

## Adaptation of a food frequency questionnaire to assess dietary intake in the Caribbean Coast of Costa Rica

### *Adaptación de un cuestionario de frecuencia alimentaria para evaluar la ingesta alimentaria en la costa caribeña de Costa Rica*

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#### Resumen

Los medios de comunicación han promovido la ingesta de aceite de coco para prevenir y controlar casi cualquier problema de salud sin contar con evidencia que respalde esas propiedades. Por lo tanto, los estudios de dieta-enfermedad en las regiones tropicales que usualmente consumen coco y sus derivados son necesarios. El objetivo de este estudio fue desarrollar un cuestionario de frecuencia de consumo de alimentos para la población que vive en la Costa Caribe de Costa Rica (FFQ del Caribe), mediante la adaptación de un FFQ previamente desarrollado y validado en el Valle Central de Costa Rica. El FFQ incluyó 92 ítems de alimentos, preguntas sobre el consumo de productos de coco y la preparación de recetas tradicionales que incluían aceite de coco y/o leche de coco, y preguntas abiertas. Esta versión adaptada se administró a 34 sujetos (57 ±9 años) para identificar los alimentos que deberían agregarse o eliminarse según la frecuencia de consumo y la varianza. Se eliminaron un total de 21 alimentos porque rara vez se consumieron y 12 se eliminaron porque explicaron menos del 1% de la varianza dentro del grupo de alimentos. Los alimentos que se agregaron son: fruta de coco, 13 recetas que contenían aceite de coco y/o leche de coco y otros 11 alimentos que se reportaron frecuentemente en las preguntas abiertas. En resumen, desarrollamos un FFQ para evaluar la ingesta dietética en la Costa Caribe de Costa Rica. Los estudios futuros deberán validar el uso de este cuestionario para evaluar la ingesta dietética en esta población y determinar si la ingesta dietética en la región es adecuada para futuros estudios epidemiológicos sobre la ingesta de coco y la enfermedad crónica.

**Palabras claves:** aceite de coco, leche de coco, cuestionario de frecuencia de consumo, evaluación dietética, Hispano, Costa Rica (Fuente: DeCS-BIREME)

#### Abstract

Health claims in popular media promote intake of coconut oil to prevent and control almost any health problem. Thus, diet-disease studies in tropical regions likely to consume coconut and its derivatives are highly needed. The objective of this study was to develop a food frequency questionnaire for the population living in the Caribbean Coast of Costa Rica (Caribbean FFQ), by adapting an FFQ previously developed and validated in the Central Valley of Costa Rica. The FFQ included 92 food items, questions on the intake of coconut products and the preparation of traditional recipes that included coconut oil and/or coconut milk, and open-ended questions. This adapted version was administered to 34 subjects (mean age 57+9) to identify food items that should be added or deleted based on the frequency of intake and variance. A total of 21 food items were removed because they were rarely consumed and 12 were removed because they explained less than 1% of the variance within the food group. Food items that were added included coconut fruit, 13 recipes containing coconut oil and/or coconut milk and 11 other foods that were frequently reported in the open-ended questions. In sum, we developed an FFQ to assess dietary intake in the Caribbean Coast of Costa Rica. Future studies will need to validate the use of this questionnaire to assess dietary intake in this population and to determine whether dietary intake in the region is suitable for future epidemiological studies on coconut intake and chronic disease.

**Keywords:** coconut oil, coconut milk, food frequency questionnaire, dietary assessment, Hispanic, Costa Rica (Source: MeSH-NLM)

**Citar como:** Momi-Chacón A, Capitán-Jiménez C, Willett WC, Campos H. Adaptation of a food frequency questionnaire to assess dietary intake in the Caribbean Coast of Costa Rica. *Rev Hisp Cienc Salud.* 2018; 4(1):22-33

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## INTRODUCTION

Different types of dietary tools have been widely used to assess and describe dietetic habits of individuals.(1) The high increase in nutrition epidemiology studies in the last 25 years led to the widespread use of food frequency questionnaires (FFQ) to examine the associations between dietary intake and health in different populations around the world.(2,3) FFQs have been shown to be a cost-effective and reliable tool to assess long-term dietary exposures and how they relate to chronic disease.(1,4) The most highly regarded dietary recommendations to date are based on research of longitudinal studies where dietary intake is assessed using FFQs.(5) FFQs inquire about the frequency intake of informative food items that are selected to represent the habitual diet of the individual over the previous year. In general, they include a standard portion size for the specific population studied to estimate the nutrient composition.(1,2,6)

Most FFQs have been developed to assess diet in the general populations, thus underestimating the dietary intake of ethnic minorities.(7,8) The development of ethnic-specific FFQs to address the specific needs of these populations is warranted.(9–11) The afro-Caribbean population is of particular interest given the variety of dietary habits that are of interest to the scientific community but cannot be studied elsewhere. (8,9,11,12,13) For example, it has been hypothesized that coconut oil, a food that is widely consumed in the Caribbean region, could prevent early cognitive dysfunction.(14,15) Furthermore, black minority ethnic groups are likely to have particular health needs that can only be addressed with adequate assessment of dietary exposures.(16,17).

The Afro-Caribbean population of Costa Rica is located in the province of Limón, Costa Rica. This province is characterized by great gastronomic diversity that includes a variety of products and recipes of different ethnic influences like indigenous (Bribri, Cabécar), Afro-Caribbean, Asian, Jamaican and Hindu. However, the predominant ethnic group in Limón is the Afro-Caribbean, which migrated to the Costa Rican territory at the end of the 19th century for the construction of the Atlantic Railroad and the field works at the banana plantations.(18) The essential ingredients of most Afro-Caribbean dishes are coconut milk and coconut oil. The most popular dish is “rice and beans”, which requires a very slow preparation with coconut milk and is served with different types of meats like chicken, fish or beef. (19–21) In Costa Rica, there are no questionnaires designed to assess dietary habits and nutrient intake of the Afro-Caribbean population. The objective of the present study was to develop an FFQ for the Afro-Caribbean population, by adapting a validated FFQ for the Costa Rican adult population (CR-FFQ) previously used in numerous studies. (22,23)

## MATERIALS AND METHODS

### Development of a culture-specific food list and a preliminary FFQ

We developed a list of culture specific foods based on previous literature reviews and recipes about typical foods from Limón and other Caribbean countries. The basic steps are summarized in Figure 1. All commonly used food items included in the FFQ previously developed for the Costa Rican population (CR-FFQ) were included in the original list. We also inquired about traditional diets of the region by interviewing 6 people who had knowledge of the Limón cuisine. The original list was screened to include only foods known to be available in Limón, Costa Rica. Individual foods were classified according to food groups and recipes. All the culture specific foods were categorized according to the main food groups in the CR\_FFQ, source (publication or recipe).

The first version of the Caribbean FFQ included a total of 92 items and open-ended questions. The questionnaire inquired about the frequency of the following food sections: dairy products, fruits, vegetables, starchy vegetables, nuts, beans, cereals, meats, beverages and sweets. After each section, participants were asked if they consumed (at least once per week) any other food that was not included in the questionnaire. The following frequency categories were used: < 1/m, 1-3/m, 1/wk, 2-4/wk, 5-6/wk, 1/d, 2-3/d, 4-5/d and 6+/d. The FFQ also inquired about specific fats and oils used for cooking and specific questions on intake of coconut products as well as open-ended questions on their use in the preparation of traditional dishes of the Limón region.

### Training and standardization sessions

Several training and standardization sessions were given to the potential interviewers before data collection. Training included basic information on the research project, nutrition survey methodology, and fieldwork theory. Interviewers were also instructed on specific procedures on dietary assessment using FFQ, including practice of dialogues (before and during the application of the questionnaire), guidelines for ambiguous responses and its application using iPads. Training included the material for the interviewers. All potential interviewers passed an implementation test.

### Study participants and data collection

The FFQ was administered to 34 participants (6 men and 28 women) from Limón, Costa Rica, who were in-charged of meal preparation at home. Subjects were volunteers recruited from different neighborhoods by “word of mouth” or through church meeting in the central district of Limón. Trained and standardized fieldworkers visited the participants’ home for data collection. A total of 18 neighborhoods were visited for data collection. As shown on Figure 2, the volunteers represented a diverse set of communities: Corales 1, Corales 2, Roosevelt, San Juan, Quinto, Juan Pablo Segundo, Pacuare, Pacuare nuevo, Las brisas de Pueblo Nuevo, Siglo 21, La colina, Los Cocos, Bella Vista, Cieneguita, Beverly, Moin, Río Banano and Limón downtown. Subjects were assured of anonymity and all participants sign an informed consent as stated in the Declaration of Helsinki.(24) The names and contact information were not collected in the dietary questionnaire.

## Data analyses

Data collected were downloaded into the Statistical Analysis Software (SAS) for data cleaning and descriptive analyses. The 92 food items were grouped into the following categories: Dairy (9 items), Fruits (7 items), Vegetables, starchy vegetables and seeds (33 items), Meats (12 items), Cereals (10 items), Beverages (11 items) and Sweets (10 items). Frequencies were estimated for each food group, as well as the type of oil used for cooking, and ingredients used in the preparation of traditional dishes. Food items deleted from the final questionnaire were those with reported frequency of intake of less than 1/week by >90% of the population. Stepwise regression was used to identify the variance explained by each food item within the corresponding food group. Food items that explained less than 1% of the variance and/or were not potential major contributors to calories, vitamins or minerals were also removed. Open-ended questions on the intake of coconut products and the preparation of traditional recipes that include coconut oil and/or coconut milk were used to identify food items that needed to be added to the FFQ.

## RESULTS

Table 1 shows the frequency of reported intake when dietary intake was assessed with the preliminary FFQ. Relatively high reported intake was found for fruits (70% 2+/d), dairy (71% at least 1/d), refined cereals (79% at least 1/d) and roots and tubers (59% at least 1/wk); and relatively low intake was found for sugar sweetened beverages (6% at least 1/d), green leafy vegetables (18% at least 1/wk), legumes (20% at least 1/d), whole cereals (23% at least 1/d), sweets and pastries (29% at least 1/d) and red meat (35% 2+/d). The reported intake of fish and seafood was moderate (53% 2-6/wk).

Table 2 shows that all participants (100%) reported using vegetable oil for cooking and additionally 9% of these participants also reported using palm shortening. The most commonly used oil for cooking and/or frying was soybean (73%) followed by sunflower (15%) and palm (6%). In addition, most dishes were cooked with vegetable oil. None of the participants reported coconut oil as the main oil used for cooking.

Table 3 shows the ingredients used in the preparation of regularly consumed traditional dishes that used coconut oil or milk in their preparation. "Rice and beans", "Rondón" and "Stew beans" were reported as being consumed at least once per month by at least 50% of participants. "Rice and beans" was the most widely consumed traditional dish. Most participants used coconut milk (97%) in the preparation of this dish. In addition to rice and beans, some recipes included other ingredients such as chicken, vegetables and sweet plantain. Coconut milk was also used in the preparation of "Rondón", a popular soup-like dish. Most participants used fish (95%) in its preparation although 66% also added red meat and 33% added chicken. Starchy vegetables were also used by 52% of those who prepared this dish.

"Stew beans" were prepared with coconut milk by 71%, and 94% of participants used red meat in its preparation. Vegetables were also used to a less extent.

Food items that were added or deleted from the preliminary FFQ are shown in Table 4. A total of 33 food items were deleted from the preliminary FFQ. Of these, 21 were removed because they were rarely consumed by the population, and 12 were removed because they explained less than 1% of the variance within the food group. Food items that were added included coconut fruit, 13 recipes containing coconut oil and/or coconut milk and 11 other foods that were regularly consumed in this population but were not included in the preliminary questionnaire.

The final Afro-Caribbean FFQ included 83 food items. The food items were grouped into the following categories: Dairy (6 items), Fruits (10 items), Vegetables, starchy vegetables and seeds (20 items), Meat and fish (11 items), Cereals, flours and legumes (14 items), Beverages (13 items) and Sweets (9 items).

## DISCUSSION

We developed an FFQ for the Afro-Caribbean population living in the Caribbean Coast of Costa Rica by adapting a validated FFQ originally developed for the population living in the Central Valley. Overall, the preliminary questionnaire captured most of the basic food components with most food items remaining the same. A total of 25 new food items that included mostly fruits and traditional foods prepared with coconut or its derivatives were added, whereas 33 items were deleted from the original questionnaire.

The development of FFQs requires the careful selection of food items that need to be included. It is generally recommended to select food items according to the aims of the study.<sup>(1)(2)</sup> Investigators must ensure that all food groups and the main contributors to dietary intake are included so that total caloric intake and dietary patterns can be adequately estimated.<sup>(1)</sup> Particular attention should also be paid to food items that may serve as confounders for the association between the foods or nutrients of interest and the outcome.<sup>(1)</sup> However, the total number of food items included should take into consideration the time it will take to complete the questionnaire.<sup>(1,2)</sup> Very long questionnaires can cause participants to get bored and reduce the level of accuracy in reporting.<sup>(2)</sup> The FFQ in the current study took between 45 and 60 minutes to complete. This length of time was mostly attributed to the open-ended questions and the detailed information on several traditional recipes that were collected. In general, it was observed that participants were tired towards the end of the interview. We expect that the Afro-Caribbean FFQ will take about 20 minutes to complete on average.

The Afro-Caribbean FFQ in this study has less food items compared with other FFQ's developed for specific ethnic groups. However, the total number of items, 92 in the present study, is very close to the average of 100 food items in previous studies. (3,6,8,13,26–28). Should be noted that the number of items in the Afro-Caribbean FFQ took into account the number of food items needed to diminish common problem such as overestimation of intake if the food items are excessive or a lack of information if the food items are very few. (28) The first draft of the Afro-Caribbean FFQ inquired about the frequency of intake in seven food groups: dairy, fruits, vegetables, starchy vegetables and seeds, cereals, grains and legumes, beverages, and sweet. An open-ended question was included after each food group to give participants an opportunity to add food items that were not included in the FFQ.

An important factor to consider in the assessment of dietary intake is the participant's motivation.(1) Overall, the fieldworkers in this study perceived that participants were interested and enthusiastic about participating. In our view, this could be achieved because the aims and importance of the study were explained to the participants. Thus, it is possible that they understood their contribution to research. This adult population, however, is generally friendly and highly cooperative with activities that involve the community. In our study, frequently consumed foods such as sweet potatoes, cassava, rice and beans, white rice, breadfruit, akee, bananas, plantains, avocado, meat stews, chicken and fish are common to other Afro-Caribbean populations in other countries.(6,8,9,11,13,25) However, we also found numerous food items that differed between this and other regions. This difference could be due to the availability of certain products, as well as the integration of the Afro-Caribbean community into other populations.

Coconut oil and coconut milk have been considered essential ingredients in the preparation of Afro-Caribbean dishes.(29) The use of coconut products in the culinary culture of the Caribbean Coast of Costa Rica was introduced by Jamaicans who immigrated to Costa Rica in the late 19th century.(29) Our study showed that some of the most popular dishes, such as "Rice and Beans", "Stew Beans" and "Rondón", are still part of the Afro-Caribbean cuisine today, although its intake may not be as high as it once was. It has been suggested that intake of these traditional dishes has decreased dramatically with globalization particularly among the young population. (21)

This study also revealed that coconut milk, but not coconut oil is regularly used in the preparation of Afro-Caribbean dishes. For example, 97% of participants reported using coconut milk in the preparation of rice & beans, whereas only 17.6% reported using coconut oil. There are several possible reasons for this. Coconut oil for cooking may be available in specialty shops but not in regular supermarkets or convenience stores. When available, the price can be 6 to 9 times higher than other vegetable oils such as soybean or sunflower.

Local artisan coconut oil is rarely available and the price is also high because of the long and cumbersome extraction procedure.(19) The current high prices could be attributed, in part, to the popularity of coconut oil in the cosmetic industry.(30)

More studies are needed to determine intake of coconut products in this population and whether these are consumed in large enough quantities to be able to assess the role of their intake on chronic disease in epidemiologic studies.

In sum, we adapted a FFQ previously developed and validated for the population living in the Central Valley of Costa Rica to assess dietary intake in the Caribbean Coast. Future studies are needed in order to validate the use of this questionnaire to assess dietary intake in this population and to determine whether intake of coconut and its derivatives in the region is suitable for future epidemiological studies on diet and chronic disease.



Table 1. Frequency of reported intake of food groups in the county of Limón, Costa Rica.

Food group	Consumption frequency/portions per day				
	Never or < 1/wk	1/wk	2-6/ wk	1/day	2+/day
	%	%	%	%	%
<b>Dairy</b>					
Low fat dairy (Skimmed or semi-skimmed milk, yogurt)	32.3	8.8	23.5	32.3	2.9
High fat dairy (Whole milk, condensed milk, custard or sweet cream, ice cream, fresh white cheese or yellow cheese, butter)	2.9	8.8	23.5	38.4	26.4
<b>Fruits</b>					
Tropical fruits (pineapple, banana, watermelon or cantaloupe, mango, orange)	14.7	2.9	8.8	20.5	52.9
Apples and pears	20.5	17.6	29.4	14.7	17.6
<b>Vegetables</b>					
Green leafy vegetables (Lettuce, chिकासquil leaves, okro leaves, spinach and other green leafy vegetables)	32.3	17.6	32.3	14.7	2.9
Salad vegetables (Tomato, tomato sauce, cucumber, avocado, okro, chayote, squash, green beans).	8.8	0.0	11.7	29.4	50.0
Cruciferous (cabbage, broccoli, cauliflower)	17.6	38.2	20.5	11.7	11.7
Spices (Celery, cilantro, sweet pepper)	2.9	17.6	8.8	29.4	41.1
Other vegetables (radish, palm heart, carrot)	11.7	38.2	26.4	11.7	11.7
<b>Roots, tubers, and starchy vegetables</b>					
Potato	44.1	8.8	41.1	2.9	2.9
Yam, tiquisque, sweet potato, cassava	20.5	41.8	29.4	2.9	5.8
Other vegetables (pejibaye, sweet plantain)	14.7	8.8	44.1	26.4	5.8
<b>Legumes &amp; nuts</b>					
Legumes (chickpeas, lentils, cubaces, beans, other beans)	2.9	23.5	44.1	20.5	8.8
Nuts Peanuts and other nuts	38.4	23.5	23.5	11.7	2.9
<b>Meats</b>					
Red meats (beef, pork, processed meats*)	0.0	8.8	25.3	32.3	35.2
Chicken	5.8	5.8	70.5	5.8	11.7
Eggs	20.5	2.9	47.0	14.7	14.7
Fish and seafood†	2.9	32.3	52.9	5.8	5.8
<b>Grains &amp; cereals</b>					
White rice	2.9	2.9	38.2	23.5	32.3
White bread and flour tortillas	11.7	11.7	26.4	38.4	11.7
Pasta	32.3	29.4	32.3	2.9	2.9
Whole cereals (fiber or whole grain oat supplements, wholegrain bread, brown rice)	29.4	17.6	20.5	23.5	8.8
Breakfast cereal	50.0	8.8	26.4	11.7	2.9

Corn tortillas	76.4	14.7	8.8	0.0	0.0
Salty snacks & chips	70.5	2.9	17.6	2.9	5.8
<b>Beverages</b>					
Sugared beverages (Sugar sweetened carbonated and non-carbonated beverages, commercial fruit drinks and commercial orange juice)	23.5	17.6	32.3	5.8	20.5
Diet soda	91.1	2.9	5.8	0.0	0.0
Homemade fruit beverages "fresco"	11.7	14.7	41.1	23.5	8.8
Natural orange juice	58.8	14.7	17.6	8.8	0.0
Alcohol (beer, liquor)	70.5	11.7	11.7	2.9	2.9
Coconut water	55.8	11.7	20.5	5.8	5.8
Coffee	52.9	5.8	11.7	26.4	2.9
Water	0.0	0.0	5.8	5.8	88.4
<b>Sweets and pastries</b>					
Candies and chocolates	29.4	23.5	32.5	8.8	5.8
Cookies, deserts and pastries§	0.0	20.5	41.1	20.5	17.6

N= 34

\* Processed meats includes ham, mortadella, salami, chorizo and sausage.

† Seafood as lobster and shrimps.

§ Pastries includes sweet and salty pastries.

Type of fat used for cooking	Oil n=34 %	Shortening n=9 %
Soybean	73.5	na
Sunflower	14.7	na
Corn	2.9	11.1
Palm	5.9	88.8
Canola	2.9	na
Coconut	0.0	0.0

N= 34

na = not applicable

Ingredient used	Typical dishes		
	Rice and beans	Rondón	Stew beans
	%	%	%
Coconut oil	17.6	15.7	12.5
Coconut milk	97.0	100	70.9
Beef or pork	34.3	66.6	93.7
Chicken	50.0	33.3	15.6
Fish	37.5	94.7	15.6
Rice	97.0	23.5	28.1
Black Beans	97.0	11.7	96.8
Vegetables	48.4	35.2	40.6
Roots and tubers	34.3	52.6	21.8
Sweet plantain	46.8	29.4	28.1

N=34

Table 4. Foods removed, added or modified in the development of the Afro-Caribbean FFQ.	
Removed	Added
<b>Dairy</b>	<b>Fruits</b>
Condensed milk	Grapes
Ice cream	Strawberries
Margarine	Breadfruit
<b>Fruits</b>	Coconut
Watermelon and cantaloupe	<b>Vegetables, starchy vegetables and seeds</b>
<b>Vegetables, starchy vegetables and seeds</b>	Mustard greens
Tomato sauce	Escabeche with coconut oil and/or milk†
Cabbage	Akee with coconut oil and/or milk §
Radish	<b>Meat and fish</b>
Palm heart	Rondónb
Chicasquil* and okro leaves	<b>Cereals, flours and legumes</b>
Okro	Rice and beans≠
Winter squash	White rice with coconut or coconut oil
Broccoli	White rice in other preparations
Cauliflower	Stew beanst
Green beans	White beans
Chickpeas	Guandú beans
Lentils	<b>Beverages</b>
Large beans Cubaces	Chicheme¥
Other kind of beans	<b>Sweets and desserts</b>
Cocoyam	Coconut cookies
<b>Meats</b>	Other sweet cookies
Fresh, smoked or canned sardines or salmon	Coconut pudding
Shrimps, lobster and seafood	Cocadas y/o cajetas de coco
<b>Cereals and flours</b>	Fried cake
Wheat tortillas	Coconut flan
Brown rice	Banana pudding ™

<b>Beverages</b>	
Diet sodas	
<b>Sweets and desserts</b>	
Chocolates	
Cookies	
Cake	
Desserts	
Pastries	
Sweet pastries	
Jam	
Artificial sweeteners	

\*Plant with green leaves like spinach, eaten in different dishes.

†Marinade made with vegetables oil, vinegar, bay leaf and other spices.

§Fruit grown in the Caribbean region of Costa Rica and is widely eaten as a vegetable.

↳Traditional soup from the Caribbean coast of Costa Rica made with fish, tubers and coconut milk.

≠Traditional dish from the Caribbean coast of Costa Rica made with rice, beans and coconut milk.

‡Traditional dish from the Caribbean coast of Costa Rica made with beans, green plantain, coconut milk and different kind of meats like pork and beef.

¥Drink made with cooked corn unground, cooked with sugar, milk and spices.

¶Drink made with pineapple and coconut milk.

⌘Typical Costa Rican sweets made with coconut and sugarcane.

□A thick porridge made with corn flour and banana or breadfruit.

□ The format of the name of the group changed in the new version of the FFQ.



FIGURES

Figure 1. Methodological design for the development of the Afro-Caribbean FFQ.

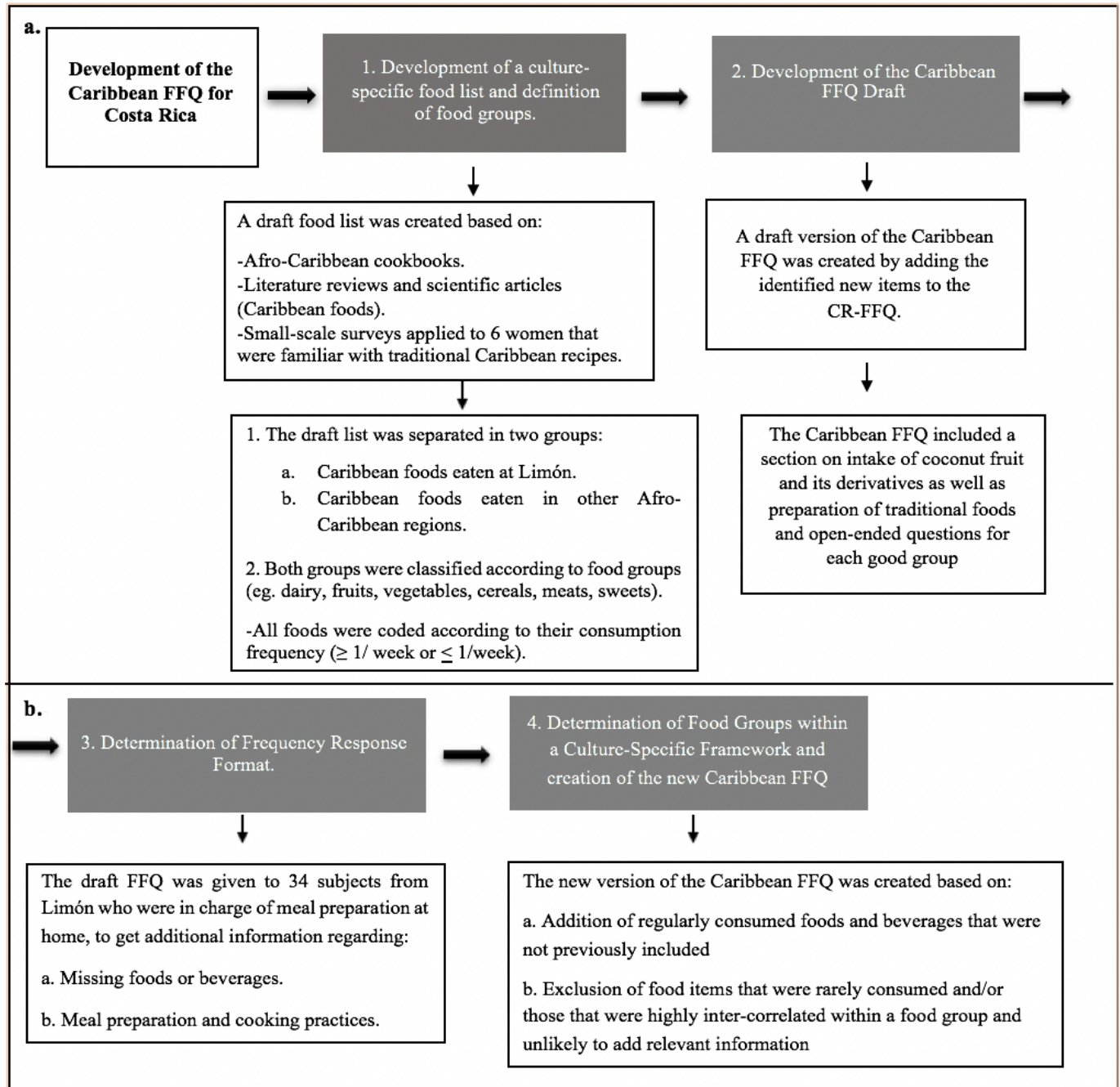
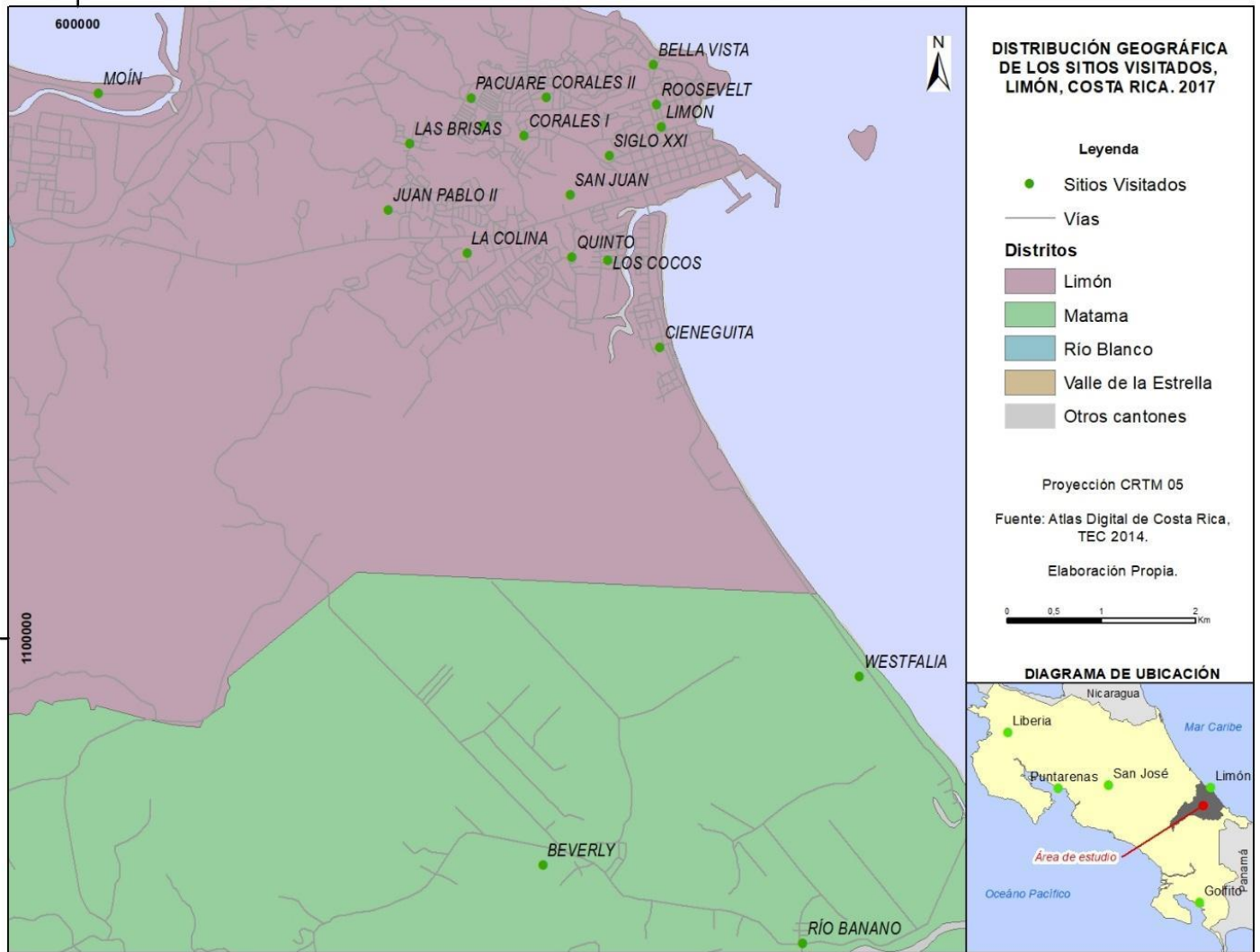


Figure 2: Households visited in the central district of Limón



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#### FUNDING:

CIINT Fund, Universidad Hispanoamericana and a research award from the Stewart H. Watson zFlo Inc. USA

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