# Dietary Habits, Diversity and the Indigenous Diet of The Turks and Caicos Islands

## Implications For Island-specific Nutrition Intervention

TE Maitland


### *ABSTRACT*

***Objective:*** *To describe dietary habits in the Turks and Caicos Islands.*

***Design and Methods:*** *Food frequency questionnaires were administered to female-household-heads of 144 households randomly selected from three islands' voter's lists (Grand Turk [*n = *48], Providenciales [*n = *46] and Middle Caicos [*n = *50]). Data were collected on the distribution of:*

*(a) Households among Levels 0 – 7 of a Food Group Scale, developed using the Cornell Technique of Scaling Dichotomous Data, and based on number of households that consumed seven food groups (meat and legumes, bread/cereals, fruits, vegetables, starchy roots/tubers/fruits; dairy and beverages) weekly;*

*(b) Foods among four categories (common core, island core, occasional or rare) also based on weekly frequency of consumption.*

***Results:*** *Thirty per cent of households on Grand Turk and 37% on Providenciales were at level 7, the most varied and complex diets, compared to 3% for Middle Caicos, which exemplified the indigenous diet of local seafood, beans, and grits (corn) supplemented with imports* eg *rice and bread/flour. Middle Caicos had substantially fewer island core foods ([*n = *16] from four food groups) than did Grand Turk (*n = *29) and Providenciales (*n = *30), which represented the 7-food groups and included 15 (94%) of Middle Caicos' island core foods.*

***Conclusion:*** *Providenciales and Grand Turk had more varied and complex diets. Understanding how various islands supplement the indigenous/traditional diet is imperative to develop and evaluate (a) island-specific nutrition intervention* eg *culturally appropriate nutrition education messages (*eg *to increase iron consumption); and (b) future research protocols.*


# Implicaciones de los Hábitos Dietéticos, la Diversidad y la Dieta Autóctona de las Islas Turcas y Caicos

## para la Intervención Nutricional Insular Específica

TE Maitland


### *RESUMEN*

***Objetivo:*** *Describir los hábitos dietéticos en las Islas Turcas y Caicos.*

***Diseño y Métodos:*** *Se aplicaron cuestionarios sobre frecuencia de alimentos a mujeres cabeza de familia de 144 familias, seleccionadas de manera aleatoria de tres listas de votantes de las islas (Gran Turca [*n = *48], Providenciales [*n = 46] y Caicos Central [n = *50]). Se recogieron datos sobre la distribución de:*

*(a) Familias entre los niveles 0 – 7 de una Escala de Grupo de Alimentos, desarrollada usando la Técnica de Cornell para el Escalonamiento de Datos Dicotómicos, y sobre la base del número de familias que consumían siete grupos de alimentos (carnes y legumbres, pan/cereales, frutas, vegetales, raíces/tubérculos/frutas con fécula, productos lácteos y bebidas) semanalmente;*

*(b) Alimentos entre cuatro categorías (núcleo común, núcleo insular, ocasional o raro) también sobre la base de la frecuencia de consumo por semana.*


From: Department of Dietetics and Nutrition, Florida International University 11200 SW 8th Street (HLS 449), Miami, FL 33199, Fax: (305) 348-1996, e-mail: maitlant@fiu.edu

Correspondence: Dr TE Maitland, Department of Dietetics and Nutrition, Florida International University, 11200 SW 8th Street (HLS 449), Miami, FL 33199, Fax: (305) 348-1996, E-mail: maitlant@fiu.edu.

***Resultados:*** *El treinta por ciento de los hogares en Gran Truca y el 37% en Providenciales estuvieron en el nivel 7, las dietas más complejas y variadas, en comparación con el 3% de Caicos Central, que ejemplificaba la dieta autóctona con productos locales – mariscos, frijoles, y sémola (maíz) – suplementados con importaciones, tales como arroz y pan/harina. Caicos Central tenía alimentos del núcleo insular en cantidades sustancialmente menores ([*n = *16] de cuatro grupos de alimentos) que los que tenían Gran Turca (*n = *29) y Providenciales (*n = *30), los cuales representaban los grupos de 7 alimentos e incluían 15 (94%) de los alimentos de núcleo insular de Caicos Central.*

***Conclusión:*** *Providenciales y Gran Turca tenían dietas más variadas y complejas. La comprensión de como las diversas islas suplementan la dieta autóctona/tradicional es imprescindible para poder desarrollar e evaluar (a) la intervención en la nutrición insular específica, por ejemplo, los mensajes educativos culturalmente apropiados en relación con la nutrición (digamos, a fin de aumentar el consumo de hierro); y (b) los protocolos de investigaciones futuras.*

**West Indian Med J 2006; 55 (6): 376**

## INTRODUCTION

In the Turks and Caicos Islands, health conditions for which diet is a modifiable risk factor include iron deficiency anaemia (IDA), the only reported nutrient deficiency threat to women and children, and chronic non-communicable diseases (*eg* heart disease and diabetes). There are no reported food insecurity and undernutrition concerns (1–4). IDA, defined as Hb < 12 g/dl based on WHO standards (5) is a longstanding public health concern, especially on Middle Caicos (1, 2). Reported inter-island prevalence rates for pregnant women varied from 17% to 24% in 1997 (1).

Whereas marked economic and demographic growth (1, 4) have occurred in recent years, food availability remains in *status quo.* This is largely due to the historic, albeit necessary, dependence on imported foods, mainly from the United States of America (USA), because of the islands' semi-arid conditions, and virtual absence of agricultural production, permanent crops and arable land (approximately 2.3%) (4). Hence, substantial mark-ups exist on imported foods to offset importation costs and unregulated profit margins (3).

In this previously unstudied developing nation of islands, Guttman Scalogram Analysis (GSA) provides a simple, inexpensive, and valid method to analyze data collected from the first national dietary survey to define dietary habits and diversity in the islands. It can describe dietary diversity among population groups *eg* among the islands (6, 7), assess dietary adequacy, monitor dietary change over time and generate data for programme planning initiatives. GSA can also measure dietary complexity and the order in which foods enter the diet as complexity increases (8). This is imperative to understand inter-island differences in dietary habits.

Guttman Scalogram Analysis is based on the premise that scalable items in the diet indicate a greater degree of dietary complexity than their absence. Also, once developed, scalable items are retained in the diet, if not indefinitely, at least for a long period of time (6). The order in which foods enter diets is not a measure of their relative nutritional values. However, diet complexity is a good indication of nutritional status (9). GSA utilizes the Cornell Technique of Scaling Dichotomous Data, which is based on the score concept to generate data to develop and evaluate intervention programmes to improve nutritional status.

Though infrequently used, GSA's versatility has many advantages over contemporary, more expensive computer-based analytical techniques for the aforementioned reasons. Also, it is simple, inexpensive to administer, requires few specialized tools, and could be used in programme planning and evaluation *eg* as a variable in regression analysis to determine dietary quality (10, 11). GSA score also has the added advantage of being ordinal, cumulative, reproducible and unidimensional (12). Prior to its adoption by the field of nutrition, GSA was widely used in sociology. Food scales produced from GSA are able to categorize foods because the scalability of the diet follows a set pattern, influenced by underlying forces that impact on food intake (*eg* culture, economics and availability). The resulting GSA score reflects which food groups are eaten. Food scales describe and analyze food habits over time rather than food consumption (7).

Despite lingering public health concerns over anaemia and the morbidity and mortality that ensue from chronic diseases (*eg* cardiovascular disease and hypertension) for which diet is a modifiable risk factor (1), this was the islands' first and only national dietary survey with the following goals: (a) to collect baseline dietary data to define food habits, dietary diversity and complexity; (b) compare inter-island trends in iron consumption and reports of IDA. The Turks and Caicos Islands consists of 40 islands, eight of which are inhabited. This manuscript describes the application of GSA to define food habits and examines dietary diversity and complexity on three target islands (Grand Turk [the administrative capital], Providenciales [the economic centre] and Middle Caicos [the most sparsely populated and least developed island]; Fig.1).

## METHODS

The Ministry of Health, Education and Welfare of the Turks and Caicos Islands, the Caribbean Food and Nutrition

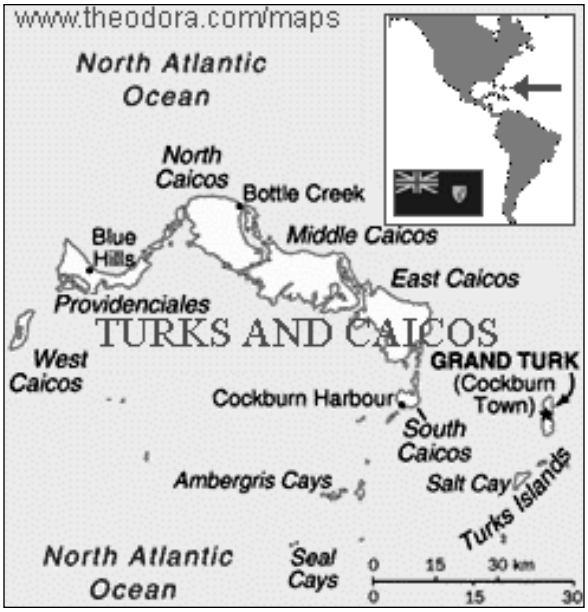


Fig. 1: Map of the Turks and Caicos Islands showing individual islands as well as proximity to the USA.
Map courtesy of www.theodora.com/maps, used with permission.

Institute (CFNI) and the University of the West Indies (UWI) approved the conduct of the study. Voters' lists for the three target islands were used to randomly select 150 households (50 each) to participate in the survey. Over a six-month period (September 1983 – February 1984) the principal investigator (PI), a trained nutritionist and native of the islands, interviewed female household-heads after the informed consent was obtained. A generic pre-coded, pre-tested questionnaire was interviewer-administered to collect sociodemographic and dietary data (*via* a food frequency questionnaire [FFQ]) for household members.

Prior to being used in this survey, the 52-item semi-quantitative FFQ, developed by the PI, was validated against multiple (x 3) 24-hour recalls from ten households ($r = 0.93$, $p < 0.001$) (10). It listed foods frequently consumed in the islands (10). Portion sizes were specified using natural units or other commonly used portion sizes (*eg* slice of bread, 8 oz [227 ml] glass of milk). The frequency of consumption of foods was assessed by one of five possible categories, ranging from "never" to "$ 6 times/week." Foods were categorized in seven groups: meat and legumes ($n = 18$), breads/cereals ($n = 8$), fruits ($n = 3$), vegetables ($n = 8$), starchy roots/tubers/fruits ($n = 3$), dairy ($n = 5$) and beverages ($n = 7$) (10). Visual aids *eg* measuring utensils and photographs of foods and appropriate probing techniques enhanced participants' ability to provide details about cooking methods, recipes, and portion sizes (13–15). Each food's iron score was calculated based on the product of (a) the frequency of consumption (range 0–4) and (b) the iron content (mg) in a normal portion size (range 0 – 10) as shown in Table 1 (13–15).

Table 1: Iron content and frequency of consumption food scores

| Criteria | Score |
|---|---|
| **Iron (mg) per portion size** | |
| # 0.5 | 1 |
| 0.6 – 1.0 | 2 |
| 1.1 – 1.5 | 3 |
| 1.6 – 2.0 | 4 |
| 2.1 – 2.5 | 5 |
| 2.6 – 3.0 | 6 |
| 3.1 – 3.5 | 7 |
| 3.6 – 4.0 | 8 |
| 4.1 – 4.5 | 9 |
| $ 4.6 | 10 |
| **Frequency of consumption** | |
| Never or hardly ever (< 1 month) | 0 |
| 1 – 2 per month | 1 |
| 1 – 2 per week | 2 |
| 3 – 5 per week | 3 |
| 6 or more per week | 4 |

## Data Analysis

*Sociodemographic variables:* Descriptive and other summary statistics (*eg* frequencies, percentages, means ± standard deviations) were calculated for sociodemographic variables. Data were initially analyzed with the Statistical Package for Social Sciences (SPSS) mainframe (16) and subsequently with SPSS version 11 (17). Results were statistically signifi-cant if the corresponding *p*-value was $p < 0.05$.

*Dietary data:* Each food consumed was converted to a dichotomous variable based on whether or not it was consumed at least once/week over the past year. If "yes", the household scored (+), and if "no" the household scored (-). The Cornell Technique for scaling dichotomous data (GSA) provided lists of foods (food scales) that were consumed by households on each island and ranked in descending order. The Coefficient of Reproducibility (R) measured the extent to which the scale score predicted the households' response pattern, $r > 0.9$ indicated a valid scale. The Coefficient of Scalability (S) measured the extent to which a scale was unidimensional and cumulative; $s > 0.6$ indicated an acceptable scale. Separate scalograms were constructed for each food group on each island, and R and S values calculated.

Foods were also categorized in the following four groups (Fig. 2) based on the frequency of consumption: common core (consumed > 20% of participants on all three islands $ 3 times per week); island core (consumed by >20% of participants on an island $3 times per week); occasional (consumed by # 20% of participants on an island $3 times per week); and rare (consumed by # 20% of participants on an island < 3 times per week). These data provided descriptive information to define inter-island dietary complexity and diversity.

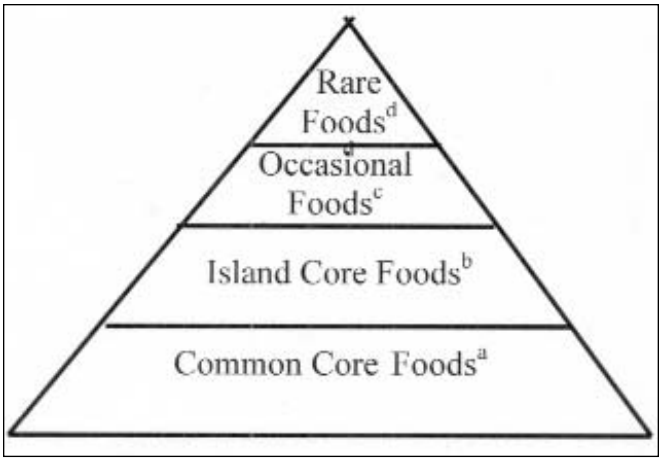


Fig. 2: Categories in the Turks and Caicos Islands' food hierarchy

[a]**Common Core –** consumed > 20% of participants on all three islands $3 times per week.

[b]**Island Core** – consumed by >20% of participants on an island $3 times per week.

[c]**Occasional –** consumed by # 20% of participants on an island $3 times per week.

[d]**Rare food** – consumed by # 20% of participants on an island <3 times per week.

*Dietary iron scores:* Households were assigned to low (<100), medium (100 – 160) or high (> 160) iron-intake-score categories. The $\chi$ – squared statistic was used to assess associations between categorical variables (*eg*, inter-island differences in iron score categories). Results were considered statistically significant if the corresponding *p*-value was $p < 0.05$.

## RESULTS

### Sociodemographic Characteristics

A total of 859 individuals resided in the 144 participating households. Approximately half (53%) of the occupants were $ 15 years old. Mean household size ranged from 5.32 " 2.16 on Middle Caicos to 6.14 " 2.43 on Grand Turk and 6.14 "2.99 on Providenciales. Most female household-heads (132 [92%]) were natives, and 101 (70%) were cur-rently married and listed a man as the "absolute head" of household. About half (22 [51%]) of the 43 female "abso-lute" household-heads had been married but were either widowed or separated. Half of the households were nuclear families (72 [50%]).

Most households on each island (139 [96%]) had at least one employed member. Types of employment of household-heads differed markedly. On Grand Turk and Providenciales 15 (31%) and 20 (45%) of household-heads, respectively, were skilled or professional, but there were none on Middle Caicos. Most Middle Caicos household-heads (37 [74%]) were semi-skilled and employed by the fishing industry, compared to Grand Turk (18 [38%]) and Providenciales (9 [20%]). A socioeconomic status (SES) score was calculated based on whether households had refrigerators, piped/running water, flush toilets and professional household-heads. Each variable was rated on a scale of 0 –10. Out of a maximum score of 40, the mean scores for Grand Turk and Providenciales were 21.1 and 19.3, respectively, compared to 6.9 for Middle Caicos.

### Food Habits

*Guttman Scalogram Analysis:* Step 1 organized foods consumed by households on each island into two food scales in descending order of popularity based on household consumption. Acceptable R and S values were achieved for all seven food groups and ranged from 0.90 – 1.00 and 0.72 – 1.00. Food Scale #1 (Table 2) listed foods ($n = 52$) consumed at least once/week during the past year. Food Scale #2 (Table 3) listed foods ($n = 31$) consumed most often (by > 20% of households at least three times/week) on each island during the past year. A ranking of foods in Food Scale # 2, from

Table 2: Foods consumed by households (%) at least once per week during the past year.

| **Grand Turk ($n$ =48)** | + | **Providenciales ($n$ = 46)** | + | **Middle Caicos ($n$ = 50)** | + |
|---|---|---|---|---|---|
| **Meat and legumes** | | **Meat and legumes** | | **Meat and legumes** | |
| Chicken | 100 | Chicken | 100 | Legumes | 100 |
| Legumes | 98 | Fish | 100 | Chicken | 98 |
| Beef | 98 | Legumes | 100 | Fish | 96 |
| Fish | 94 | Beef | 91 | Conch | 86 |
| Hot dogs | 90 | Pork | 89 | Corned beef | 80 |
| Pork | 88 | Conch | 74 | Pork | 80 |
| Other sausage (bologna, salami) | 83 | Corned beef (canned) | 74 | Hot dogs | 78 |
| Conch | 77 | Ground beef or oxtail | 74 | Other sausage (bologna, salami) | 74 |
| Hot dogs | 90 | Pork | 89 | Corned beef | 80 |
| Conch | 77 | Ground beef or oxtail | 74 | Other sausage (bologna, salami) | 74 |
| Ground beef/oxtail | 71 | Hot dogs | 74 | Beef | 64 |
| Bacon | 69 | Other sausage (bologna, salami) | 72 | Vienna sausages | 60 |
| Sardine/tuna | 65 | Bacon | 67 | Lobster | 56 |
| Corned beef | 60 | Lobster | 52 | Sardine/tuna | 32 |
| Vienna sausages | 60 | Vienna sausages | 50 | Bacon | 20 |

Table 2: Foods consumed by households (%) at least once per week during the past year (Cont'd)

| **Grand Turk (*n* =48)** | + | **Providenciales (*n* = 46)** | + | **Middle Caicos (*n* = 50)** | + |
|---|---|---|---|---|---|
| **Meat and legumes** | | **Meat and legumes** | | **Meat and legumes** | |
| Liver | 52 | Sardine/tuna | 48 | Ground beef/oxtail | 20 |
| Lobster | 31 | Liver | 26 | Mackerel (canned) | 14 |
| Mackerel (canned) | 10 | Mackerel (canned) | 20 | | |
| **Cereals** | | **Cereals** | | **Cereals** | |
| Rice | 100 | Bread | 100 | Grits | 100 |
| Bread | 98 | Rice | 100 | Bread | 96 |
| Macaroni and cheese | 96 | Grits | 96 | Macaroni and cheese | 92 |
| Cornflakes | 92 | Macaroni and cheese | 96 | Cornflakes | 86 |
| Grits | 92 | Cornflakes | 85 | Rice | 86 |
| Cream of wheat | 31 | Cream of wheat | 48 | Oatmeal | 26 |
| Cornmeal | 33 | Cornmeal | 46 | Cream of wheat | 22 |
| Oatmeal | 29 | Oatmeal | 38 | Cornmeal | 12 |
| **Fruit** | | **Fruit** | | **Fruit** | |
| Oranges | 94 | Oranges | 98 | Bananas | 78 |
| Bananas | 92 | Bananas | 91 | Oranges | 74 |
| Apples | 77 | Apples | 72 | Apples | 58 |
| **Vegetables** | | **Vegetables** | | **Vegetables** | |
| Tomatoes | 92 | Cabbage | 87 | Okra/corn/broccoli | 80 |
| Cabbage | 83 | Tomatoes | 85 | Cabbage | 52 |
| Carrots | 71 | Lettuce | 78 | Tomatoes | 42 |
| Lettuce | 69 | Carrots | 67 | Carrots | 16 |
| String beans | 42 | String beans | 11 | String beans | 2 |
| Okra/corn/broccoli | 15 | Okra/corn/broccoli | 20 | Lettuce | 6 |
| **Dairy products** | | | | **Dairy products** | |
| Eggs | 94 | Eggs | 98 | Eggs | 98 |
| Cheese | 90 | Evaporated milk | 93 | Evaporated milk | 90 |
| Evaporated milk | 88 | Fresh milk | 80 | Fresh milk | 38 |
| Fresh milk | 83 | Cheese | 74 | Condensed milk | 30 |
| Condensed milk | 15 | Condensed milk | 17 | Cheese | 20 |
| **Starch roots, tubers and fruits** | | **Starch roots, tubers and fruits** | | **Starch roots, tubers and fruits** | |
| Potatoes | 92 | Potatoes | 94 | Potatoes | 88 |
| Plantains | 90 | Plantains | 94 | Sweet potatoes | 94 |
| Sweet potatoes | 50 | Sweet potatoes | 54 | Plantains | 66 |
| **Beverages** | | **Beverages** | | **Beverages** | |
| Orange juice/Tang | 85 | Kool-Aid | 89 | Milo | 82 |
| Kool-Aid | 83 | Orange juice/Tang | 87 | Sodas | 80 |
| Milo | 81 | Coffee | 78 | Kool-Aid | 78 |
| Tea | 75 | Sodas | 67 | Orange juice/Tang | 74 |
| Coffee | 73 | Tea | 59 | Coffee | 72 |
| Sodas | 63 | Cocoa | 50 | Tea | 54 |
| Cocoa | 35 | Milo | 41 | Cocoa | 24 |

(+ ) - Percentage of households that consumed food at least once per year.

lowest to highest, within their respective food groups, is presented in Table 4. As a food group, on the average, the bread/cereals were consumed most frequently. Seventy-eight per cent of households on Grand Turk and 80% on Middle Caicos consumed four foods from the bread/cereals group at least three times/week and 65% of households on Providenciales consumed five foods from the bread/cereals at least three times/week.

Table 3: Foods consumed by > 20% of households ≥ 3 times per week over the past year

| **Grand Turk (*n* = 48)** | + | **Providenciales (*n* = 46)** | + | **Middle Caicos (*n* = 50)** | + |
|---|---|---|---|---|---|
| **Meat and legumes** | | **Meat and legumes** | | **Meat and legumes** | |
| Chicken | 69 | Legumes | 70 | Legumes | 88 |
| Legumes | 58 | Chicken | 54 | Conch | 60 |
| Hot dogs | 36 | Fish | 37 | Chicken | 54 |
| Other sausage (bologna, salami) | 31 | Other sausage (bologna, salami) | 24 | Fish | 52 |
| Fish | 31 | Hot dogs | 24 | | |
| **Cereals** | | **Cereals** | | **Cereals** | |
| Bread | 98 | Bread | 100 | Bread | 96 |
| Rice | 90 | Rice | 94 | Rice | 94 |
| Cornflakes | 69 | Cornflakes | 63 | Grits | 66 |
| Grits | 56 | Grits | 35 | Cornflakes | 62 |
| | | Macaroni and cheese | 26 | | |
| **Fruit** | | **Fruit** | | | |
| Oranges | 48 | Oranges | 48 | | |
| Bananas | 42 | Bananas | 31 | | |
| Apples | 25 | Apples | 32 | | |
| **Vegetables** | | **Vegetables** | | | |
| Tomatoes | 44 | Tomatoes | 54 | | |
| Lettuce | 31 | Lettuce | 50 | | |
| Cabbage | 27 | Cabbage | 41 | | |
| Carrots | 21 | Carrots | 28 | | |
| **Dairy products** | | **Dairy products** | | **Dairy products** | |
| Evaporated milk | 81 | Evaporated milk | 91 | Evaporated milk | 86 |
| Eggs | 79 | Eggs | 83 | Eggs | 52 |
| Cheese | 58 | Cheese | 50 | | |
| Fresh milk | 50 | Fresh milk | 46 | | |
| **Starch roots, tubers and fruits** | | **Starch roots, tubers and fruits** | | | |
| Potatoes | 52 | Potatoes | 46 | | |
| Plantains | 33 | Plantains | 35 | | |
| **Beverages** | | **Beverages** | | **Beverages** | |
| Kool-Aid | 75 | Orange juice/Tang | 78 | Milo | 80 |
| Milo | 73 | Coffee | 74 | Coffee | 58 |
| Tea | 65 | Kool-Aid | 74 | Kool-Aid | 50 |
| Coffee | 58 | Tea | 50 | Orange juice/Tang | 42 |
| Orange juice/Tang | 48 | Sodas | 48 | Sodas | 40 |
| Sodas | 42 | Cocoa | 31 | Sodas | 42 |
| Cocoa | 25 | Milo | 32 | Cocoa | 25 |

The remaining steps of the GSA distributed households among levels 0–7 of a food group scale based on number of food groups (meat and legumes, bread/cereals, fruits, vegetables, starchy roots/tubers/fruits, dairy and beverages) consumed by > 20% of households at least three times/week. Dietary patterns on Grand Turk and Providenciales were similar, with 55% and 57%, respectively, of households distributed among levels 0–3 and the remaining among higher levels 4–7. The largest percentages of households (30% on Grand Turk and 37% on Providenciales) were in level 7, indicating the consumption of all seven food groups at least three times/week was the most commonly found dietary pattern (Table 5). On Middle Caicos, 51% of households were in levels 0–3 and the remaining 49% in levels 4–7. The highest percentage of households (42%) was in level 4, indicating that consumption of four-food groups (meat and legumes, bread/cereals, dairy and beverages) at least three times/week was the most commonly found pattern. Only 3% of households on Middle Caicos, compared to Grand Turk (30%) and Providenciales (37%), were in Level 7 (Table 5).

Table 4: Ranking of households (mean %) in excess of 20% on each island that consumed various foods at least three times/week

| Food Groups Grand Turk (*n* = 48 ) | Average % of Households |
|---|---|
| Vegetables (*n* = 4) | 31 |
| Fruits (*n* = 3) | 38 |
| Starchy roots, tubers and fruits (*n* = 2) | 43 |
| Meat and legumes (*n* = 5) | 45 |
| Beverages (n = 7) | 55 |
| Milk and dairy (n = 4) | 67 |
| Bread and Cereals (n = 4) | 78 |
| **Providenciales (n = 46 )** | |
| Fruits (n = 3) | 37 |
| Starchy roots, tubers and fruits (n = 2) | 41 |
| Meat and legumes (n = 5) | 42 |
| Vegetables (n = 4) | 43 |
| Beverages (n = 7) | 55 |
| Bread and cereals (n = 5) | 64 |
| Milk and dairy (n = 4) | 68 |
| **Middle Caicos (N = 50)** | |
| Vegetables (n = 0) | 0 |
| Fruits (n = 0) | 0 |
| Starchy roots, tubers and fruits (n = 0) | 0 |
| Beverages (n = 6) | 49 |
| Meat and legumes (n = 4) | 64 |
| Milk and dairy (n = 2) | 69 |
| Bread and cereals (n = 4) | 80 |

*The Food Hierarchy:* Foods consumed at least once/week were distributed among four categories of a food hierarchy (Figs. 2, 3, 4 a – g). The most frequently consumed foods, (core foods) occupied the base (levels 1 and 2) and foods consumed less often (occasional and rare foods) comprised level 3 and level 4 (the apex). Among the islands, 31 (60%) of the foods on the FFQ qualified as core foods. Of these, 15 (28%) were "common core" foods. Grand Turk (29 [56%]) and Providenciales (30 [58 %]) had similar numbers of island core foods compared to substantially fewer for Middle Caicos (16 [31%]). Locally grown sapodillas (*Mikara zapota*) and imported avocados and mangoes were island favourites but were excluded from GSA food scales and the food hierarchy because of their extremely seasonal nature.

*Iron Scores:* On Grand Turk and Providenciales (1%, $p < 0.05$) significantly fewer households were in the "low" scoring category (< 100) than on Middle Caicos (20%; Table 6).

## DISCUSSION

Historically, people eat what their forbearers ate and what their environment offers. Indeed, cultural food patterns are transmitted by example when caregivers inform children about desirable foods, how to eat them, and rules that govern conduct while eating (3, 18). The socio-cultural inputs that influence dietary patterns are very complex and explain why once dietary patterns are entrenched, they are extremely difficult to change (18). This, coupled with the fact that foods consumed in the islands were scalable and reproducible and scalable foods remain in the diet for a long period of time (6), strongly suggests that it is highly unlikely that appreciable changes in dietary patterns in the islands have occurred since this survey was done.

Table 5: Frequency distribution of households by Guttman scalogram level

| Scale level | Food consumed by > 20% of households $ 3 each level | % households | Cumulative % of households reaching times/week |
|---|---|---|---|
| **Grand Turk** (*n* = 48) | | | |
| 0 | None | 22 | |
| 1 | Bread and cereals | 11 | 78 |
| 2 | Level 1 + Dairy | 12 | 67 |
| 3 | Level 2 + Beverages | 10 | 55 |
| 4 | Level 3 + Meats | 2 | 45 |
| 5 | Level 4 + Starchy roots, tubers and fruits | 5 | 43 |
| 6 | Level 5 + Fruits | 8 | 38 |
| 7 | Level 6 + Vegetables | 30 | 30 |
| **Providenciales** (*n* = 46) | | | |
| 0 | None | 32 | |
| 1 | Bread and cereals | 4 | 68 |
| 2 | Level 1 + Dairy | 9 | 64 |
| 3 | Level 2 + Beverages | 12 | 55 |
| 4 | Level 3 + Meats | 1 | 43 |
| 5 | Level 4 + Starchy roots, tubers and fruits | 1 | 42 |
| 6 | Level 5 + Fruits | 4 | 41 |
| 7 | Level 6 + Vegetables | 37 | 37 |
| **Middle Caicos** (*n* = 50) | | | |
| 0 | None | 20 | |
| 1 | Bread and cereals | 11 | 80 |
| 2 | Level 1 + Dairy | 5 | 69 |
| 3 | Level 2 + Beverages | 15 | 64 |
| 4 | Level 3 + Meats | 42 | 49 |
| 5 | Level 4 + Starchy roots, tubers and fruits | 0 | 7 |
| 6 | Level 5 + Fruits | 4 | 7 |
| 7 | Level 6 + Vegetables | 3 | 3 |

The dependence on imported foods and concern over the prevalence of anaemia that provided the rationale for this dietary survey still persist (3, 10, 11). In addition, the increasing concerns over the morbidity and mortality from chronic diseases augur well for dietary recommendations (*eg* regarding IDA), and comparisons to be made in the future on the bases of this study's findings. These data are unique as findings of the first and only dietary survey of the islands. They clearly show that dietary patterns of the three islands are similar, with half of the most frequently consumed foods being common to all three islands (common core foods). Thereafter, diets differed in complexity largely due to availability and economics.

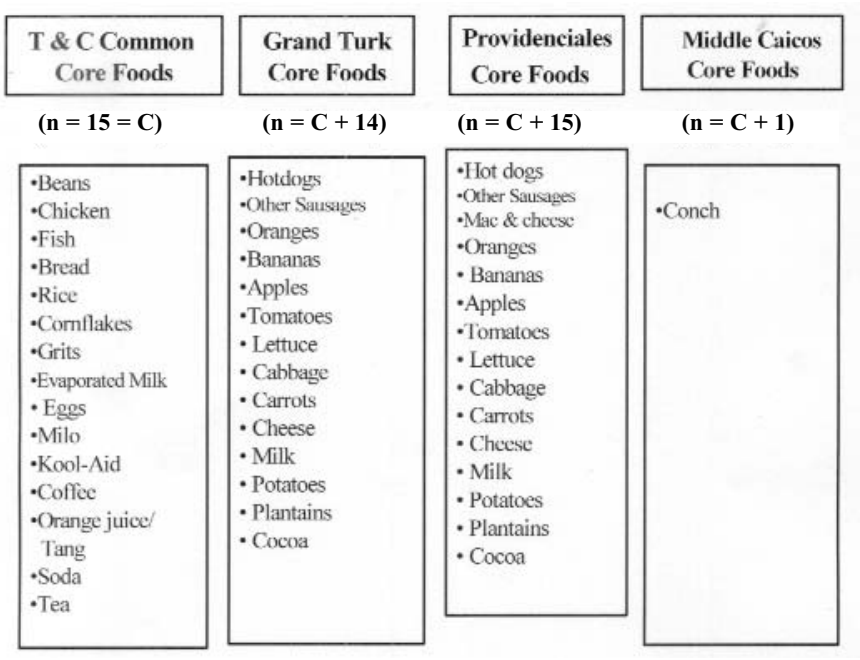


Fig. 3: Core foods consumed on each of the three islands of the Turks and Caicos Islands.
C = common core foods

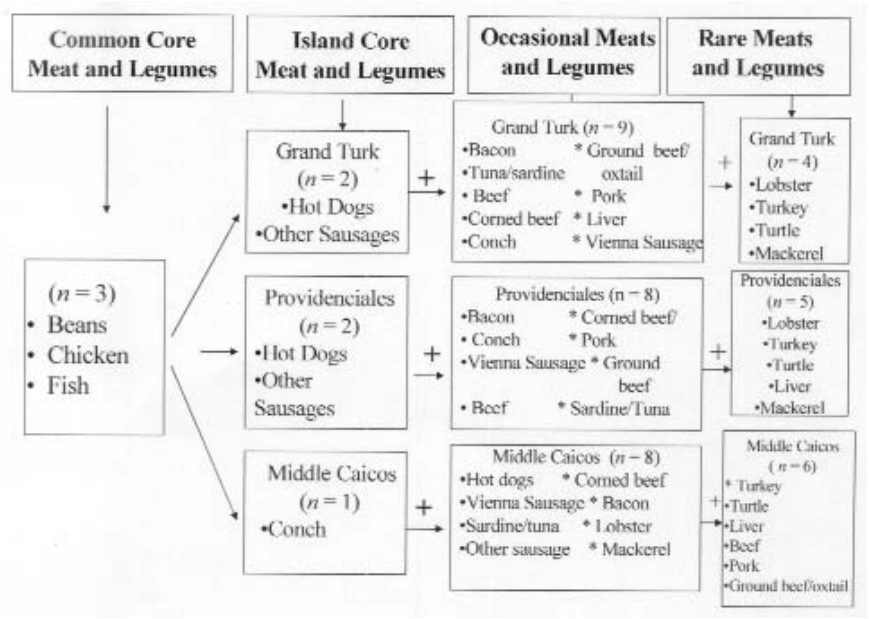


Fig. 4a: Distribution of foods consumed in the Turks and Caicos Islands among the categories of the meats and legumes hierarchy.

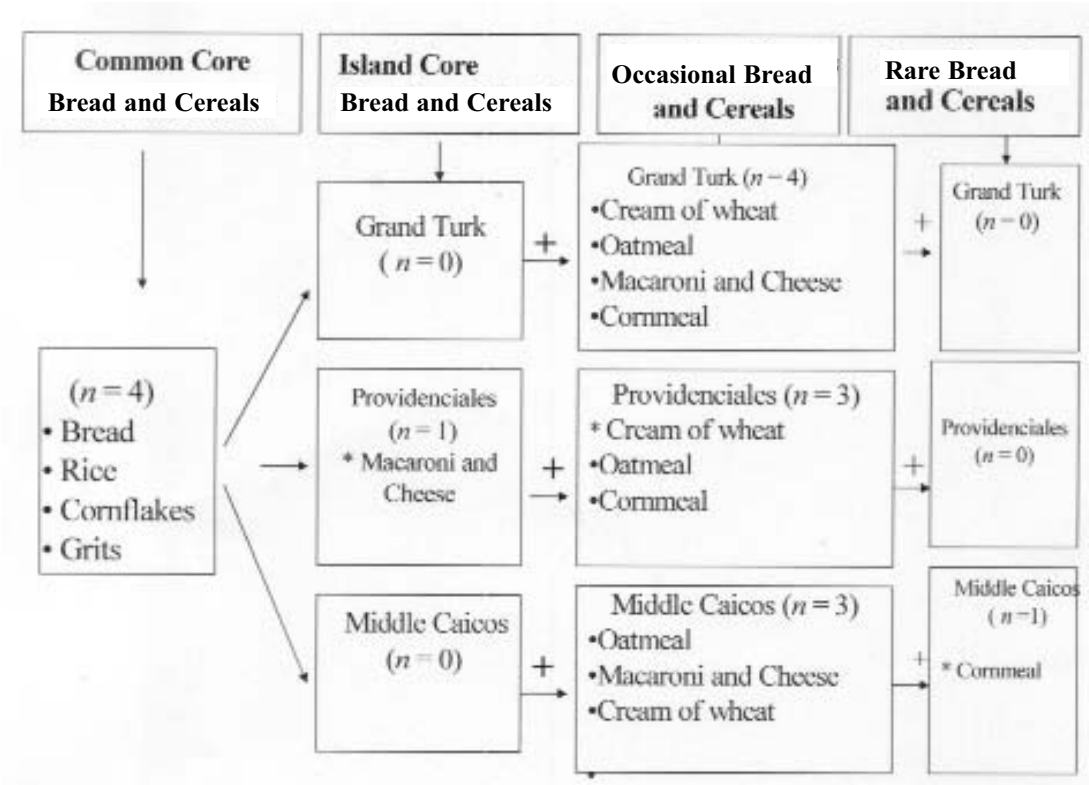


Fig. 4b: Distribution of foods consumed in the Turks and Caicos Islands among the categories of the bread and cereals hierarchy.

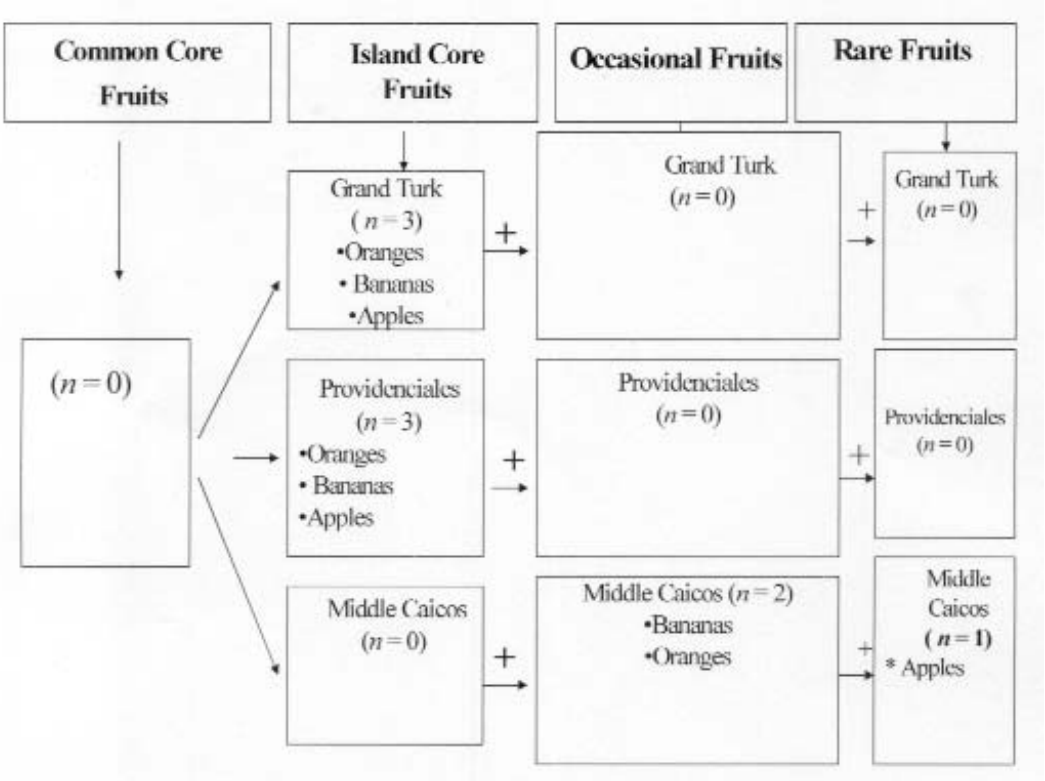


Fig. 4c: Distribution of foods consumed in the Turks and Caicos Islands among the categories of the fruits hierarchy.

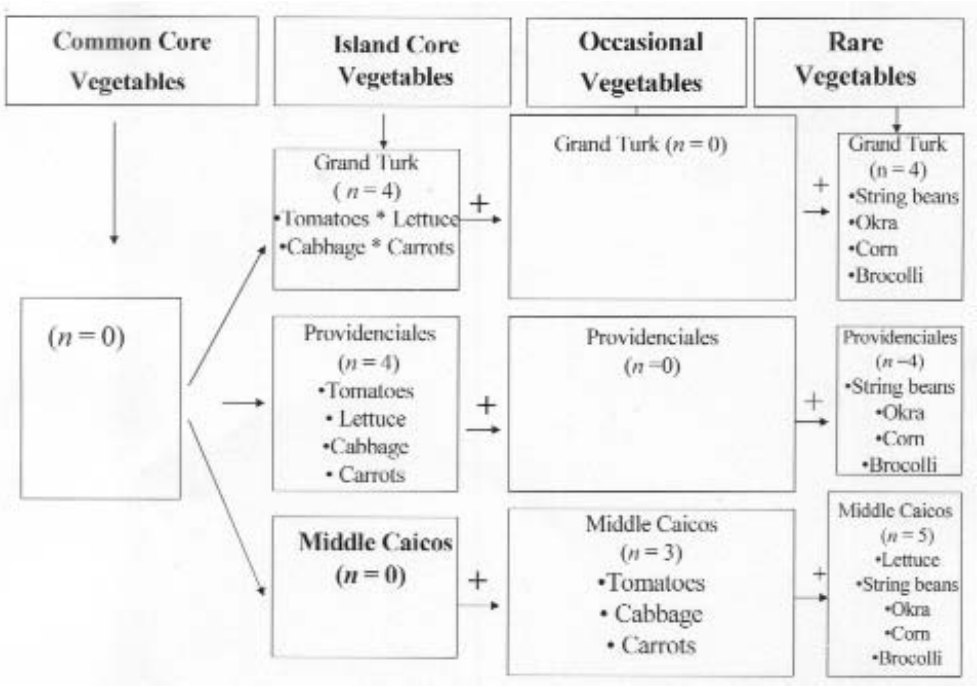


Fig. 4d: Distribution of foods consumed in the Turks and Caicos Islands among the categories of the vegetable hierarchy.

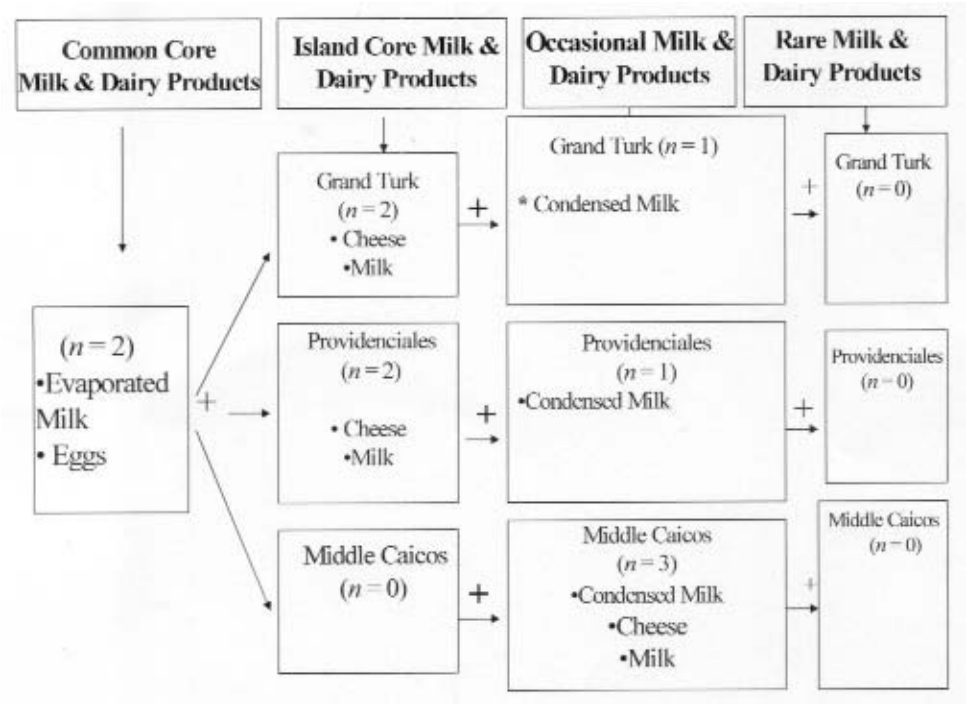


Fig. 4e: Distribution of foods consumed in the Turks and Caicos Islands among the categories of the milk and dairy hierarchy.

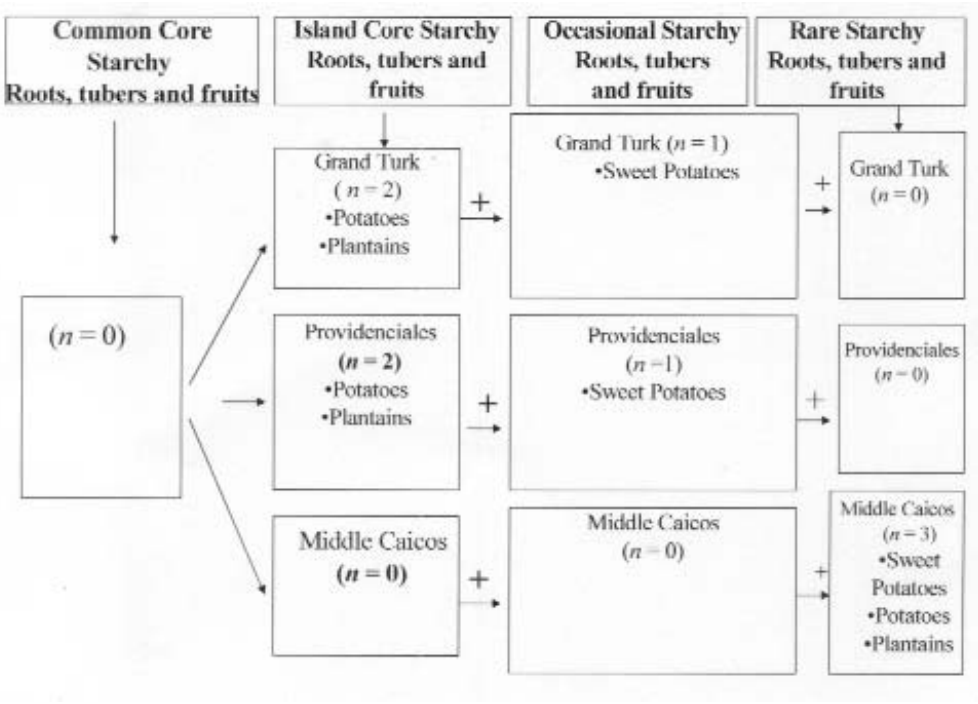


Fig. 4f: Distribution of foods consumed in the Turks and Caicos Islands among the categories of the starchy roots, tubers and fruits hierarchy.

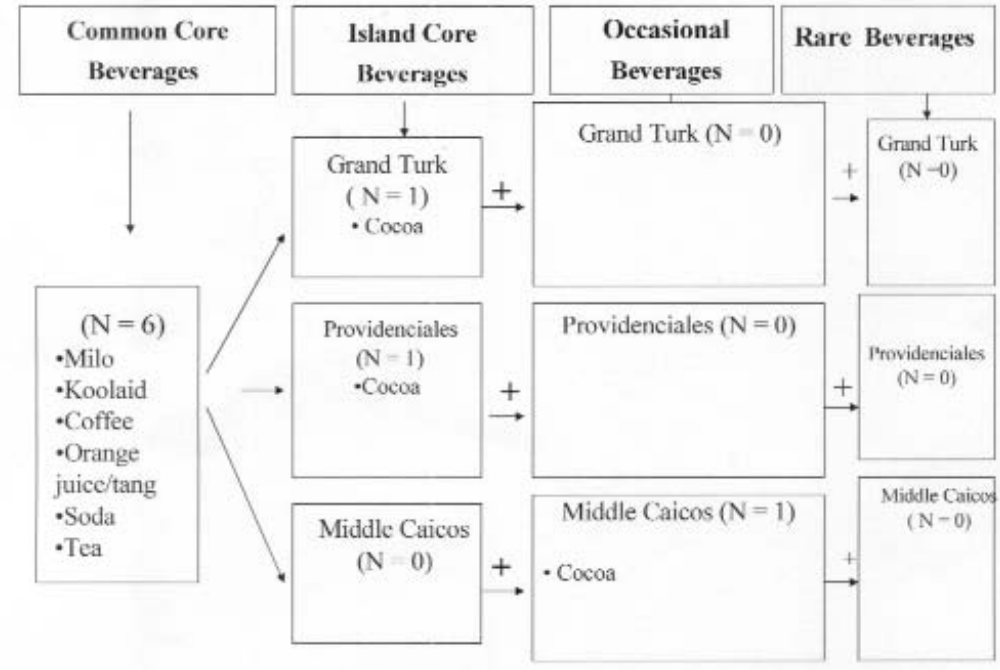


Fig. 4g: Distribution of foods consumed in the Turks and Caicos Islands among the categories of the beverages hierarchy.

Table 6: Iron score and score categories for the Turks and Caicos Islands

| Criteria | Score |
|---|---|
| **Iron Scores** | |
| Grand Turk | 186.7 "34.7 |
| Providenciales | 178.7 "45.3 |
| Middle Caicos | 147.3 "46.7 |
| **Score Categories** | |
| < 100 | Low |
| 100 – 160 | Moderate |
| > 160 | High |

On Grand Turk and Providenciales (1%, $p < 0.05$) and Middle Caicos 20% of households were in the low iron score category

Diets on Grand nTurk and Providenciales, the more affluent islands, were similar. They were, however, more diverse and complex with twice as many island core foods and a higher GSA ranking than diets on Middle Caicos (the least developed island). Grand Turk and Providenciales had ten times as many households in GSA Level 7 than Middle Caicos, where GSA level 4 (which excludes fruits, vegetables, and starchy roots/tubers/fruits) was the most common level.

Core foods (15 common plus one island core) which formed the bases of Middle Caicos' diet, represented the nation's indigenous diet of locally available seafood, supplemented with imports *eg* beans and grits (some produced locally) and rice and bread/flour as detailed in Figure 3. Imported evaporated milk and chicken were perishable but longstanding "staples" consumed by > 50% of households on all three islands $ 3 times per week.

The locally accepted "national dish" of the islands (beans/peas and hominy (grits) seasoned with dried conch, and served with fish as the entrée) utilizes four core foods for Middle Caicos. Three of these (excluding conch) are common core foods. Conch did not qualify as a core food for Grand Turk and Providenciales but remains an important protein source for those islands. It was consumed by 8%, 13% and 60% of the households on Grand Turk, Providenciales and Middle Caicos, respectively, at least three times/week.

Economics, availability, culture/tradition and nutritional value influence food choices worldwide (19) and undoubtedly in the islands. As an example, evaporated milk is more perishable than condensed milk but culturally preferred even on Middle Caicos where only 50% of households had refrigerato. Condensed milk would arguably have been the better choice (3). Grits, originally brought to the islands by loyalists and their slaves who settled in the Turks and Caicos islands after the US civil war of 1861–1865, is well entrenched as part of the indigenous diet of the islands and the nearby Bahamas but not in other Caribbean countries (3).

Within the cultural context, consumption of foods that comprised the diet of the islands was delineated by economics. SES-score for Grand Turk and Providenciales exceeded Middle Caicos' by threefold. This underscores the impact of economics on inter-island differences in dietary habits by directly impacting the availability of disposable income to purchase food, and indirectly by influencing food choices *eg via* access to refrigeration for perishable foods. Half as many households on Middle Caicos had refrigerators as on Grand Turk and Providenciales.

Economics and culture impacted dietary habits, complexity and diversity by influencing how foods were added to or subtracted from Middle Caicos'/traditional diet by Grand Turk and Providenciales households. At least 15 foods (*eg* oranges, beef products and carrots) listed as occasional or rare on Middle Caicos were more entrenched (island core foods) on the more affluent Providenciales and Grand Turk where they were available and affordable. Conch, the core food for Middle Caicos, was displaced on Grand Turk and Providenciales and became an occasional food.

The fishing industry (fish, conch and lobster), a national economic mainstay (4), was the primary employer of Middle Caicos men. Therefore, conch was more available and affordable on Middle Caicos than on Grand Turk and Providenciales where it was less readily available and more expensive than other culturally acceptable alternatives *eg* chicken.

Dietary patterns, including the relative lack of complexity and diversity of Middle Caicos' diet compared to Grand Turk and Providenciales diets, was also reflected in the distribution of dietary iron scores. Significantly fewer households on Grand Turk and Providenciales (1%, $p < 0.05$) compared to 20% on Middle Caicos were in the "low" category (3). A score of "10" was the highest possible iron score for a food on the FFQ. However, among 31 core foods, a "3" was the highest iron score obtained, and only by 13% of core foods. This means that the foods which formed the basis of the diet in the islands were poor sources of iron. This proved most dire for Middle Caicos with fewer core foods, signifying a less varied diet which also lacked fruits and vegetables. In addition to contributing carbohydrate and fibre, the fruits and vegetables are good sources of micronutrients *eg* vitamin C that enhances iron absorption (20–25).

GSA provided an effective, inexpensive way to measure dietary diversity and complexity in this previously unstudied developing country. Findings have national implications for understanding the relationship between diet and prevalence of nutrition-related conditions *eg* IDA and chronic non-communicable diseases such as hypertension, diabetes and cardiovascular disease. Specifically, the understanding of the food habits and indigenous diet of the islands, and factors that influence how each island modifies these, as provided by this survey's findings, is imperative. It could inform policy makers and enable public health professionals to develop national and island-specific, culturally appropriate intervention *eg* nutritional educational

messages to enable the citizenry to increase dietary iron consumption and/or monitor energy and salt intake while simultaneously consuming nutritionally adequate and balanced diets. It could also facilitate the development of research protocols to monitor dietary change overtime.

## ACKNOWLEDGEMENTS

Thanks to the Ministry of Health, Turks and Caicos Islands, the Caribbean Food and Nutrition Institute and The University of the West Indies for their support in this research as well as Dr M Golden, Dr S Ismail and the people of the islands.

## REFERENCES

1. Pan America Health Organization. Health in the Americas. Health of the Americas. Vol I and II. Scientific Publications No 549. Washington DC, PAHO, 1994.
2. Cohen MD, Morgan P, Baker P. The nutritional status of children in the Turks and Caicos Islands. West Indian Med J 1974; **23:** 93–7.
3. Maitland TE. Variation in dietary patterns in the Turks and Caicos [MSc thesis]. Kingston (Jamaica): University of the West Indies; 1985.
4. CIA. The World Factbook. Available from: *http://www.cia.gov/cia/publications/ factbook/geos/tk.html.* Accessed March 3, 2004.
5. World Health Organization (WHO). Indicators and Strategies for Iron deficiency and Amemia Programmes. Report of the WHO/UNICEF/UNU Consultation. December 6–10 1993. Geneva, Switzerland, 1994.
6. Chassey JP, Van Veen AG, Young FW. The application of social science research methods to the study of food habits and food consumption in an industrializing area. Am J Clin Nutr 1967; **20:** 56–63.
7. Hertzler AA, Owen C. Sociologic study of food habits-a review I. Diversity of diet and scalogram analysis. J Am Diet Assoc 1976; **69:** 377–81.
8. Schorr BC, Sanjur D, Erickson EC. Teenage food habits: a multi-dimensional analysis. J Am Diet Assoc 1972; **61:** 415–20.
9. Ismail SJ. Diet and disease during the first industrial revolution: England as a developing country 1795–1850. [Doctoral thesis]. New York: Cornell University, 1977; 48–50.
10. Harrison KR, Bond JB. Guttman scalogram techniques and a method of dietary analysis. J Can Diet Assoc 1984; **45:** 26–32.
11. Johnson NE, Schwin S. Coefficients for estimation of nutrient adequacy scores of diets of a specific population group. Home Economics Research 1978; **7:** 98–107.
12. Guttman L. A basis for scaling qualitative data. Am Soc Rev 1944; **9:** 139–50.
13. Church CF, Church HN. Food Values of Portions Commonly Used. Philadelphia: JP Lippincott Company; 1975.
14. Caribbean Food and Nutrition Institute. Food Composition Tables For Use in the English-speaking Caribbean, Kingston, Jamaica; CFNI; 1974.
15. Caribbean Food and Nutrition Institute. Recommended Dietary Allowances for the Caribbean. Kingston, Jamaica: CFNI; 1976.
16. Nie NH, Hull CH, Jenkins JG, Steinbrenner K, Bent DH. Statistical Package for Social Sciences. New York, McGraw Hill; 1975.
17. SPSS Graduate Pack 11.0 for Windows [computer program]. Version 11. Chicago Il, Washington, DC: National Academy Press; 2002.
18. Lowenberg ME. The development of food patterns. 1973 Lenna Frances Cooper Memorial Lecture. J Am Diet Assoc1974; **65:** 263–8.
19. Whitney E, Rolfes S. An overview of nutrition: food choices. In: Understanding Nutrition. 10th ed. New York: West Publishing Company; 2005: 3–5.
20. Guttman L. The Cornell technique for scale and intensity analysis. Educ Psychol Meas 1947; **7:** 247–79.
21. Garcia-Casal MN, Layrisse M, Solano L, Baron MA, Arguello F, Llovera D et al. Vitamin A and beta-carotene can improve nonheme iron absorption from rice, wheat and corn by humans. Nutr 1998; **128:** 646–50.
22. Hallberg L. Bioavailability of dietary iron in man. Annu Rev Nutr. 1981; **1:** 123–47.
23. Reddy MB, Hurrell RF,Cook JD. Estimation of nonheme-iron bioavailability from meal composition. Am J Clin Nutr 2000; **71:** 937–43.
24. Siegenberg D, Baynes RD, Bothwell TH, Macfarlane BJ, Lamparelli RD, Car NG et al. Ascorbic acid prevents the dose-dependent inhibitory effects of polyphenols and phytates on nonheme-iron absorption. Am J Clin Nutr 1991; **53:** 537–41.
25. Morris ER. An overview of current information on bioavailability of dietary iron to humans. Fed Proc 1983; **42:** 1716–20.