsistence diet of sorghum, maize, beans, and oil (Figure 1).

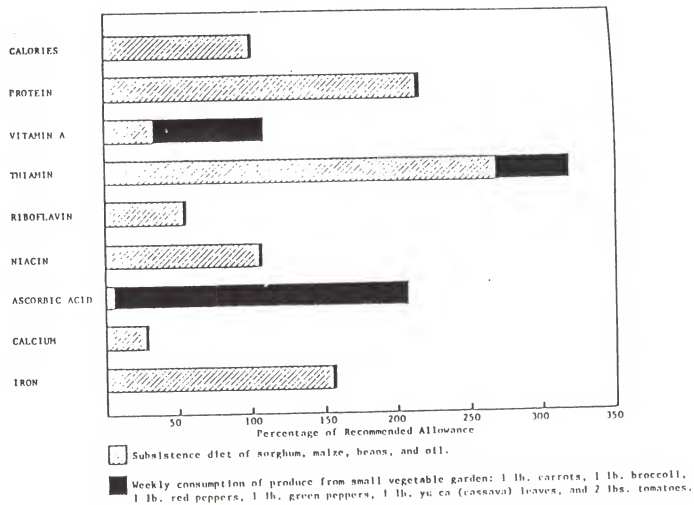


Figure 1. Supplementing Nutrition with Vegetable Garden Produce.

Traditional agricultural practices based on polyculture usually are sound ecologically and render an adequate and balanced diet, since the combination of those crops supplies diversity. A greater variety of foods normally provides a greater chance to obtain all of the essential nutrients. This is especially true for protein when the main source are plants. Complementary patterns of essential amino acids are most likely to occur with several protein sources (Dewey, 1979).

Besides providing important nutritional input for peasant families, home gardens also are important economically. Gardens provide fodder for household animals, material for handicrafts, and fire wood. They guarantee women, who stand as "gate keepers" between food production and consumption, a regular and secure supply of food, petty cash, or goods to trade and barter (Ninez, 1984). Many times the garden serves as the experimental unit for new genetic plant material and cultivation techniques before they are implemented in field agriculture. Gardens diffuse plant material and maintain genetic diversity as well.

How is a home or household garden defined? With the words of Ninez (1984; also see Appendix C):

> The household garden is a subsystem within larger food procurement systems which aims at production of household consumption items either not obtainable, readily available, or affordable through field agriculture, shifting cultivation, hunting, gathering, livestock, husbandry, fishing, or wage earning. Household gardens supply and supplement subsistence requirements and generate secondary direct or indirect

income. They tend to be located close to permanent or semi-permanent dwellings for convenience and security.

In fact home gardens feature one of the most intensive farming systems in which the largest number of crops (up to 60 species) are grown for "food, condiments or spices, masticants, drugs, fibers, structural materials, animal feed, ..." and other uses (Okigbo, 1981). Their development is the result of the traditional division of labor between the sexes, where women, responsible for food, grow as many vegetables, fruits, even some staples (normally large-scale production in the fields), condiments, medicines and spices as possible for the convenience of proximity. It saves time if one can just pick these items instead of obtaining them at a store or distant field. A garden is a much more efficient and economic method of storing vegetables, too, because the earth conserves the nutritive value and keeps them from spoilage for a long time. Food bought on the market, on the other hand, has lost a great deal of its nutrients by the time it is cooked.

Kitchen refuse, animal manure, farm residues, ashes, and human waste used as fertilizers and the fact that pesticides and regular irrigation are unnecessary render household gardens the cheapest agricultural unit with the lowest opportunity costs when it comes to output per time, energy, and money spent. "Traditional-style peasant farming," which includes gardening as well, "is some six times more efficient than monocropping in terms of the energy yielded

in food compared with the energy input required to produce that food" (Dewey, 1979). Existing with permanent or shifting field production, home gardens complement high-carbohydrate field staples with plant and animal protein, vitamins, and minerals. Gardens often serve as a refuge for species fast disappearing from the forest. They also have the important function of bridging the gap between the end of stored field staple supply and new harvest. Providing a convenient supply of fresh 'garden staples' (maize, roots, tubers), they alleviate the problem of seasonality in food intake discussed before. They can also serve as a small income source for peasant women, who sell surpluses on the local markets (Ninez, 1984), which in itself helps to improve food supply, food intake, and nutrition of the family. And good nutrition means less sickness, and therefore less time and money spent on health services. Another positive aspect is that it is a good device to teach children good nutrition, agricultural, and conservation practices (Chaney, 1985).

As the society, Caribbean gardens represent a mixture of African, European, and native cultures. Many of the patterns used are of Arawak or Caribic origin (Kimber, 1973), even though the European garden layout and crop diffusion are still obvious. Tools used are hoes, machetes, and dibbles, the same as in Africa and many parts of Latin America. The plantation economy, where slaves from Africa

served as labor force, influenced gardening and diet. The methods of cultivation of crops like cassava, maize, sweet potato, and beans greatly resemble the African method.

In spite of the tradition of gardens in some areas and their introduction in some parts of Plan Sierra, no attempts have been made to introduce them in the area of La Celistina. "Yet there are gardens which have been recently adopted by women who have seen them in other parts of the Sierra" (Flora and Santos, 1984). Other than in los conucos (subsistence plots), where men grow primarily cassava, maize, beans, and pigeon peas, women tend to cultivate 'salad vegetables' like tomatoes, carrots, leaf lettuce, cabbage, beets, onions, and radishes in their gardens. Since pigeon peas can also be found in both gardens and in los conucos, they can be considered either a male or female crop, depending upon where they are grown.

Depleted soils which are inadequate in depth, low in fertility, and weak in structure, problems of erosion and great soil losses, and unreliable rainfalls hinder agriculture (Santos, 1982). Small gardens, on the other hand, do not tax the soil, labor force, and other factors severely. They would help indeed to conserve and improve soil structures, income, and nutrition. Introduction or adoption should therefore be of great benefit for environment and people.

Nutritional Status - influencing factors and their relationship

Assessment of the Nutritional Status

Nutritional status is the overall nutritional well-being of individuals, as determined by clinical, biochemical, anthropometric observations, and dietary evaluations. For the determination of an individual's nutritional status, whether he/she is under- or over weight according to national standards, it is useful to develop indices that are easy to obtain and are highly correlated with weight, but independent of stature and reflect body composition accurately. The most accurate measures are obtained by biochemical methods, but time and cost make those unreasonable for field studies. Triceps skinfold measurements in combination with body mass indices (BMI), on the other hand, are cheap, quick, and reliable.

A good clinical judgement based on the person's overall appearence and anthropometric results is most desirable. The most commonly used procedure in large-scale epidemiological studies is to determine the person's weight and height and compare them with "standards" on height-weight tables. These standards are based on average weight-for-height, age, sex, or "ideal", "desirable", "best", or "acceptable" weights. Whereas for children, weight-for-height, along with triceps skinfold (TSF) measurements seems to be the most valid

indicators and are therefore widely used currently. Up to now "there is no hard and fast criteria for the evaluation of body weight for adults" (Simco et al.,1984). Body mass indices (BMIs) which are different weight over height ratios, however, have attained growing popularity over the last decade. Roche et al. (1981) illustrated by comparing BMIs with standardized techniques (hydrodensitometry, underwater weighing) that it is indeed possible to assess body fatness reliably. They compared weight for height (wt/ht), Quetelet index (wt/ht^2), Khosla-Lowe index (wt/ht^3), and Benn index (wt/ht^4) and found wt/ht^2 to be the best index for total body fat in men and women with respect to the correlation betwen weight and height. In fact, wt/ht and wt/ht^2 were the only indices not correlated with height but strongly with weight. Those indices also had the lowest standard error and the strongest correlation with hydrostatic and TSF measurements of body fat. Even though there are limitations to a BMI, the Quetelet index is now the most accepted BMI and is used widly in large epidemiological and health investigations. The U.S. National Health and Nutrition Examination undertaken by the National Center for Health Statistics during 1971-74 (NHANES I) and 1976-80 (II), as in other studies, (Micozzi et al. 1986, Cronk and Roche, 1982) tested various BMIs and also recommended wt/ht^2 as the most simple and valid indicator for total body fat, independent of stature and highly

correlated with weight over all ages especially for women between 25-65 years of age (r=0.97). Triceps skinfold measures (TSF), however, was preferred to obtain percentage of body fat.

Factors that have to be considered when using BMI, because they might affect this variable, are that height is a divisor --therefore inadequate for growing children--, age, relative leg length and sitting height, body proportions, and that it can distinguish between leanness/fatness/obesity only when used in connection with other measurements (Garn et al., 1986; Kunkel, 1987).

Collecting food consumption data

For the evaluation of the nutritional status of a population, it is not only necessary to look at clinical, biochemical and anthropometric measurements but also to study the food habits and consumption. Especially in underdeveloped countries, where protein calorie malnutrition (PCM) is the most influential public health factor responsible in some areas for death rates of almost 50% among children pt to 5 years for (Pacey and Payne 1985), food consumption data provide crucial information for proper medical, nutritional, economic, and agricultural programs. Food industries and trade also benefit from food consumption data. Consumption surveys are needed to evaluate whether the diet is qualitatively and quantitatively balanced. Having a

variety of methods on hand, selection of the most appropriate one becomes a compromise between various factors. Sample size, funds, number of trained people, and time are just some factors affecting the choice. As Pekkarinen (1970) put it: "when selecting a method attention should be paid to general level of education of the people, national characteristics, typical habits and patterns, etc." Most commonly used methods for the collection of food consumption data are:

a) quantitative approach

- Weighing — of food as it is consumed within a certain period. Nutrient intake is determined analytically or by calculation from food tables. It is the most accurate but also the most time consuming and expensive method

b) qualitative approach

- Food balance sheets — are an indirect estimate of the amounts of food consumed by the population of a county at a certain time. The calculations are based on food produced, imported, exported, and changes in the food stock. Based on FAO food composition tables, mean intakes of nutrients and energy are calculated.

- Food records — amounts of foods consumed are recorded in detail over a certain period of time within a household. Trained investigators supervise the survey and visit the families at the beginning and end of the survey. This method is suitable for studying food intake of population groups, to give a general idea of a population's diet.

- Dietary recall — food items consumed during the last 24 hours or 1-7 days are recalled by an interviewer.

-Diet history	rather used to determine general dietary patterns than the current diet. This method developed by Burke (1947) differs from the recall in that questions are not asked about food intake of previous days but on general food habits and patterns over a longer period of time, even one year. It has been shown sufficiently valid for epidemiological studies (Jain et al. 1986). Usually includes 24-hour or 3 day recall.
- Food frequency questionnaire	subjects estimate the frequency with which they consume food items listed on the questionnaire.

Willett et al. (1986) looked at the reproducibility and validity of a semiquantitative food frequency questionnaire in a large study on women, where two questionnaires were given in a year's interval plus four one week diet records. They showed that the methods were generally comparable, and that a simple dietary questionnaire can provide useful information about the nutrient intake of an individual over a year's period. Hankin et al. (1975) compared a 24 hour recall with a 7 day diary and suggested that "a 7 day quantitative recall of particular food items has considerable validity and is a resonable choice of method for studies of large groups". Nevertheless, qualitative recall methods do not necessarily provide a measure of usual intake, i.e. changes in food intake due to illness, seasonal variations, or availability are not shown in one simple recall (Mokbel and Pelet, 1987). Still another limiting factor in a recall is the fact that it just covers the food

consumption of the previous day which may be subjected to temporary variations in the daily diet. Thereby, small intakes tend to be over-reported and large intakes under-reported (Karvetti and Nuts, 1981).

Until now, not one method has proved to be the best, most reliable and most accurate for all situations. All methods seem to have advantages, disadvantages and sources of error which are difficult to eliminate (Butz 1976). But over decades qualitative dietary interview methods (diet recall, diet history) have shown to be practical, easily manageble, and economical. Diet history, in particular, was found to be sufficiently valid and reliable for epidemiological studies. They are, therefore, the methods of choice (Karvetti and Nuts 1981, Jain et al. 1986). "Food frequency interview is a simple and economical tool for examining relationships between diet and health in groups of people" (Abrahamson et al., 1986). When compared, food frequency, 24 hour- and 7 day recall showed an overall agreement in nutrient intakes. Food frequency and recalls over a longer period of time, however, are to be preferred since they reflect dietary patterns better (Hankin et al., 1975; Karvetti and Nuts, 1981; Stuff et al. 1983).

Factors affecting the Nutritional Status of Farming Women

Like the phenomenon of malnutrition, nutritional status itself has to be seen as a multifactorially determined

variable. To quote Hamilton, Popkin, and Spencer (1984) pertaining to the determination of the nutritional status of women:

> Women's status involves a configuration of multiple roles and positions in different domains, and nutrition may provide an example of the way role and status are differentiated by gender.

Factors having an impact on dietary needs and intake are of a biological, socioeconomic, and cultural nature. So not only income, resources, home food production, and life cycle, such as pregnancy, adolescence, etc., have to be considered, but seasonal cycles and changes, diseases, amount of work, knowledge and training, use of health and social services, education, food habits and patterns, access to markets, residential changes, diversity and adequacy of the diet and quantity and quality of the food allocated to the individuals within the household also play an important role. Energy intake and expenditure are the main factors in the human energy system affecting weight. There is an adaptative response of energy expenditure to low intake due to changes in the metabolism which is compensated by reduced activity to maintain energy needs (Sukhatme, 1977). According to FAO standards, moderately to very active women in less developed countries have daily energy use of 40-47 kcal/kg plus an additional requirement of 300 kcal/day when pregnant or 500 kcal/day while lactating. Actual determination of energy needs is complicated, since it is

affected by factors such as gender-type task allocation, work setting, type of technology available, and sex differences in quantity and performance of work (Montgomery, 1978). Particularly in low income countries the number of chores taken care of by women exceeds that of men by far, not only in terms of number but also in their complexity. Barsky et al. (1981) in their study on the role women play in Ecuadorian agriculture found that the man normally plans, sometimes together with his wife, whereas the woman has to organize and actually do the work. Besides being in charge of the routine household chores, which include such arduous tasks like gathering fire wood for cooking and heating, hauling water, washing by hand, and rearing children, in most countries of the world women usually are responsible for growing food crops rather than cash crops (coffee, tea, sugar cane, rubber). They prepare the soil for planting, sow, weed, fertilize, harvest, thresh, process, and trade the crop. It is also their task to look after the animals, milk, feed, and clean them (Dixon 1978, Staudt 1979 a, Flora 1986).

Income, as well, is a major determinant of the quality and quantity of the diet, depending on how regularly it is received, in what form (cash or food), and whether the woman or the man is the recipient. It has been estimated that women's income is twice as important as men's in determining the nutritional status of children. When women receive

money, more of it is spent on food (AID 1982, Katona-Apte 1983). Thus her income determines more the total amount of food available to the family and the nutritional quality of the diet (Jansen et al. 1977). Women's income is considered as reproductive, as it is used to maintain the household. Since women are in charge of cultivation, preparation, and child care, they are less likely to make non-food purchases (Frankenberger et al., 1987). Male income, on the other hand, is often seen as discretionary: he can take it and spend it in a bar if he wants.

Consumption patterns of small farms are affected by market prices and access. The higher the prices, the less can be purchased, and food shortages may occur. Import and export also come into play, since they can have drastic effects on stability of the market and thereby on income obtained by selling farm produce. However, the lower the purchasing power or income of the women, the more she must depend on produce from garden or field. If a garden does not contribute to the diets diversity, nutrition is more likely to be inadequate, imparing the nutritional status of the whole family.

The impact of seasonal variation on nutritional status is very complex. Besides those obvious effects such as climatical seasonality in agriculture on food supply, employment, income, migration, vital events, and governmental intervention also show a seasonal pattern (Chen

et al., 1979; Longhurst and Payne, 1979). Unfortunately many of those negative factors occur at the same time. The labor demand at harvest time is very high just when food is scarce, contributing to an increased morbidity and mortality rate, exacerbating malnutrition especially of women and children (Hamilton et al., 1984). An increased prevalence of diseases with seasonal occurrence is reported from many parts of the world (Chambers, 1979) due to climate favorable for transmission (mostly wet season): an increase in malaria, diarrhea and skin infections is visible (Bradley, 1981; Porter 1981). Thus, nutritional status will also undergo seasonal fluctuation. Inadequate transportation during wet seasons, so that health services can hardly be reached impair this situation. Knowledge of the disease process and how to treat it would therefore have a positive effect.

The nature of agriculture itself implies seasons with a higher workload, where additional work is superimposed on women. Many studies showed that the women's workload exceeds that of men's significantly. A.Berio (1979), for example, investigating in the Central African Republic and in Nepal, reported a 10 hour work day for women compared to a 7 hour day for man. Obviously women have less leisure time and therefore also a higher energy expenditure and nutritional needs. Taking into account the seasonality of work in the fields and for wage income, women are more likely to be

overworked. There is evidence that earnings of working mothers have a positive effect on the nutritional and health status of their children as long as the job is close to home or allows a more flexible schedule (ICRW, 1981). As King-Quinzon and Everson (1978) found in the Philippines, only when women worked more than 6 hours a day the food production time declined. Higher educational background of the mothers however, lead to socioeconomic changes, modernization processes, and higher income levels that bettered the overall nutritional situation of the family. Monsted (1978), looking at peasant families in Kenya, depicted the importance female trading has for the family. Not only did she find that 82% of the women traders did not receive contributions from their husbands and had to trade to support the family, but also that the husbands did not perceive it as their obligation to pay for regular costs. Women were regarded as responsible even for part of the school fees. Price changes on the market or lack of access to markets would be highly detrimental for the family's well-being. The importance of the mother as a trader and bread-winner in the rural economy thus becomes obvious. To alleviate this pressure, women often set up communal agricultural groups. Organized on a neighborhood basis they share labor during peak work seasons and information about agriculture (Staudt, 1978; Monsted, 1978).

Agriculture most directly affects food available and food distribution, both necessary if not sufficient

condition for adequate diet. A third set of factors affecting diet are those revolving around food utilization - all the social and cultural beliefs and practices that determine on what amount each person finally encounters on his plate at meal times, buys as snack outside the school, or picks up along the road in the country side (E. Chaney, 1983).

Here schooling, education, and information comes into play. Studies have shown that general and specific education can affect food intake by increasing ability to absorb new ideas and use them to improving selection, allocation and use of resources, income and time, thus increasing household production of foods, storage and preparation (S.Hamilton et al., 1984). Smith (1969) found that education enables production of a more nutritious diet with less effort and fewer inputs by purchasing, preparing and distributing food more efficiently. Especially in the Caribbean, where there is a high male out-migration in search for better job opportunities, women are pushed into a multi-role position of being head-of-household, farmer, bread winner. Her education becomes expedient for the health of children and herself. Knowledge about age and sex-specific nutritional needs, disease processes, food production, and hygiene, for example, might help to avoid deterioration of a precarious nutritional status while following unreasonable food beliefs and taboos.

Having a large family can be detrimental to the nutritional status of family members in low-income countries. For families with limited resources a large

household size means fewer resources per individual (quantity and quality may suffer) and additional time and energy expenditure on part of the mother (Florencio and Aligaen, 1980). This is even more dangerous when distribution patterns and food beliefs, which mostly relate to lactating and pregnant women and children, deprive those risk groups of their essential needs. A vicious circle evolves: general depletion of body stores, progressive weight loss -- especially if parity is high and spacing between deliveries too short -- diseases like goiter, anemia, osteomalacia, infections, and diabetes, cause work performance to drop (Venkatachalam, 1962; Blair, 1980). Consequently, less food will be produced for on-farm-consumption and for income generation, both affecting her nutritional status and that of the rest of the family adversely.

Food Diversity and Adequacy

Collecting reliable food intake data as discussed before provides problems. The more precise the method the more likely it is to deviate from and give a wrong picture of the normal diet. On the other hand, the more non-invasive the method the more difficult it is to quantify the intake. Food recall is subject to memory loss, under or over estimation of the amounts consumed, and under reporting of food gathered or eaten away from home. Seasonal changes in

availability are not reflected either and may mask times of scarcity. A mere reporting of average household intakes does not reveal intra-familiar distribution differences. Food supply data overestimates the actual consumption by not taking into account food that is wasted, or given away, fed to guests. Despite those difficulties it is possible to identify key foods frequently consumed, dietary patterns and food habits quite adequately by means of food frequency questionnaires which therefore have been used in this study. This device gives enough information to make inferences on the diversity and adequacy of the diet. Once a list of food items most commonly eaten by the population has been established, diversity can be obtained by mere summation of the items where the sum serves as a score or aggregation into food groups (Bindon, 1986; Harding et al., 1985). This allows analysis for the determination of patterning among groups and the adequacy of the diet. Still another way of scaling described by Guttman (1944) would be to tally the food frequencies, condense them into an 11 item list of the foods most frequently reported, and assign a point to each consumed item thus obtaining a score for the diet. A similar approach will be made in this study.

Food diversity does not necessarily imply an adequate diet. A diet composed of 16 different vegetables could be as diverse as one with fewer food items which are evenly distributed in all 4 major food groups. Contrary to the

first one, it would be an adequate diet. Adequacy is ensured when the food selected meets the protein, mineral, vitamin and energy requirements. Therefore the division of the food in major food groups like in protection (minerals and vitamins), construction (proteins), and energy (carbohydrate) food groups is reasonable and will give information on food patterns, too. Cohen (1986) divided the food into 7 groups (cereal, beans, animal products, dairy, vivere, fruits and vegetables) to establish a score from 1 to 7 for each diet. A score of four or more was considered to represent or meet the standards of being adequate.

Food patterns and beliefs

Diet has a high impact on nutritional status. What one eats is a function of various variables: food produced, bartered, bought, or sold, access to land, having a garden, social customs, income, education, family size (among how many people the food has to be divided), food distribution, patterns and beliefs, all of which determines what will be found on the plate. The diet in conjunction with the amount of energy spent for work performed defines the nutritional status of the individual, where health, i.e. morbidity and mortality, serves as a good estimator. All these factors "create the condition of life of which malnutrition is more a symptom than a cause" (Sebrell et al., 1972).

In 1969, Sebrell et al. conducted the first nationwide survey of the nutritional status on low and middle class Dominicans. The survey team revealed a picture of

> "a group of people living consistently on a level of nourishment considerably better than famine onditions but distinctly below the level at which their physical vigor and general health can be optimum".

Average nutrient intake varied according to family size and geographic area. Only about 15% of the population sampled enjoyed a reasonably satisfactory overall diet. Nevertheless even among those were significant deficiencies of retinol, riboflavin, pyridoxine, vitamin B12, vitamin E, copper, zinc, and magnesium. Except for phosphorus and the essential amino acids lysine, leucine, isoleucine, thryptophan, and phenyl-alanine the diet did not meet INCAP recommendations for daily intakes of vitamins, minerals, and calories at all. The calorie deficit was estimated as being as high as 500 kcal daily. Almost 70% of the population was considered below standards for nutritional well-being in one or more essential elements. This situation has improved since then. Smith (1982) in her study in the Plan Sierra, the mountainous region south-west of Santiago, found only 12.5% of the children to be less than 75% of the National Center for Health Statistics (NCHS) reference standard for weight/age. However, 6.5% were more than 110% of the standard indicating overweight. The high incidence of growth retardation and stunting on the other hand indicates chronic undernutrition (Smith, et al., 1982).

The diet has not changed much. Three meals per day, where rice and plantain are the most important sources for calories, are common. Breakfast normally consists of viveres, i.e. plantain, sweet potatoes, yucca, oatmeal, bread (more important in urban areas), or sometimes spaghetti which is consumed either with eggs, white cheese, milk, or salchichon (cheap sausage made of flour, meat, color). Very poor people just have viveres. The noon meal usually consists of moro, a boiled dish of rice and beans with some oil added to it, some meat and salad containing shredded cabbage, lettuce, and tomatoes. Dinner is mostly prepared from leftovers, so plantains, eggs, spaghetti (very popular in rural areas), yucca, or a soup from various tubers, plantain, or squash with small amounts of meat or sausage are used. The main protein source is plant proteins; meat is just a condiment and only eaten in greater amounts at festivities or on special occasions (Lashman and Daly, 1974). Juices made from milk and fruit (litchis, orange, guava, mango) are liked as an afternoon snack. Good sources of vitamin A, especially dark green leafy and deep yellow/orange vegetables, are rarely included in the diet. Popular garden vegetables are onions, tomatoes, garlic and red pepper.

Various taboos and beliefs regarding to consumption of specific foods are prevelant. They exacerbate the nutritional deficiencies. Pregnant and lactating mothers and

children of young age are primarily affected. Mothers, for example, should avoid soursop, rice, eggplant, sugar cane, herring, cashew, lemon and other fruits, fish, chicken, and avocados, because these foods would either effect her own health or that of her baby. Locally it is a custom to wean infants with plantains, containing little protein, which causes serious dietary problems if children do not get enough milk or other food along with it to compensate for this lack. Most of the beliefs cluster around fruits and protein rich foods which, negatively affects the nutritional status of the individuals.

Summary

The Dominican Republic is one of the typical low to middle income countries in the world that still faces the problem of chronic mal- or undernutrition. Malnutrition, mainly a lack of nutrients but primarily energy in form of calories, leads to a bad nutritional status which manifests itself in low weight-for-height ratios, decreased work performance and ill health, heralding the onset of a myriad of problems. How can we assess malnutrition and make statements about the nutritional status? The most commonly used and probably cheapest parameter, together with triceps skinfold (TSF) measurements, is body mass index (BMI): weight/height squared. To get an overall picture about food

intake and food patterns, and to make inferences about diversity and adequacy which together determine the nutritional status, the food frequency questionnaire cross checked by a dietary recall is the most valid method.

Malnutrition is a multifactorial problem with many interwoven causes. There certainly is not just one cure for it. The problem has to be tackled in a holistic approach. Therefore increasing food production is certainly not the only way to break this vicious cycle, but it is an easy, economical (if cash cropping is not promoted), wholesome way, which can have a quick and long-lasting effect on the nutritional status of those who suffer from undernutrition. Their resulting lack of energy can cause changes in the whole metabolism and be very detrimental for children's growth and development, with life long effects that might even impair the ability later on to help themselves to better their situation.

Traditional agricultural practices based on polyculture, as well as those used in home gardens, are usually fairly sound and render a quite adequate and balanced diet since the combination of all of those crops and vegetables impart a diversity in food intake. Thus by increasing production and variety one can assume that intake of nutrients will increase and at the same time leave more articles to sell and barter, reducing the amount of food that has to be purchased. This helps to generate some income that can be

used to buy the "missing parts" in the diet. Food diversity implies adequacy, thus promoting better health through an improved nutritional status which is necessary to perform the tedious tasks at home and in agriculture.

Since in developing countries the women have to procure the food, produce, process, save, and market it, and are in charge of all the household chores and the rearing of children, the attempt to increase production should not add extra burdens to their tight time budget. Economic use of the mother's time and energy is most important if the nutritional situation of the whole family is to benefit from an increased production. From the point of ecology, economy, and improvement of the nutritional status, i.e. without putting more strain on farming women, a home garden is probably one of the best solutions. With this study an attempt will be made to obtain a deeper insight into those connections and to test this hypothesis.

METHODOLOGY

Data Collection

In 1986 four undergraduate students, two from Kansas State University and two from Cornell University, carried out a survey of production-consumption patterns as well as the socio-economic situation in this area. They intervied 114 families, using a structured questionnaire concerning household characteristics, years of education, and work pursued by the family members (Appendix A). A food frequency table of 44 food items procured information on food production, saving, barter, selling of produce, and what was bought (Appendix B). Inferences on food consumption were cross checked by a 24 hour recall. As literature showed, this method is simple, cheap and reliable enough to obtain sufficiently valid information on consumption and food patterns.

Both mother and father were asked about the chores they did in house, field, garden and pasture, about animal husbandry, and if they sell or buy things. Social and income generating activities (at home or away from home) were also part of the questionnaire.

To obtain a picture of the standard of living of the family, observations and questions were used to determine the condition of the house i.e. the construction material of roof, floor and walls , type of lighting, kinds mass media

used, type of cooking facilities (fire place on the floor or a kind of stove), their means of transport, type of sanitation, source of water (well, stream, or piped into the house), and if they had latrines. The only anthropometric measurements that were taken were height, weight and age of the mother.

Data Management

From 114 interviewed families 133 variables were gathered and read into the computer. Since food cost and the amount of money people earned was rarely recalled, these two variables were omitted. In order to create new variables, all discrete variables were changed into 0 and 1. Thus the number of operational variables could be reduced considerably.

To obtain means, standard deviations, and frequencies, and to be able to make inferences about significant differences, new variables were created, including nutritional status, work performance of mothers and fathers, social activities, food production, and food consumption.

Nutritional Status:

The nutritional status of the mothers was obtained by using the anthropometric measurements of weight, height and age. After conversion of pounds to kilograms and

centimeters to meters, a body mass index (BMI), specifically the Quetelet index, was constructed.

$$BMI = weight/height^2$$

It is the most commonly used and best measure for women between 25 and 65 years of age (Micozzi et.al., 1986; Cronk and Roche, 1982). The decision whether those BMIs resembled undernutrition or not was made by using the smoothed percentile values of wt/ht^2 for white females which were obtained from the NHANES I. Since no international standards for BMIs could be found in the literature, Cronck's and Roche's standards for white populations were used, because those for blacks are higher. The social mixture in the area being studied includes whites, blacks and indigenous peoples (Indios). Their BMIs should be lower than those for blacks.

For most group or population comparisons, where uniformity is important, the standard statistical cut-off points are the means plus or minus 2.5 standard deviations (WHO working group, 1986). This has also been used to define the lower limits of the BMI for the mothers in this sample. As the body composition changes with age (natural weight gain), body mass indices are age standardized, which means that the cut-off points rise with increasing age.

Work performance, social activities, and income generation:

To make inferences about potential differences between the number of work tasks women do compared to those done by men, as well as to see whether a garden affects the number

of tasks performed, the number of different activities done in house, garden, field, pasture, with animals, part employment, and trading activity were added up resulting in a score from 0 - 31. Zero meant the individual did none of the work tasks, while 31 meant they did all of them. The differential effort or caloric expenditure per task was not measured.

Work Performance = (cook+take food+clean+wash+child care+ fetch water or get wood) + (Prepare+ seed+weed+water+debug+fertilize+harvest) of the garden + (prepare+seed+ weed+debug+harvest+scare birds) of the field + (prepare+cut+seed) of the forest + (feed+clean+milk+vaccinate+ help deliver+kill) of animals + buy + sell

The same pattern was used for social activities. The activities, attending dances, meetings, weddings/baptisms /funerals, listening to radio, visiting the sick or relatives/neighbors, resting, and going to church, were added together. This gave totals between 0 and 8.

Whether income was generated from activities at home or away from home was also asked. These two resposes were combined to create an income generation variable.

Food production and use:

The respondents were asked if they produced, saved, bought, sold, or bartered each of the 44 food items listed on the questionnaire. The summation of the information obtained in each category yielded the variables food 1)

production, 2) selling, 3) buying, 4) barter, and 5) saving. Since there is a difference in what is normally grown in a garden and in the field, a variable was created just from garden articles, which included carrots, tomatoes, lettuce, chili pepper, onions, cabbage, eggplant, beets, radish, and summer squash.

Food diversity and adequacy:

Since the presence of a garden will probably change the ranking of the food items reported to be eaten most, each of the 44 foods listed on the questionnaire which are consumed at least four times a week was counted individually. The score thus yielded ranged between 0 and 44 and depicted the household's food diversity. The higher the score, the more foods are included in the diet. It was assumed that the more varied the diet, the more likely the individual is to obtain all nutrients required for an adequate diet. But a diversity score alone cannot be taken for the evaluation of the diet. A score of 10, for example, can mean that 50% of the items are just different carbohydrates. Since the key idea of an adequate intake implies a balanced diet covering the main food groups as noted by the Dominican "Secretaria de Estado de Salud Publica y Asistencia Social": construction (protein), protection (vitamins and minerals), and energy, the food was divided into 7 groups.

Cereals	bread, rice, cornmeal, oatmeal, noodles, sorghum.
Beans	kidney, pigeon peas.
Animal products	egg, fish, pork, beef, chicken, codfish, small fish.
Dairy	milk, cheese, condensed milk.
Viveres	cassava, sweet potato, plantain, yucca, green banana.
Fruits	mango, oranges.
Vegetables	cabbage, onion, tomato, summer squash, lettuce, chili peppers, raddish, beets, eggplant, winter squash.

Using the method of Cohen (1986), each household's diet receives a score of 1 to 7, depending on how many different food groups are included in the diet. A score of at least 4 should indicate a fairly balanced though not necessarily optimal diet.

Standard of living index as an indicator of income:

The standard of living is an expression of the purchasing power and living conditions of an individual. It is manifest either directly in the amount of money one has on hand or saved, or it can be seen indirectly in the level of 'luxury' or 'conveniences' in the home and field. In rural areas, the economy is often based on trading and bartering activities. Therefore it is hard to tie the standard to a monetary basis. Agriculture provides highly seasonal income, i.e. times of cash flow and direct

consumption (harvest) and times where one has to live from savings. The use of income as a measure to evaluate the standard of living is also hindered by the reluctance of the people to give information on income sources or their total income. Therefore indirect values have been taken and combined into a standard of living index (SLI). For this index the type of shelter, type of lighting, mass media used, means of transport, type of cooking facilities, source of water, and type of sanitary facilities were observed. Each of these variables was divided into three categories indicating low, moderate, and high standard levels. In the house, for example, the investigators identified the construction material of the floor, walls, and roof. Floor was divided into dirt, wood, or cement, representing an ascending level.

The SLI for each family was calculated by adding the levels for each observation and dividing it by the number of observations.

SLI = (roof+wall+floor+light+media+water+sanitation+ kitchen+transport) / 9

Statistical analysis of the data:

The Statistical Analysis System (SAS, 1987) was used to describe the population and to show relationships between the variables. Procedures applied were means, standard deviations, frequencies, minima and maxima, Pearson and Spearman correlation coefficients, biserial correlation.

Significance was calculated using Chi square test and paired sample t-tests.

Since the main objective of this study was to determine if a home garden affected food production, consumption, trading, saving, social activities, work performance and the nutritional status of the women, the data set was sorted by garden. The Chi square test was then used to detect any possible differences in the frequencies the two groups reported those variables and to decide whether the obtained values differed significantly from the expected ones (Anderson, et al., 1986).

A testing of the path diagram, the visual representation of the cause and effect relationship among variables drawn in the introduction, was attempted using path analysis (Bornstedt, Knocke, 1988). This is a method for analyzing correlations that yield empirical estimates of effects in a hypothesized causal system. However, there were not enough cases to statistically justify its use.

Analysis of variance (ANOVA) and the t-statistic were then used to test differences among means. Whereas the Pearson correlation coefficient works for correlations between two discrete values, a biserial correlation has to be used if a continuous and a discrete variable are to be evaluated, as was done with BMI / garden, SLI / garden, and SLI / malnutrition.

RESULTS AND DISCUSSION

Comparative statistical analysis of the data was carried out dealing with household characteristics, nutritional status, and access to different types of food.

Household Characteristics

Family composition of the whole sample did not differ much from the findings of Smith's (1981) survey. Mean household size was 6.5 people. However, when families without gardens (n=47) were compared as to those with garden (n=67), some differences were observed (see Table 1).

Contrary to M.Smith's findings men attended school longer than women (2.5 years for men, compared with 1.8 for women). Interestingly, the garden group had fewer years of education than those without a garden, although the difference in education of the women in the two groups was not significant (p=0.077).

When looking at the anthropometric findings of the mothers, it became obvious that the presence of a garden was associated with a higher weight. Whereas age was the same, weight, height and Quetelet index were higher for those women who gardened, indicating a better nutritional status (see Table 2).

Families with a garden had a significantly higher

standard of living ($p < 0.01$). They also received less monetary help from outside, i.e. relatives in the Dominican Republic and emigrants to the U.S.A. (see Table 1).

Food Production

It is not surprising that gardeners produced significantly more food since they devoted additional area for vegetable production (see Table 3). When the population was divided in three groups according to the number of items they produced, far more people with a garden than without were in the 'medium' or 'high' food production category (see Table 4). Ranking the data and displaying those food items produced by more than 60% of the sample also revealed that a garden not only meant a greater variety, but also that those farmers were more likely to keep chickens or produce eggs.

Besides green pepper, the only vegetable grown by almost everybody, there was little source of vitamin C or A. Leafy dark green or dark yellow/orange vegetables are not considered field crops. Mangoes, a favourite fruit eaten frequently when in season, may compensate for that lack somewhat. Nevertheless, yucca, sweet potatoes and pigeon peas are the mainstay of the diet and are grown by most of the people.

A garden, on the other hand, is a source for vitamins

and minerals. Green peppers, lettuce, eggplant, tomatoes, and onions are the vegetables mainly grown. Very few people, who had a garden sold their products on the market (see Table 6), so the surplus production did not serve as a direct income source. However, a garden can be an indirect source, because it saves money people otherwise would spend buying these vegetables (without gardens an average of 6 vegetables was purchased vs 4 in the garden group). Some of the produce could even be saved and used for bartering, thus putting gardeners moneywise in a 'better off' positions for times of food scarcities. In this study the vegetables were mainly used for on-farm-consumption, which is reflected in the significantly higher average of 5.5 vegetables that were eaten compared to 2.5 for those without a garden.

Bartering, Saving and Trading Behaviour

The analysis showed that those with a garden not only bartered more, but they mainly bartered garden products: chili peppers, lettuce, sweet potatoes, tomatoes, onions, radish and cabbage. On the other hand when there was no garden, they bartered food items such as rice, beans, and tomatoes, that had to be purchased first since they were not grown (see Table 7). More food on hand also implies that one should be able to sell and save more and that one is

less forced to buy food. Although it was not significant, gardeners did indeed purchase fewer food items (see Table 3). Therefore income savings were greater for garden owners.

Gardeners also were significantly more likely to save food (see Table 8) : 48% reported saving some of their food in comparison to 30% in the other group. All families saved sweet potato, yucca, beans, maize and peas, while those with a garden also saved peppers, onions, chili peppers, eggplant, beets, cabbage and rice. Since rice is not grown, they must have had enough money to buy it for provision.

Whereas a garden enabled all people to sell something (16 items reported, mostly garden vegetables and animal products - chicken, eggs and milk), only one person with a garden reported selling sweet potatos, eggs, honey or chickens. On the other hand, over 50% of those without access to a garden recalled 28 items they had bought on the market. Besides noodles, bread, beans, beef and rice, these were mostly garden vegetables that they did not produce (see Table 9). Their "shopping list" was also considerably longer, implying that they were less self sufficient than those with a garden. This also suggested that they had higher expenses and less money left that they could use to improve their living conditions. This would explain the significantly lower SLI in the non-garden group (see Table 1).

Nutrition

It is not surprising that food consumption is higher when more food is bought or produced. A garden did, indeed, increase the amount of food that was eaten significantly (see Tables 3 and 10), especially foods of the protection group (vitamin and mineral rich foods), i.e. fruits and vegetables. Correlation analysis reinforced this finding.

Food Consumption and Diversity

The ranked order of the food items that were eaten and recalled by over half the group showed on one side that the production of vegetables resulted in a diet rich in vegetables, while the absence of a garden diminished the supply for the daily menu considerably (see Table 11). The only garden vegetables consumed by over 50% of the sample were onions and chili peppers.

Animal products was an under-represented food group. Whereas over fifty percent of the families with a garden ate eggs regularly, the diet of those with no gardens consisted mainly of rice with beans and onions, mango, bread, less often other starches such as yucca, sweet potatoes, noodles, and chili peppers. This is similar to the findings reported by Smith (1981) and Venhaus (1985). The mainstay for the garden owners also was rice, beans, and onions. More families in this group ate rice and not always together

with beans and onions, since rice was recalled with 98.51%, beans, on the other hand, with 92.54% and onions with 91.04% (see Table 11). Not only was the variety of vegetables remarkably larger for those with gardens (over 50% of them ate nine different vegetables versus two in the other group) but also the total number of food items was greater. Those with a garden ate nearly twice as many different food items (20) as those without a garden (12). This result is reflected in the diversity score as well.

Table 12:	**Diversity score**
with garden	29 *
without garden	23

* significant difference on 0.0001 level

Adequacy of the diet

As the combination of rice and beans represents a complete protein combination with a very high biological value, there is actually no need for animal products every day. When the diets were divided into the seven food groups and every family's diet checked to determine whether at least four food groups were covered, no inadequacy was

detected. Still, this does not prove the diet to be optimal. Diets which might cover all food groups but are deficient in calories are just as detrimental over time as nutrient defecient diets.

The frequencies with which the different food groups were represented in the diet indicated that if there were a lack, it occurred in the dairy group. This suggests that the diets are generally low in calcium, riboflavin and vitamin A, which would support Sebrell's et.al. (1972) and Venhaus' (1982) findings.

Nutritional Status of Women and Work Performance of both Sexes

It was hypothesized that those farm women with a garden would have higher BMIs than those without. This was not supported. There were undernourished women in both groups, even though more mothers who had a garden were well nourished and their percentage with a critical nutritional status was lower (38.8%) than those without a garden (44.7%) (see Table 13).

Mere addition of tasks showed that women apparently do more tasks than men. The average for women was 13.5 tasks, whereas a man just had 9.1. Most of the women (64.0%) faced 6 to 14 jobs everyday, and a good portion (20.2%) up to 22. Some even reported up to 38 tasks (Figure 2). The number of chores was normally distributed. In contrast the number of

tasks performed by men was almost evenly spread out over a wide spectrum. Many men (68.4%) reported just a few tasks, but some (26.3%) listed between 13 and 18 tasks. Most of the men reported between 7 and 12 chores (see Figure 2).

STEM	LEAF	#
48	0	1
46		
44		
42		
40		
38	0	1
36	0	1
34	0	1
32	0	1
30	0	1
28	0	1
26	00	2
24		
22	00000	5
20	000000	6
18	0000	4
16	00000000	8
14	0000000000	10
12	00000000000000000	16
10	00000000000000000000	19
8	000000000000000000	18
6	0000000000	10
4	000000	6
2	00	2
0	0	1

Work Performance of Mothers

STEM	LEAF	#
48		
46		
44		
42		
40		
38		
36		
34		
32		
30		
28		
26		
24		
22	0	1
20	00	2
18	0000000	7
16	000000000000	12
14	0000000000	10
12	00000000000000	14
10	0000000000000	13
8	00000000000000000	17
6	0000000000000	13
4	000000	6
2	0000000	7
0	000000000000	12

Work Performance of Fathers

Figure 2. Comparison of Work Performance

Optimal work performance depends on sufficient energy reserves. Thus the nutritional status of women as housewives, mothers, and farm workers is extremely important. The woman clearly has high energy demands. She performs more different tasks than her husband (see Table 15): She is not only in charge of running the household, i.e. cooking, taking food to the fields, cleaning, arduous washing of clothes, child care, fetching water, collecting wood (even though 47.37% of the men reported do that as well), she also works in the garden, where her task is mainly watering and harvesting. She is the one in charge of feeding, milking and slaughtering the animals, and she does the trading. Compared to men, women are more involved in social activities, which means that they visit more sick people and their friends and relatives and are more present at church activities (see Table 14).

Almost three quarters (71.9%) of the husbands pursued work away from home. Still, their role at home was mainly to prepare, seed, and fertilize garden and field, to seed, prepare and cut the forage and to keep the stables of the animals clean.

Relationships between Variables

In order to verify the hypothesized model, path analysis was tried (Bohrnstedt and Knocke, 1987).

Unfortunately nonspuriousness, i.e. covariation between two variables that is causal and not due to the effects of a third variable, was too weak for most of the variable paires, probably because of a too small sample size. Strong enough relationships between the variables that would have been needed to construct the model could not be depicted. It is possible that the ways the variables were created were not optimal either. Further studies and investigation would be worthwhile to reconsider the measures or indicators used.

Correlational analysis was undertaken to determine the relationaship between continuous variables within the garden groups. The Pearson product moment correlation coefficient and the p values were calculated and showed a very interesting significance. In the group without a garden standard of living was highly positively correlated (r=0.5051; p=0.0003) with the BMI, as anticipated. However, this relation was totally wiped out when a garden was present (r=0.1135; p=0.3606). This shows that gardens can become an intervenous variable between the standard of living and the nutritional status , which is particularly important for poor people. As garden helped families save, sell, barter, and produce food, as well as diminuish the amount of food they had to buy (see Table 3), poor people will benefit the most from a garden which will help them to increase their food consumption and thus improve their nutritional status. So the presence of a garden, indeed,

makes a difference.

The chi-square test was used to identify significant differences between having a garden and not having a garden in terms of the number of activities performed and number of foods bartred, sold, bought, marketed, produced and eaten. As Table 16 demonstrates, differences were only significant for food production and consumption and almost significant ($p = 0.054$) for the amount of food that was saved. Consequently, a garden definitely had a positive effect. While garden status was not directly correlated with BMI (see Table 17), it intervened between standard of living and BMI, as shown by the partial correlations.

It is particularly important to note that the presence of a garden did not put an extra burden on the woman ($p = 0.609$): she did not perform more tasks when a garden was present (see Table 16). The number of social activities, which can be considered as an indicator for free time, was not affected either ($p = 0.436$). A garden did not consume too much of the precious time of farm women.

Since BMI and SLI represent continuous variables, contrary to garden or malnutrition, biserial correlation had to be used for the analysis. Whereas the Pearson coefficients for the standard of living index indicated a significant relationship between garden and malnutrition, none was detected between nutritional status and having a garden. Even though fewer women who gardened were

malnourished than were those who did not, a p value of 0.115 (see Table 20) is not strong enough to verify a relationship. The washing out of the relation between SLI and BMI in the partial correlation for those with a garden suggests the importance of the garden in overcoming disadvantages that affected nutritional status.

In the analysis, treating nutritional status as a dichotomous variable did not yield the anticipated results. Clearly, that is too crude a way to deal with malnutrition. It was only when the BMI was treated as a continous variable that the real impact of gardens on nutritional status - as a substitute for economic status - was revealed.

The lack of power of the dichotomous variable is because the cut off point is extremely arbituary. There have been no well defined cut-off points for when the BMIs represent malnutrition. Some researchers suggest two standard deviations (WHO working group, 1986), while others use the 75th percentile. It may be that the limits used here were actually too low so that not all women who were actually undernourished fell in the right category. The fact that there are no national standards for BMI and U.S. standards derived from the NHANES-I data had to be used, too, might have distorted the actual situation. For further investigations, efforts to establish national standards for the Dominican Republic should definitely be made.

SUMMARY AND CONCLUSIONS

This study investigates the impact of family home gardens on food production, consumption, selling, bartering, saving and buying, using a sample of 114 families living in a mountainous region near Santiago, Dominican Republic. La Celestina, as this area is called, is part of an integrated rural development project, Plan Sierra. The main objective was to determine whether the introduction of home gardens, which were not traditional in this area, had a positive impact, particularly on the nutritional status and work performance of the farm women, who do considerably more kinds of work in the house and in the field than any other family member (the average number of tasks for women was 13.5 compared to 9.9 for men).

The data was collected by means of a questionaire. Items asked included the family's socio-economic situation and their production, consumption, selling, buying, saving and bartering of 44 food items. The population was then divided into garden owners and those who did not own a garden. Some significant differences between the two groups were discovered. Those without a garden had a lower standard of living index (SLI) than those with gardens. However, we do not know if the gardens caused the higher SLI or if a higher SLI facilitates the development of a garden. Very interesting was the finding that the standard of living

showed a high positive correlation with the BMIs in the non-garden group. The relation, though, did not hold for the those with a garden. This suggests that presence of a garden intervenes between the impact of socioeconomic status on nutritional status.

The analysis of the data showed that families with a garden had a far more diverse diet. They produced an average of 16.4 food items, significantly more ($p< 0.0001$) than the average for people without a garden (8.3 items). Gardeners also produced and consumed more chickens and eggs. This would refute the apprehension of some farmers in other areas, that it is impossible to have a garden when raising chickens which would eat the seed and vegetables. More research needs to be done on differences in poultry raising practices between families with and without gardens.

As only a few items were actually sold on the market by any of the sample,
the produce was used mainly for on-farm consumption, leading to a significant difference ($p< 0.0001$) in the number of food items eaten by those who had a garden compared to those without garden. The diet of those with a garden was much more diverse (diversity score of 29 vs 23 for those without a garden), and thus, it can be assumed, also balanced and adequate. Unfortunately, this could not be verified when adequacy was tested, which may be attributed to the way it was defined. The classification of this variable is

definitely worth a second thought, because the greater consumption of fruits and vegetables (protection group) of those with a garden is not depicted by such a scoring method. The frequencies with which each food group was covered showed, however, that little milk or other dairy products were generally consumed. This might be indicative of calcium, vitamin A and riboflavin deficiencies, as reported by Venhaus (1985) and Sebrell (1972).

Further advantages for garden owners were that they had more to save, sell and barter, suggesting that they had more disposable income, which would enable them to consume more food or raise their standard of living. This became evident in a significantly ($p < 0.001$) higher standard of living index of those with a garden, as well as in a higher percentage (61%) of women that were well nourished.

The hypothesized model dilineated in the introduction could not be verified by path analysis, since the sample size was too small. However, correlations cross tabulations indicated the positive effect a family home garden has on consumption, saving, bartering and selling of food by rendering surplus produce. It can be assumed further that with an increase in food intake, the nutritional status, and with it, the well-being and work performance of an individual is ensured or at least optimized.

A recommendation of this study is to advocate the introduction of family home gardens in all areas in which

mal- or undernutrition exists. Home gardens are a cheap, quick and safe way to increase food consumption and thereby alleviate dietary deficiencies without imposing an extra burden on women who already bear a heavy work load. Growing additional fruits or vegetables, indigenous to this area, on a year round basis would not only help to overcome vitamin A, ascorbic acid, riboflavin, and mineral deficiencies, but also the problem of agricultural seasonality, with times of plenty and times where food is scarce. The surplus produce could well serve as an indirect and direct source of income when the food is sold on the market, bartered or saved. Since a garden is usually regarded as female property, the income directly falls in the hands of those who are in charge of food. As women are more likely to spend money on food, this extra income would benefit the nutritional status of all family members.

Additionally, such a small plot is a very effective teaching tool, not only for the women, but also for the next generation. Simple instructions on what to grow and how, which combination of vegetables have synergistic effects according to fertilization and optimization of the 4 biological value of protein, and also on small animal husbandry would increase the knowledge about nutrition, which is expedient if malnutrition is to be eradicated. Nevertheless, introduction of gardens should be part of an integrated program, since malnutrition is caused by many

factors and therefore cannot be solved from just 'one corner of the square'. Sanitation, health care, improved farming systems that emphasize intercropping and crop rotation (i.e. multicrop systems to conserve soil fertility without additional expensive fertilizers as often seen in cash cropping), and soil conservation, especially in mountainous areas as La Celestina, must be taught in order to get long lasting positive changes and results.

For further studies it might be suggested that the sample size be increased and more thought invested in the optimization of the formulation of the questions to get more valid measures of nutritional status, work performed, child health and infant mortality.

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TABLES

Table 1 : **Educational level and standard of living;** means and standard deviations by garden status

Household Characteristic	**no garden** n=47 Mean	SD	**garden** n=67 Mean	SD
Years of education:				
of the father	2.6	2.3	2.4	2.1
of the mother	2.1	2.2	1.6	1.4
SLI	1.9	0.3	2.1	0.3 *

* Significant at 0.01 level

Table 2: Means, standard deviation, significance of means of **Anthropometric measures of the mothers** by garden status

Characteristic of mother	**no garden** n=47 Means	SD	**garden** n=67 Means	SD
Age	39.8	15.1	39.1	13.5
Weight (kg)	48.3	7.9	51.6	10.2 *
Height (cm)	150.20	6.7	151.8	7.5
BMI	21.3	2.9	22.3	3.3

* significant at 0.1 level

Table 3: Means, standard deviation, significance of means of **Food Characteristics** by garden status

Food Characteristic	no garden n=47 Means	SD	garden n=67 Means	SD	
Food produced	8.3	4.4	16.4	3.4	***
bought	24.5	7.1	22.8	7.2	
saved	1.6	3.5	5.0	9.7	*
marketed	0.1	0.3	0.3	1.1	
bartered	6.7	6.9	8.3	8.6	
eaten	14.2	4.5	18.7	5.2	***

Level of significance of the difference between the means

* P < 0.05
** P < 0.001
*** P < 0.0001

Table 4: **Food production** by garden status

Level of Food production (# of items)		no garden n=47 %	garden n=67 %	
high	(17-25)	0.0	41.8	
medium	(9-17)	31.9	53.7	
low	(< 9)	66.0	0.0	
		Chi-square	55.029	2 df
		p-value	0.000	

Table 5: **Food produced** by > 60% of the people by garden status

garden		no garden	
Food item	%	Food item	%
Green Pepper	95.52	Mango	82.98
Chicken	95.52	Chicken	80.85
Mango	92.54	Eggs	72.84
Yucca	92.54	Yucca	72.84
Lettuce	91.65	Green Pepper	65.96
Eggs	85.07	Potatoes	65.96
Potatoes	88.05	Pigeon pea	63.83
Egg plant	80.56		
Tomatoes	80.60		
Chili Pepper	74.63		
Pigeon pea	71.64		
Beets	67.16		
Onions	65.67		
Radish	65.67		

Table 6: Means, standard diviations, significance of means of **production and use of garden vegetables** garden status

Food Characteristic	**no garden** n=47 Means	SD	**garden** n=67 Means	SD	
vegetables					
produced	1.2	2.1	6.3	2.4	***
saved	0.3	1.5	1.4	2.7	**
bought	6.0	2.5	4.1	3.1	**
sold	0.0	0.0	0.1	0.5	
bartered	2.1	2.9	3.2	3.4	
eaten	2.5	1.6	5.5	2.6	***

Level of significance of the difference between the means

* $p < 0.05$
** $p < 0.001$
*** $p < 0.0001$

Table 7: **The 10 most commonly bartered foods** by garden status

garden	no garden
Yucca	Tomato
Lettuce	Yucca
Green Peppers	Green Peppers
Potatoes	Beans
Beans	Lettuce
Tomato	Chili Pepper
Chili Pepper	Rice
Onion	Tomato
Radish	Egg plant
Cabbage	Milk

Table 8: **Saving of food** by garden status

Save food	garden n=67 %	no garden n=47 %
no	52.2	70.2
yes	47.8	29.8

Chi-square 3.708 df = 1
P-value 0.054

Table 9: **Food bought** by > 50% of the People

no garden		garden	
Food item	%	Food item	%
Noodles	100.00	Noodles	98.50
Rice	97.87	Rice	97.01
Beef	97.87	Bread	97.01
Beans	95.74	Beef	97.01
Onions	93.62	Coffee	95.52
Bread	93.62	Beans	91.04
Coffee	91.49	Chocolate	89.55
Chocolate	89.36	Oatmeal	83.58
Plantain	85.11	Plantain	82.09
Oatmeal	80.85	Onions	70.15
Chili Pepper	76.60	Sweets	70.15
Beets	70.21	Beer	67.16
Tomatoes	70.21	Cheese	65.67
Cabbage	65.96	Maize	64.18
Egg plant	65.96	Codfish	61.12
Sweets	63.83	Pork	61.12
Cheese	63.83	Pop	53.73
Potatoes	59.57	Avocados	50.75
Pop	59.57	Cond. milk	50.75
Zucchini	59.57		
Pigeon pea	57.00		
Small fish	57.45		
Lettuce	55.32		
Cassava	53.19		
Milk	53.19		
Beer	51.06		
Chicken	51.06		

Table 10: **Food consumption** by garden status

Level of Food consumption (# of food items)		garden n=67 %	no garden n=47 %
low	(<10)	0.1	38.8
medium	(10-20)	72.3	56.7
high	(21-30)	21.3	0.0
		Chi-square	19.319 2 df
		p-value	0.000

Table 11: **Food consumed** (food items recalled by > 60%) by garden status

garden		no garden	
Food item	%	Food item	%
Rice	98.51	Rice	93.62
Onions	92.54	Onions	93.62
Coffee	91.04	Beans	93.62
Beans	91.04	Mango	86.57
Mango	86.57	Coffee	87.23
Yucca	82.09	Bread	70.21
Chili Pepper	80.60	Milk	68.08
Lettuce	73.13	Yucca	68.08
Milk	71.64	Noodles	65.96
Eggs	70.15	Chocolate	59.57
Bread	67.16	Chili Pepper	55.32
Noodles	62.70	Potatoes	53.19
Potatoes	61.19		
Chocolate	58.20		
Green Pepper	56.72		
Eggplant	56.72		
Tomatoes	56.72		
Avocado	55.22		
Radish	55.22		
Beets	53.73		

Table 13: **Nutritional status of the farm women by garden status**

Nutritional status	no garden %	garden %
normal	55.3	61.2
malnurished	44.7	38.8
	Chi-square 0.393	df=1
	p-value 0.530	

Table 14: Comparative **social activities** of fathers and mothers

(n=114)

	Percentage of sample carring out each activity **Fathers** %	**Mothers** %
Weddings, Baptism, Funerals etc.	40.4	43.0
Dances	37.7	23.7
Meetings	57.9	57.9
Listen to radio	25.4	30.7
Rest	31.6	38.5
Mass	30.7	38.6
Visit sick	36.0	43.0
Visit neighbors	32.5	38.6

Table 15: **Work performance of mothers vs fathers**

(n=114)

	Percent of sample performing each task	
	Fathers %	**Mothers** %
Household		
Cook	3.5	91.2
Take food	10.5	57.0
Clean	2.6	87.7
Wash	2.6	87.7
Child care	6.1	72.8
Water wood	47.4	60.5
Garden		
Prepare	39.5	12.3
Seed	39.5	22.8
Weed	33.3	22.8
Water	22.8	33.3
Debug	20.2	11.4
Fertilize	30.7	10.5
Harvest	24.6	27.2
Forage		
Prepare	51.8	
Seed	57.0	0.9
Cut	52.6	1.8
Animal		
Feed	43.0	41.2
Clean	27.2	5.3
Milk	17.5	47.4
Vaccinate	4.4	0.9
Birth	7.0	0.9
Kill	15.8	71.9
Buy	34.2	50.0
Sell	4.4	7.9
Income generating activities		
At home	6.1	67.5
Away from home	71.9	7.0

Table 16: **Chi square test statistic for all variables with respect to having a garden**

Varable name	Chi square	df	p
Social activity of mothers	1.659	2	0.436
Work performance of mothers	0.269	1	0.604
Food: bartered	0.782	2	0.676
saved	3.708	1	0.054
marketed	2.161	2	0.339
bought	1.381	1	0.240
produced	55.029	2	0.000 *
eaten	19.319	2	0.000 *

* indicates a significant result.

Table 17: Pearson coefficient and p value for **Biserial correlations**

Pearson r (p value)	**garden**	**malnutrition**
nutritional status	0.150 (0.115)	---- ----
standard of living	0.250 * (0.007)	-0.244 * (0.009)

* $p < 0.05$

A P P E N D I C E S

71 KS 004-1-2

Jefe de familia: BENEDITO ANT. REYES Fecha: [illegible] 1986

1. Código: 004-1-2

2. Localidad: El [illegible]

3. TAMAÑO Y COMPOSICION FAMILIAR: (TOTAL DE MIEMBROS)

____ niños un año
// niños 1-3 años
____ niños 4-6 años
____ niños 7-9 años
____ varones 10-12 años
____ varones 13-15 años
____ Varones 16-19 años
____ Hembras 10-12 años
____ Hembras 13-15 años
____ Hembras 16-19 años
/ Hombres 19 años
// Mujeres 19 años (abuela)

4. EDUCACION DE LOS PADRES:

2 Grado completo del Padre 5 Grado completo de la madre

5. PARIDAD DE LA MADRE:

2 Total de hijos 2 Vivos 0 Muertos

Está embarazada? ____ Si ✓ No ____ Meses de embarazo

Está lactando a su hijo? ____ Si ✓ No

6. TRABAJO DE LA MADRE:

✓ Oficios domésticos ____ Tejedora
✓ Trabaja fijo, de qué [illegible] Días: 5
____ Trabaja a medio tiempo, de qué ____ Días: ____
____ Otro, de qué? ____

7. TRABAJO DEL PADRE:

✓ Agricultor ____ Artesano
✓ Trabaja fijo, de qué? [illegible] Días: 5
____ Trabaja a medio tiempo, de qué? ____ Días: ____
____ Otro, de qué? ____

8. TRABAJO DE LOS ~~HIJOS~~ (CANTIDAD): ABUELA [illegible]

____ Agricultor ____ Artesano
____ Trabaja fijo, de qué? ____ Días: ____
____ Trabaja a medio tiempo, de qué? ____ Días: ____
____ Otra, de qué? ____

9. INGRESO FAMILIAR:

____ Quincenal ____ Mensual ____ De vez en cuando
____ Ayuda familiar extranjera mensual
____ Ayuda familiar en el país mensual

10. GASTOS EN ALIMENTOS:

____ 6Diario ____ Semanal ____ Quincenal

11. ¿QUE ALIMENTOS COMPRA?

¿QUE ALIMENTOS COMPRA?	COSTO	UNIDAD
Arroz		20 L Q
[illegible]		5 L Q
Azúcar		20 L Q
[illegible]		5 L Q
[illegible]		5 (sem) Q
[illegible]		15 sem (x) Q
Sal		[illegible] Q
[illegible]		[illegible] (2 L) Q
[illegible]		1/2 L Q
[illegible]		3 L Q
		1 - Q
		[illegible] - Q

III. CONSUMO DE ALIMENTOS:

A. Los alimentos que la madre comió hoy.
Pregunte a la mujer.

Alimento		Produce o compra	cantidad	Código
Mañana				
	Arroz (g. 28)		150 ml	
	Leche (1)			
	Azúcar 40 m			
	Sopa			
	Pan de trigo		1	
Mediodía				
	Plátano (con. 4 cm)		1	
	Espagueti		1C	
	Salsa de tom.			
	Arroz			
	Tortillas			
	Frijoles		1C	
	Pastelillo			
	Lechuga			
Tarde	Refresco			
	Tomate			
	Café			
	azucar		4	
	Pan de trigo		1	
Noche				
	1 Huevo (2 cm. Esp)		Frit	
	Frijoles 1/2 1/2 cm		2T	
	Tortillas 1/2			
	Arroz 3 Sp			
	Café 1			

Manteca 1 sp
Chocolate 1/2 barra
Leche 1 bocote (vaso de 1/4 L)
azucar 1/4 L

Arroz 1 sp

B. Frecuencia de Consumo de alimentos claves

Preguntar a la mujer de la casa si ellos consumen cada alimento. Si lo consumen, preguntar cómo lo consiguen y cuántas veces durante la última semana.

Alimento *	Produce	Guarda	Compra	Vende	Presta o Trueque	Cuantas veces come Diario	Semanal
1. Tayota	—		✓			un poco	
2. Tomate	✓		—			✓ si hay	
3. Lechuga	✓		—			✓ si hay	
4. Ajies	✓		—			✓ si hay	
5. Rábano	✓		✓			✓ a veces	
6. Cebolla	✓		✓			✓	
7. Remolacha	✓		—			✓ a veces	
8. REpollo	✓		—			a veces	si hay
9. Naranjas	✓		—				2x sem
10. Zanahoria	✓		—				2x sem a veces
11. Batata	—		✓				✓
12. Habichuelas	—		✓			✓	
13. Guandules	✓		—				✓
14. Yuca	✓		—			✓	
15. Yuca amarga	—		—			—	—
16. Platano	✓ verde		✓			intercalando	
17. Guineos	—		—			—	—
18. Ayuama	✓		—				✓
19. Leche de vaca	✓		—			✓	
20. Carne de cerdo	poco veces		✓				a veces
21. Pollo o Pato	✓		—			unpoco	
22. Huevos	✓ 3 por dia					✓ si hay	
23. Bacalao	—		—			—	—
24. Peces	—		—			Perfecta	
25. Carne de vaca	—		✓				✓
26. Queso	—		✓				Quincenal
27. Miel de abejas	✓ veces no mucho		—			✓	
28. Arroz	—		✓			✓	
29. Avena	—		✓			✓	
30. Aguacate	✓		✓			si hay a veces	
31. Mango	—		—			a veces - regalado	
32. Naranja	✓		✓			2 veces a sem - quincenal	
33. Pica Pica	—		✓				2 veces por sem
34. Pan	—		✓			✓	
35. Higos o espagueti	—		✓				3/3 veces sem
36. Chocolate en tableta o polvo	—		✓			✓	
37. Leche condensada	—		—			—	—
38. Dulce	—		✓			intercalando	
39. Refrescos de bot.	—		✓				✓
40. Cerveza negra	—		—			—	—
41. Ron	—		—			—	—
42. Café	—		✓			✓	
43. Maíz	✓		✓ para consumo			—	—
44. Sorgo o millo	—		—			—	—

* Poner un astrix si se comen sólamente en su época.

V. EL TRABAJO DE LA FAMILIA:

Preguntar a la mujer quién lo realizó durante la semana pasada, cada una de las actividades siguientes:

Actividad M y M	Mujer	Esposo	Hombres	Varones
La Casa:				
(1) Cocinar	✓			
(2) Llevar la comida	✓	✓		
(3) Limpiar la casa y el patio	✓			
(4) Lavar ropa	✓			
(5) Cuidar los hijos	✓	✓		
(6) Cargar agua/buscar leña	✓	✓		
El Huerto:				
(7) Preparación de la tierra		✓		
(8) Sembrar		✓		
(9) Desyerbar	✓	✓		
(10) Mojar	✓	✓		
(11) Sacar insectos Project				
(12) Abonar		✓		
(13) Cosechar	✓	✓		
(14) Otras actividades (elaborar)				
El Conuco:				
(15) Preparación de la tierra				
(16) Sembrar		✓		
(17) Desyerbar		✓		
(18) Sacar insectos		✓		
(19) Abonar		✓		
(20) Cosecha		✓		
(21) Otras actividades (elaborar)				
El Forraje:				
(22) Preparación de la tierra		✓		
(23) Sembrar y resembrar		✓		
(24) Cortar la yerba y llevarla a los animales.		✓		
Crianza de los animales:				
(25) Alimentarlos		✓		
(26) Limpiar su lugar	✓	✓		
(27) Ordenar y/o buscar los huevos	✓			
(28) Poner vacunas Project				
(29) Ayudar a los partos Project	✓			
(30) Sacrificar los animales				
Ir a la pulpería para:				
(31) Comprar ✓	✓			
(32) Vender				

Actividad	Mujer	Esposo	Hembras	Varones
Las actividades sociales:				
(33) Bodas, bautizos, entierros, velas, juntas y rezos	✓	✓		
(34) Bailes	✓	✓		
(35) Reuniones	✓	✓		
(36) Escuchar radio	✓	✓		
(37) Descansar				
(38) Misa y celebración de palabra	✓	✓		
(39) Visite a enfermos	✓	✓		
(40) Visite a vecinos o parientes	✓	✓		
Las Actividades de generación de ingreso (Horas):				
(41) Tejido u otras actividades productivas en la casa	✓			
(42) Actividades fuera de la casa				

ESCALA DE NIVEL DE VIDA

I. VIVIENDA:

Techo:
- ___ Yagua
- ✓ Cana
- ___ Zinc

Paredes:
- ___ Tablade cana o palo parado
- ✓ Madera
- ___ Block

Piso:
- ___ Tierra
- ___ Madera
- ✓ Cemento

II. AGUA POTABLE:
- ✓ Rio,arroyo o manantial
- ___ Lluvia o tanque
- ✓ Molino (tubular)

III. ELIMINACION DE EXCREMENTO:
- ___ En la tierra
- ___ Letrina en malas condiciones.
- ✓ Letrinas en buenas condiciones.

IV. LUZ:
- ✓ Cuaba o velas
- ✓ Lámpara humeadora
- ___ Lámparas de Kerosene comprada

V. FACILIDADES PARA COCINAR:
- ___ Fogón en el suelo
- ___ Anafe
- ✓ Fogón en alto

VI. MEDIOS DE COMUNICACION
- ✓ Ninguna.
- ✓ Revista, periódicos, radio en casa.
- ___ Televisor

VII. MEDIOS DE TRANSPORTE:
- ___ Ninguno, sólo a pie
- ___ Burro, caballo, mulo
- ✓ Motor, bicicleta

Edad 25
Peso 128
Talla 1,57

Appendix B **FOOD ITEMS AND THEIR ENGLISH TRANSLATIONS**

Garden vegetables

Tayota	: Summer squash
Tomate	: Tomato
Lechuga	: Lettuce
Ajis	: Chili peppers
Rabano	: Radish
Cebolla	: Onion
Remolacha	: Beets
Repollo	: Cabbage
Berenjena	: Egg plant
Zanahoria	: Carrots

Field produce

Batata	: Sweet potato
Habichuela	: Beans
Guandules	: Pigeon pea
Yuca	: Yucca
Casaba	: Cassava
Platano	: Plantain
Guineos	: Banana
Auyama	: Winter squash
Arroz	: Rice
Avena	: Oatmeal

Trees

Aguacate	: Avocado
Mango	: Mango
Naranja	: Orange

Miscellaneous

Pan	: Bread
Fideos	: Noodles
Chocolate	: Chocolate
Leche condens.	: Condensed Milk
Miel de abejas	: Honey
Dulce	: Sweets
Refrescos	: Pop
Cerveza	: Beer
Ron	: Rum
Cafe	: Coffee

Animal Products

Carne de cerdo	: Pork
Carne de vaca	: Beef
Pollo	: Chicken
Huevos	: Eggs
Bacalao	: Codfish
Peces	: Fish
Queso	: Cheese
Pica Pica	: Sardines

Appendix C

TENDENCY CHARACTERISTICS OF SELECTION PRODUCTION SYSTEMS

Concept	Household garden	Market garden	Field agriculture
Species density	High	Medium to slow	Low
Species type	Staple, vegetable fruit (cultural)	Vegetable, fruit (market oriented)	Staple (subsistence agro-industrial)
Main production objective	Home consumption	Market sale	Subsistence, market sale
Labor source	Family (female, elderly, children)	Family or hired (male, female)	Family, hired (male, female)
Labor requirements	Part-time	Full-time	Full-time
Water requirements type	High-irrigation	High-irrigation	Med. to low/irrig. rain food
Harvest frequency	Daily, seasonal	(Short) seasonal	(Long) seasonal
Size of unit	Small (relative)	Medium to large	Medium to large
Space utilization	Horizontal, vertical	Horizontal, vertical	Horizontal
Fencing	Frequent	Less frequent	Limited
Location	Close to dwelling	Close to urban market	Rural setting, close or distant from homestead
Cropping patterns	Irregular, row	Row	Row
Economic role	Supplementary	Major economic activity	Major economic activity
Technology	Simple hand tool	Hand tool or mechanized	Mechanized if possible, hand tool
Inputs - cost	Low	Medium to high	Medium to high
Geographical distribution	Rural and urban	Sub-urban	Rural
Skills	Gardening-horticultural	Market-horticultural, fruticultural	Agricultural, commercial
Government assistance	None or minor	Credit	Credit, extension

Ruthenberg [(10), p. 104] distinguishes "garden cropping from... arable cropping by the following features which are usually but by no means in all cases, found simultaneolusy: 1) cropping those plants for personal consumption that cannot be collected nor supplied by arable farming, 2) small plots, 3) proximity to the house, 4) fencing, 5) mixed or dense planting of a great number of annual, semi-permanent, and perennial crops, 6) a high intensity of land use, 7) land cultivation several times a year, 8) permanence of cultivation, and 9) cultivation with hand implements."

(V.K. Ninez, 1984)

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RELATIONSHIP OF FAMILY HOMEGARDENS TO THE NUTRITIONAL STATUS AND WORK PERFORMANCE OF FARM WOMEN IN THE DOMINICAN REPUBLIC

by

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AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Foods and Nutrition

KANSAS STATE UNIVERSITY
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ABSTRACT

This study investigated impact of family home gardens has on production, selling, buying, bartering, saving and consumption of food, and how these variables affect the standard of living (SLI), mortality of children, and the nutritional status and work performance of Dominican farm women. A survey of 114 households was conducted in 1986, in La Celestina, a mountainous area near Santiago, Dominican Republic. The area is part of an integrated rural development project. Path analysis was tried to depict causal relationships between the variables, but had to be replaced by several common correlational analysis tests since the sample was too small after it was divided into garden owners and those without a garden.

The results showed that a vegetable garden increased food production and consumption significantly ($p < 0.0001$ for both). The diet became much more diverse, women with gardens had a better nutritional status than without gardens. Leaving more products to barter with, to save and sell, a garden had an income generating effect that not only helped to raise the standard of living significantly ($p < 0.01$), but also to secure better nutrition and health of the family, depicted in a fewer children having died. On the other hand the number of tasks the mother had to face everyday (13.5), which is significantly higher than that of

men (9.9), was not negatively affected by a small plot near the house; there was no significant difference in the means. Social activities, an indicator of women's spare time, were the same for both groups as well.

These findings advocate strongly for the introduction of family home gardens as a cheap, quick and appropriate tool to overcome nutritional deficiencies and provide one solution for overcoming the problem of mal- , or undernutrition.