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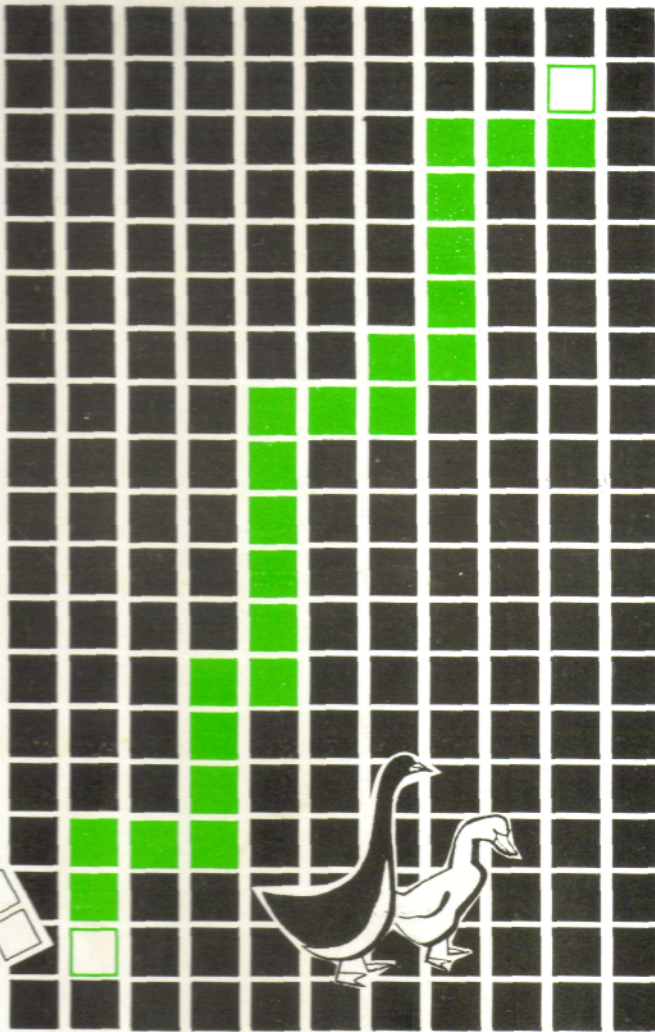
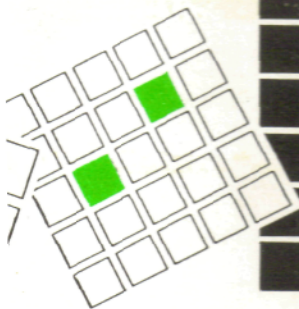
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FOOD CONSUMPTION PATTERNS AND THEIR IMPLICATIONS FOR SUSTAINED AGRICULTURAL DEVELOPMENT IN TRINIDAD AND TOBAGO

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ABSTRACT

Trinidad and Tobago is a small, open petroleum-dominated economy in which trade and the service sectors including Government play an important role in generating economic activity. While agriculture makes only a small contribution to Gross Domestic Product (GDP), it remains a source of employment for a large segment of the population and contributes to the food availability, the majority of which comes from imported sources.

There is a strong association between the morbidity and mortality trends and food consumption patterns in Trinidad and Tobago a situation which has implications for changes in food consumption patterns. Such changes that are likely to occur will lead to greater investment in domestic food production leading to improved technology, self-reliance, and farm income as well as life expectancy. However, these changes will not be realized if appropriate food.

nutrition and health *policies* are not adopted by the State and its institutions.

INTRODUCTION

Food is consumed primarily to provide nutrients for energy, growth and development, and protection against diseases. The pathogenesis of diseases is invariably a multifactorial phenomenon. Gene complement is at the heart of the body's immune response. However, good nutrition throughout the lifecycle bolsters the immune system and enhances the body's capability to meet the assault by infectious organisms, stress, and toxins from a hostile environment. Breastfeeding for example, imparts basic immunity to the infant.

Three non-communicable diseases - ischaemic heart disease, diabetes mellitus and malignant neoplasms are among the five leading causes of mortality in Trinidad and Tobago. The mortality patterns have indicated an increasing trend during the 'sixties, 'seventies and 'eighties. A similar

pattern could be discerned in food consumption. Since food consumption patterns reflect a derived demand for energy and nutrients, they hold implications for the patterns of food production and imports and ultimately for sustained agricultural development in Trinidad and Tobago. As people become more conscious of the interrelationships between food, nutrition and health, these concerns will be reflected in their purchasing patterns, thereby forcing adjustments in the patterns of supply.

This paper attempts to measure the association between components of the food availability profile and mortality due to these diseases and to highlight their implications for appropriate changes in consumption patterns that might militate against these diseases. The implications for the agricultural and import sectors are also presented.

FOOD, NUTRITION AND HEALTH INTERRELATIONSHIPS

Foods are products of plant or animal origin or fabricated by man, which when consumed are broken down by the body to provide the basic materials for bodily functions, growth and development. Nutritional status is the net effect of food consumption, digestion, absorption and assimilation in relation to physical activity, health status and growth and development potential. Nutrition-related health problems arise when nutrient imbalances beyond tolerable levels occur as the body displays remarkable adaptations to different levels of nutrient intake. Both nutrient deficiencies and excesses lead to health problems. Protein-energy undernutrition is a problem of inadequate food consumption while the consequence of over-

consumption is obesity. Obesity has been cited as a predisposing factor for such chronic diseases as diabetes mellitus, hypertension, heart disease, cerebrovascular disease and some cancers.

Most of the mortality between 45-64 years in English-speaking Caribbean populations has been due to these diseases (27% to 57% of all deaths). Trinidad and Tobago registered the highest overall percentage of deaths from these diseases. Age specific mortality rates show that adults in Trinidad and Tobago experienced a several times greater risk of premature mortality from ischaemic heart disease and diabetes mellitus than the other countries of the region [CFNI, 1991]. The causes of chronic diseases are complex. Dietary factors account for only a part. The major risk factors of the nutrition-related chronic diseases are heredity, indiscriminate eating habits, sedentary living, excessive alcohol consumption and cigarette smoking. Individuals, however, differ in their susceptibility to the adverse health effects of specific dietary factors.

Food availability in virtually all Caribbean countries has been increasing throughout the 'sixties, 'seventies and 'eighties, but not without fluctuations. More importantly, the nutrient composition of the food supply has also been changing as well as the contributions from various food sources.

Historically, food production in Trinidad and Tobago has been insufficient to satisfy the consumption requirements of the population. Consequently, the country is dependent upon food imports to meet the shortfall. Per caput food supplies of Trinidad and Tobago for the period 1967-77 and 1989 [CFNI, 1976, 1984] indicate

that the contributions to total food availability of energy, protein and fat by various groups of foods adequately met the nutrient needs of the population with a sizeable surplus.

Problems in food availability may, however, arise at the household level. The food distribution system functions in a manner such that inequalities are created in the distribution of food. Segments of the population are unable to acquire sufficient food for various reasons. Such reasons include lack of resources to produce food, unemployment and unavailability of income to purchase available food, and food too expensive relative to income. Under such circumstances malnutrition inevitably results within the population. The prevalence of protein-energy malnutrition simultaneously with obesity within the population of Trinidad and Tobago indicates obvious maldistribution of available food between and within households of the nation.

For the past two (2) decades, trends in the retail price of food in Trinidad and Tobago have been generally upward. The increasing cost of food, therefore, makes it less likely for households within the low income classes to be adequately nourished.

A qualitative analysis of food availability reveals that contrary to the World Health Organization (WHO) recommendation, the dietary consumption pattern of Trinidad and Tobago is comprised of a low level of energy supply from complex carbohydrates (particularly roots, tubers, fruit, vegetables and pulses). Epidemiological research suggests an intimate and consistent relationship between an established dietary consumption pattern like that of Trinidad and Tobago's and the emergence of a

range of chronic diseases within the population. Also, scientific research continuously provides supporting evidence of the important role of diet in the development of the most common causes of premature death [WHO, 1990].

It is often assumed that chronic diseases gradually become established within a population as a country becomes more *affluent*. Affluence is basically assessed in terms of the level of a country's Gross National Product (GNP). The change in GNP over time is taken as indication of the relative rise or fall in living standards within an economy. Trinidad and Tobago experienced a GDP average annual growth rate of 3.1% for the period 1960-1982 [Sinha, 1991].

Per caput GDP increased from TT\$1,092 in 1965 to \$1,562 in 1970, \$4,716 in 1975 and \$7,460 in 1978. According to the findings of the WHO Study Group, as a country's GNP increases, there is a progressive substitution of dietary fat from animal sources and complex carbohydrates. Additionally, free sugars, especially glucose and sucrose syrups form a much higher proportion of the total dietary carbohydrate in very affluent communities. Thus, variation in the consumption of starchy foods and animal fats is the most striking feature of the dietary pattern of a population experiencing some degree of affluence (Figure 1).

To what extent have the changes been related to the trends in morbidity and mortality of the chronic diseases? Using data for Trinidad and Tobago, the general linear regression model was used to measure the relationships. The food availability data was taken or constructed from food balance sheets developed by the United Nations Food and Agriculture

Organization (FAO). Trends in mortality were compiled from data of the Central Statistical Office (CSO) of Trinidad and Tobago. The models tested were based on the current concepts of the nutritional linkages with the chronic diseases.

Ischaemic Heart Disease

Otherwise known as coronary heart disease, ischaemic heart disease (CHD) has been linked to hypercholesterolemia, high blood pressure and cigarette smoking in a synergistic relationship. The fundamental importance of diet in the progression of coronary heart disease is mediated through its effect on the development of hypercholesterolemia and hypertension. The Framingham study on which these risk factors are based found no direct relationships between the amounts and types of food consumed by participants and the levels of cholesterol in their blood. However, increased blood cholesterol was associated with weight gain in men during the study period [Ensminger, et al., 1983]. Excess energy intake leading to obesity is implicated in the aetiology of coronary heart disease as well as increases in blood cholesterol and Wood pressure.

Populations consuming diets rich in plant food display lower CHD rates than other populations. The Seven-Day Adventists in the Netherlands and Norway have CHD rates that range from one-third to one-half of those in the general population. Also, Californian Seven-Day Adventists who eat meat have higher CHD rates than those who are vegetarians. Additionally, British vegetarians have a 30% lower rate of CHD mortality than non-vegetarian as long as allowance is made for the population's lower rates of cigarette

smoking [WHO, 1990]. However, the chronic consumption of highly refined carbohydrates (e.g. sugar, white flour) may lead to chromium deficiency and exacerbate diabetes and cardiovascular diseases [Ensminger, et al., 1983].

The consumption of cereal fibre may also protect individuals against coronary heart disease [James, et al., 1988]. However, the reasons for this are not clear [Morris, 1987]. A fall in serum cholesterol can be produced by increasing vegetable and fruit fibre intake, but cereal fibre does not usually have this metabolic effect. The epidemiological link between coronary heart disease and the low intake of cereal fibre is, therefore, unexplained.

Alcohol consumption also influences the occurrence of coronary heart disease. A slightly lower risk of coronary heart disease occurs in light-to-moderate drinkers than in abstainers [WHO, 1990]. A study of the incidence of heart disease in over 7000 Japanese men living in Hawaii found a 50 percent lower rate among those who consumed the alcohol equivalent in one bottle of beer or two shots of whiskey per day than those who abstained. Greater consumption of alcohol did not appear to confer additional benefits. Excess alcohol consumption, however, might lead to serious disorders of the heart such as irregular heartbeats and degeneration of the heart muscle [Ensminger, et al., 1983].

Based on the above review mortality due to coronary heart disease in Trinidad and Tobago was regressed upon energy, fat, and sugar availability. The best fit of the data was afforded by a combination of processed fats and oils (PFAT) and total energy (KCAL) available with a 15-year lag as shown in the following equation:

$$\text{CHD} = 220.413 + 14.823 \text{ PFAT} + 0.558 \text{ KCAL}$$

$$(49.418) \quad (1.838) \quad (0.134)$$

... (1)

$$N = 11 \quad F = 32.97 \quad DW = 2.14$$

$$= 88.88$$

The strong positive association between mortality from coronary heart disease and processed fat and total energy availability implies that reducing energy intake and processed fat in the diet might result in lowering mortality from coronary heart disease. A one percent increase in the availability of processed fat and total energy was associated with increases in mortality due to coronary heart disease of 1.7% and 12.8%, respectively.

Diabetes Mellitus

Diabetes is a collection of disorders resulting from either a lack of insulin or factors depressing the action of insulin or a combination of both. Insulin plays a pivotal role in the transfer of sugars, fats and amino acids from the blood to the cells. Thus, the lack of insulin action leads literally to starvation of tissue in the midst of an abundance of nutrients [Ensminger, 1983].

There are two major types of diabetes mellitus Insulin Dependent Diabetes Mellitus (IDDM) and Non-Insulin Dependent Diabetes Mellitus (NIDDM). IDDM occurs in less than 10% of diabetics. This condition is most observed in persons in less than 20 years of age and is believed to be caused by a genetic defect impacting on the pancreas. NIDDM contributes to approximately 90-95% of all diabetic cases and is prevalent mainly in obese adults.

The risk factors associated with diabetes include age, gender, ethnicity, family history and obesity. The incidence of NIDDM increases with age. Thus, a continuous rise in the prevalence of diabetes mellitus can be expected as the population ages, irrespective of other determinants. Diabetes mellitus is predominant in females rather than males in all age groups. However, this characteristic is most prevalent in the African ethnic group. Epidemiological studies also indicate that diabetes mellitus is dominant in persons of Indian origin in Trinidad and Tobago compared with other ethnic groups [Morris, 1977].

There is a strong genetic link in both types of diabetes mellitus. The risk of NIDDM in offspring of patients with NIDDM is six times that of non-diabetic controls and twice if both parents possess IDDM. It should also be noted that obese siblings of diabetic parents are three times at risk of having NIDDM three times as that of non-obese children.

Statistics show that in Trinidad and Tobago, one out of every ten adults is estimated to be diabetic. Mortality for diabetes in Trinidad and Tobago is the highest among the Americas. Approximately 11% of deaths in Trinidad and Tobago between the ages 35 and 64, are due to diabetes mellitus. Diabetes is also associated with an increased risk of cardiovascular and cerebrovascular disease.

Not surprisingly, a good fit of the data was obtained when mortality due to diabetes was regressed upon total energy (KCAL) availability as indicated in Equation 2. Inclusion of other variables, such as fat and sugar, did not yield significant coefficients. Based on Equation

2, a one percent increase in energy availability was associated with a 7.16 percent increase in mortality due to diabetes.

$$DM = 251.502 + 0.112 \text{ KCAL} \quad \dots(2)$$

(35.355) (0.013)

$$N = 14 \quad F = 68.71$$

$$R^2 = 83.89\% \quad D.W. = 1.47$$

Malignant Neoplasms

Malignant neoplasms (commonly known as cancer) is defined as a group of conditions characterised by uncontrolled growth cells originating from almost any tissue of the body. When control systems governing cell growth in human fails, the carefully ordered pattern of cell growth, division and differentiation is lost and an abnormal mass of cells or cancer may arise. The factors responsible for the failure of control are not predominantly the extraneous substances existing within the diets of the population or the environment; but some of the nutrients essential for health consumed in an indiscriminate manner [Sinha, 1991]. However, tobacco is the best known and most widely used cancer-causing agent. The most important cause of lung cancer is cigarette smoking [Hagtey, 1987].

Sustained heavy alcohol consumption appears to be causally linked to cancer of the upper alimentary tract and liver. Additionally, it is apparent that excessive body weight is a risk factor for endometrial and post-menopausal breast cancer. However, the association of these cancers with excessive energy intake is less

established. It is also suggested that a high fat intake is associated with cancer at several sites. A review of epidemiological evidence indicates that a high intake of total fat and in some cases also saturated fat is associated with an increased risk of cancers of the colon, prostate and breast. This evidence is strongest for cancer of the colon and weakest for breast cancer.

Diets high in plant foods especially green and yellow vegetables and citrus fruits are associated with a lower occurrence of cancer of the lung, colon, oesophagus and stomach. Although the mechanisms underlying these effects are not fully understood, such diets are usually low in saturated fat and high in starches and fibre. These diets also contain several vitamins and minerals including beta carotene and vitamin A. There is, however, no conclusive evidence that the benefits derived from consuming diets high in plant food are due to the high fibre content of such foods [WHO, 1990].

The optimum intake of fat in relation to cancer is, however, uncertain [WHO, 1990] (Table 1).

The two influential explanatory variables in relation to cancer mortality were dietary fat (DFAT) and total energy (KCAL) as indicated in Equation 3.

$$MN = -86832 + 0.021 \text{ KCAU} + 4.410 \text{ DFAT} \quad \dots(3)$$

(15818) (0.005) (0.700)

$$N = 14 \quad F = 47.64$$

$$ff = 87.77\% \quad D.W. = 2.72$$

The data suggest that one percent increase in energy availability was associated with a 0.83 percent increase in mortality due to cancer. The corresponding figure for dietary was 1.48 percent.

Table 1: Associations Between Selected Dietary Components and Cancer

Site of Cancer	Fat	Body Wt.	Fibre	Fruits and Vegetables	Alcohol	Smoked, salted and pickled food
Lung						
Breast	4-					
Colon	4+					
Prostate	^*					
Bladder						
Rectum						
Endometrium		» «•				
Oral Cavity						
Stomach						-k 4
Cervix						*
Oesophagus					c	

Key: » = Positive association: increased intake with increased cancer
 = Negative association: increased intake with decreased cancer⁰ =
 Synergistic with smoking.

Source: WHO Technical Report Series No. 797. 1990: "Diet, Nutrition and The Prevention of Chronic Diseases" A Report of a WHO Study Group, p 67

IMPLICATIONS FOR SUSTAINED AGRICULTURAL DEVELOPMENT

Trinidad and Tobago is a small open petroleum-dominated economy in which external trade and the domestic service sectors including government play important roles in generating economic activity. While agriculture makes only a small contribution to gross domestic product (GDP) - estimated at 3.2% in 1989 - it remains a source of employment for 10-15% of the labour and makes a sound contribution to the foreign exchange earnings. Agriculture's contribution to the total food supply is estimated at 30% making Trinidad and Tobago highly food import dependent. The strong positive relationships between mortality due to coronary heart disease and total energy and processed fat availability: mortality

due to diabetes mellitus and total energy availability; and mortality due to cancer and total energy dietary fat availability point to a reassessment of food production and import practices.

Reduction in total energy availability might best be achieved by cutting down the imports of highly refined carbohydrates (e.g., wheat flour), oils and fats, and increased sugar exports. Increases in the production of starchy fruits, roots and tubers, fruits and vegetables and legumes would enhance the availability of dietary fibre and valuable nutrients without unduly increasing energy levels.

While the production of fresh fruits and vegetables has been on the increase in recent years, the dominant pattern of agricultural production remains the major export crop (sugar), and to a less extent cocoa and coffee Apart from poultry

production the livestock sector remains undeveloped.

The long term trend in the production of sugar, cocoa and coffee has been downward. Sugar production declined from 255,000 tonnes in 1965 to 160,000 tonnes in 1975 and 81,000 tonnes in 1985. By 1990 production was 118,000 tonnes. The comparative figures for cocoa were 4997, 4181, 1307 and 2127 while those for coffee were 3849, 4024, 852 and 1935. The poor performance of these sectors makes them prime candidates for a diversification programme that will ensure the production of crops and livestock that are more in keeping with a health conscious population.

Sugar, and its derivative rum will continue to enjoy low demand both from international competition and a population concerned about obesity and its associated diabetes mellitus, coronary heart disease and cancers. These products provide only energy and their lack of essential nutrients is likely to contribute to nutrient imbalances. An agricultural production system dominated by sugar and rum cannot be sustained. Sustainability in this context refers to the capacity of the food and agricultural production and distribution system to achieve the desired income levels and quantity and quality of foods to meet the nutrient needs of the population without jeopardizing the natural resources for use by future generations. These resources include land, water and biological species [FAO, 1988].

Sugar and rum production offers only limited protection to the nutrition status and has deleterious effects on the environment. The annual burning of sugarcane fields adds to the emission of carbon dioxide, destroys animal species upon

which higher members of the food chain depend, modifies the soil structure adversely, kills soil organism beneficial to man and generally degrades the environment. The processing activities are not any friendlier. The frequency of upper respiratory tract infections in populations located in the environs of sugar factories during the processing season is undesirable and rum factory effluents pollute the rivers.

The system provides a source of employment and foreign exchange but at tremendous cost. The foreign exchange earned from sugar and rum is estimated at \$167.6 million in 1991. Given a food import bill of \$912.6 million in 1990, a reallocation of resources used in the production of sugar and rum may well maintain employment levels while conserving a greater amount of foreign exchange.

A healthy, long-living population is at the hub of sustained agricultural development. Over the years there has been an increasing concern among Caribbean governments about the relationships between food, nutrition and health. Several have developed food and nutrition policies and health policies. As these policies are translated into action plans and implemented, all sectors infringing on food, nutrition and health are expected to make adjustments. Within the education system, for example, good dietary practices will be promoted and myths will be dispelled. Educated consumers will then make rational food choices and force the food production and import systems as well as the food processing system to respond. This response would strengthen linkages between consumers and the domestic food production system thereby increasing

self-reliance in food production, improving farm incomes and enhancing longevity.

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