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## Perceptions of food availability and self-reported dietary intake in urban Costa Rican women: A pilot study

Percepciones sobre disponibilidad de alimentos y autorreporte de ingesta alimentaria en mujeres urbanas costarricenses: Un estudio piloto

Traci A. Bekelman<sup>1</sup>, Carolina Santamaría-Ulloa<sup>2</sup>, Darna L. Dufour<sup>3</sup> y Ana Laura Dengo<sup>4</sup>

- **ABSTRACT: Background:** Food availability and dietary intake are thought to contribute to rising obesity among women of low socioeconomic status in Latin America. In Costa Rica, few studies have investigated food availability, dietary intake, or how they vary by SES. **Objectives:** The purpose of this study in San José, Costa Rica was to (1) evaluate women's perceptions of food availability and, (2) describe dietary intake in women from low- and high-SES areas of the city. **Methods:** Thirty non-pregnant, non-lactating women between 25 and 50 years were recruited in March 2013 from a low- and high-SES canton. Structured, qualitative interviews assessed perceptions of food availability in 17 of the 30 women. Quantitative 24-hour dietary recalls assessed dietary intake in all 30 women. **Results:** Many women from the low-SES canton reported that they would include more chicken and fish in their diet if cost were not a barrier. Protein intake as a proportion of total energy intake was significantly greater in women from the high- versus low-SES canton (17% SD=5 vs. 13 SD=3,  $p = 0.02$ ). Protein intake from animal source foods was significantly greater in women from the high-SES canton (38 g SD=22 vs. 21 SD=11,  $p = 0.02$ ). **Conclusion:** Protein intake was greater in high-SES women and this may be due to the perceived cost of animal source foods.
- **Keywords:** perceptions of food availability, dietary intake, Costa Rica
- **RESUMEN: Antecedentes:** Se considera que la disponibilidad y consumo de alimentos han contribuido al aumento de obesidad entre las mujeres de bajo nivel socioeconómico (NSE) en Latinoamérica. En Costa Rica, pocos estudios han investigado cómo la disponibilidad y consumo varían según NSE. **Objetivos:** Los objetivos de este estudio en San José, Costa Rica, son (1) evaluar percepciones sobre la disponibilidad de alimentos y (2) describir el consumo de alimentos en mujeres que viven en áreas de alto y bajo NSE. **Métodos:** En marzo 2013, se reclutaron 30 mujeres no embarazadas, ni dando lactancia materna, de 25 a 50 años, en un cantón de bajo y otro de alto NSE. Las percepciones sobre disponibilidad de alimentos se analizaron de manera cualitativa mediante entrevistas estructuradas a 17 de las 30 mujeres. El consumo de alimentos se analizó de manera cuantitativa mediante recordatorios de 24 horas en las 30 mujeres. **Resultados:** Muchas mujeres del cantón de bajo NSE reportaron que incluirían más pollo y pescado en su dieta si el costo no fuera una barrera. La ingesta de proteína como proporción del valor energético total fue significativamente mayor en las mujeres del cantón de alto NSE (17% DE=5 vs. 13 DE=3,  $p = 0.02$ ). La ingesta de proteína de origen animal fue significativamente mayor entre las mujeres del cantón de alto NSE (38 g DE=22 vs. 21 DE=11,  $p=0.02$ ). **Conclusión:** La ingesta de proteína fue mayor en las mujeres de alto NSE y puede deberse al costo percibido de los alimentos de origen animal.
- **Palabras Clave:** percepciones sobre disponibilidad de alimentos, ingesta alimentaria, Costa Rica

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## 1. Introduction

In Latin America, body size increased over the last several decades. Over the same period, national level changes in the food supply occurred in many Latin American countries, as economic development and globalization introduced a variety of new foods and beverages into the Latin American economy (Food and Agriculture Organization, 2015; Popkin, 2012). Given these parallel changes in body size and food supply, dietary intake is thought to be a major contributor to rising body size in Latin America (Albala et al., 2002; Cuevas et al., 2009; Cunha et al., 2010; Kain et al., 2003; Uauy and Monteiro, 2004).

This relationship between food supply and body size is based on the assumption that foods introduced into the economy are readily available to individuals and consumed as part of their usual dietary intake; therefore contributing to rising body size. While there is sufficient data on food supply and body size at the national level in Latin American countries, very little is known about two of the main factors that link them: food availability and dietary intake at the individual level. Understanding food availability and dietary intake at the individual level may help clarify if and how the food supply influences body size.

Costa Rica provides an opportunity to shed light on these missing links because national level changes in the food supply paralleled increases in the prevalence of overweight and obesity between 1982 and 2009. The latter increased from 35 to 60% among women of reproductive age (Food and Agriculture Organization, 2015; Ministerio de Salud, 2009). If and how these two trends are linked is not well understood because little is known about food availability and dietary intake among women in this age group, especially in urban areas where we expect the availability of new foods and beverages to be highest.

Given that body size in urban Brazil and Colombia is rising particularly rapidly among women of low socioeconomic status (SES) (Dressler et al., 2008; Kasper et al., 2014; Monteiro et al., 2000; Olszowy et al., 2012) it is reasonable to assume that food availability and dietary intake may vary by socioeconomic status. However, no studies evaluated variation in food availability by SES among urban Latin American women of reproductive age. Only a few studies in Latin America have evaluated variation in dietary intake by SES, and these studies focused on a limited number of food items (Bender et al., 2015; Colón-Ramos et al., 2007; Dressler et al., 2008; Jaime, et al., 2011; Kabagambe et al., 2005). A more comprehensive picture is needed in Costa Rica of how food availability and dietary intake vary by SES.

The objectives of this pilot study in urban Costa Rica were to (1) evaluate women's perceptions of food availability and, (2) describe dietary intake in women from low- and high-SES cantons. Additionally, this paper describes the feasibility of measuring dietary intake in the study population.



## 2. Materials and Methods

### 2.1. Study design

The design was cross-sectional and used a convenience sample of 30 women, 15 of them from a low-SES canton, or administrative district, and 15 from a high-SES canton in San José, Costa Rica. The study was conducted in March 2013 after obtaining approval from the Human Research Committee at the University of Colorado Boulder (12-0743) and the Ethics Committee at the University of Costa Rica (VI-1236-2013).

### 2.2. Participants

Thirty non-pregnant, non-lactating women between age 25 and 50 years who lived in the selected cantons were recruited and included in the study after obtaining signed consent. This study focused on women because obesity is higher in women than men in many Latin American cities (Schargrofsky et al., 2008), Costa Rica included (Ministerio de Salud, 2009), and because women play a prominent role in the procurement and preparation of food in Latin America. Age range was restricted to reduce the age-associated variation in dietary intake in the sample. Pregnant and lactating women were excluded because their energy and protein requirements are different, especially during the second and third trimester of pregnancy (Butte and King, 2005; Institute of Medicine, 2005; Kaiser, et al. 2014) and because the diet of pregnant or lactating women may not reflect their usual intake.

### 2.3. Sampling and Recruitment

Costa Rica is divided into seven provinces and further divided into 81 cantons. The cantons of Escazú and Alajuelita are located in the largest urban agglomeration in Costa Rica, known as the Greater Metropolitan Area. The Human Development Index (HDI), a measure of social and economic development, was evaluated in Costa Rica and found to vary immensely by canton. Escazú and Alajuelita were selected as the study sites for this study because their HDI scores in 2011 were at two ends of the spectrum. The wealthier canton of Escazú had the highest HDI score (0.924) in San José and the poorer canton of Alajuelita had the lowest (0.596), on a spectrum of 0 to 1.0 where 1.0 indicates better conditions (Programa de las Naciones Unidas para el Desarrollo, 2013).

### 2.4. Perceived Food Availability

Structured interviews (see Weller, 2000), in which all participants were asked the same pre-determined set of questions, were used to evaluate women's perceptions of food availability. Structured interviews were chosen because the investigators already



had some familiarity with the topic and because standardized questions allow for comparison of answers across individuals or groups. Structured interviews were conducted in Spanish by an investigator from the University of Colorado (TB) with 11 women from a low-SES canton and six women from a high-SES canton. All participants were invited to participate in structured interviews, but only 17 women from the total sample size of 30 women agreed to participate in the structured interview. Structured interviews lasted between 15 and 40 minutes. Women were encouraged to respond openly and honestly to open-ended questions from an Interview Guide. All structured interviews were recorded on audio tape with the permission of participants. Structured interviews were conducted after the dietary recall (described in Section 2.5) was completed so that the types of interview questions would not influence data provided during the dietary recall. Questions included in the Interview Guide were the following:

1. As you know, I am going to ask you to tell me your opinion about the foods available in Costa Rica. When I mention this topic, what is the first things that comes to your mind?
2. Tell me what your family eats for breakfast, lunch, dinner and in between meals.
3. In what way does your diet vary between weekdays and weekends?
4. In what way does your diet vary throughout the year?
5. I would like to know what is your ideal meal. If you could eat anything you wanted for breakfast, lunch and dinner, what would you choose? In other words, if food were free and easy to obtain, what would you eat during the day?
6. What are the main challenges you face in obtaining and preparing food?
7. How do you handle those challenges?
8. Sometimes people cannot eat what they want. What would you eat if the foods you eat were too expensive or difficult to obtain?
9. When and how do you incorporate animal products, like chicken and eggs, into your diet?
10. If someone wanted to prepare pork for dinner, but the pork was too expensive, what could they replace it with?
11. What are the traditional foods in Costa Rica?
12. In the last 10 years, in what way has your diet changed?



Question 1 was designed as a warm-up question. Question 2 was designed to provide information about each woman's usual dietary intake, which could be compared against her dietary recall data. Questions 3 and 4 were included because collecting dietary data that represents usual intake in future studies requires an understanding of how and when dietary intake varies. Question 5 originally read, "What is your ideal meal?" However, the first two subjects found this question confusing. After two interviews, we added the rest of the wording in Question 5 for clarity. Questions 6 through 8 were designed to give women an opportunity to both recall challenges from memory and recognize challenges presented by the interviewer. Questions 9 and 10 were designed to assess availability of relatively expensive foods. Questions 11 and 12 were designed to determine if women's perceptions of changes in the diet were consistent with changes in food availability at the national level.

## 2.5. Dietary Intake

Twenty-four hour dietary recalls were used to measure dietary intake, following the methods described by Gibson (2005). First, participants were asked by investigators (TB, CS, ALD) to provide a complete list of the foods and beverages they consumed on the preceding day from the moment they woke up until the time they went to bed. When respondents struggled to remember what they ate, the following types of prompts were used:

- What was the first thing you ate after you woke up
- What did you eat after that
- Did you eat anything between meals or after dinner
- Did you purchase anything while you were out/at work?

Second, participants were asked what time each food or beverage was consumed. Third, participants were asked to describe where the food was obtained from (i.e. prepared at home, purchased at a restaurant) and the context in which the food was eaten (i.e. at home during breakfast). When foods were prepared at home, participants were asked to provide the recipes, the number of people who consumed the home-prepared food or beverage, and how the home-prepared food or beverage was divided between the consumers (e.g. if everybody ate an equal portion). When foods were purchased, respondents were asked the name of the restaurant, the specific name and size of the purchased food or beverage or the brand of the item.

Fourth, participants were asked to recall the quantity of all foods and beverages consumed in the measurement that was easiest for them (e.g. ounces, grams, cups, spoonfuls, slices). Fifth, the interviewer and the participant reviewed the entire recall to ensure that the information was correct and complete. Finally, women were asked if the dietary intake they reported was their usual dietary intake and if they were on a special diet. Women were included in the analysis regardless of whether their reported intake was their usual intake or whether they were on a special diet.



To improve accurate reporting of food and beverage quantities, photos of different portions of common foods or measuring and serving utensils were available during the recall to help respondents visualize and more accurately report the quantity of foods consumed (Chinnock and Castro, 2014). Data on the participant's diet (i.e. cuts of meat, methods of food preparation or brand names of prepared foods) was collected as part of the dietary recalls. Intake from packaged foods was assessed by documenting nutritional information from the packaging label, when available.

Data collection mostly took place in a public location such as a park or community center and otherwise took place at women's homes. All dietary recalls were conducted in Spanish. Recalls were conducted within a three week period, Tuesday through Saturday, in order to recall weekday consumption. Women participated in one dietary recall each.

Valornut, an online platform developed at the University of Costa Rica (Chinnock, 2010), was used to estimate the amount of energy and nutrients consumed during the measurement period. Valornut uses the nutrient database from the Food Composition Table developed by the Institute of Nutrition of Central America and Panama (INCAP) (Menchu et al., 2000). Food and beverage intakes (in grams or kilocalories) were defined in the following way:

1. Energy intake was defined as the intake of energy, in kilocalories (kcal).
2. Absolute macronutrient intake (protein, carbohydrate, fat) was defined as the intake of each macronutrient, in grams (g).
3. Macronutrient intake (protein, carbohydrate, fat) as a proportion of total energy intake was calculated as absolute macronutrient intake (kcal) / total energy intake (kcal). Macronutrient intake in grams was converted to kcals using the following equivalent: 1 gram protein=4 kcals; 1 gram carbohydrate=4 kcals; 1 gram fat=9 kcals.
4. Protein intake from animal source foods (ASFs) was calculated as the sum of intake in grams of protein from all animal-derived products, including dairy (milk, yogurt, cheese, sour cream, etc.), eggs, and meat (beef, chicken, shrimp, fish, etc.).
5. Sugar-sweetened beverage intake was calculated as the sum of intake in kilocalories of hot and cold beverages containing caloric sweeteners, including but not limited to sugar, high fructose corn syrup, agave, and honey. These drinks included purchased beverages such as soda, flavored milk, fruit juices made from concentrate, fruit-flavored beverages made from powder, and iced tea, as well as homemade beverages such as coffee, *agua dulce* (made with raw cane sugar and milk or water), and *fresco* (made with water, fresh fruit, and sugar).
6. Bread and bakery goods intake was calculated as the sum of intake in kilocalories of sweet and savory breads, cakes, cookies, pastries, and crackers.



## 2.6. Data analysis

### 2.6.1. Qualitative Data Analysis

Structured interviews were analyzed using a general inductive approach (Thomas 2006) in order to summarize women's perceptions about food availability. As part of the general inductive approach, interviews were simultaneously translated into English and transcribed verbatim. All quotes reported in this paper were back translated to Spanish and compared to the original Spanish audio file to improve data quality. The transcripts were rigorously read and re-read to identify topics that appeared repeatedly, either because structured questions were specifically asked about those topics (e.g. ideal foods) or because they emerged from women's responses (e.g. coping with high food prices). Next, statements made by the women were systematically organized into the different topics through coding. Quotes that reflected the shared views of several women, as well as quotes that reflected a minority opinion were identified for inclusion in this paper.

### 2.6.2. Quantitative Data Analysis

Women were categorized as being from a low-SES canton or a high-SES canton based only on their reported canton of residence, and not on any other demographic characteristics. A dataset containing each of the participant's dietary intake variables was created. All dietary intake variables assessed through dietary recalls and processed using Valornut were continuous variables. Intake of energy; macronutrients; protein intake from animal source foods; sugar-sweetened beverages; and baked goods were compared in women from low- versus high-SES cantons using a two-tailed Student's t-test. All statistical analyses were conducted with STATA statistical software version 13 (StataCorp, 2013). Statistical significance was set at  $\alpha = 0.05$ .



## 3. Results

### 3.1. Feasibility of Measuring Dietary Intake

A total of 50 women were approached to participate in this study and 60% (n=30) provided informed consent. Successful recruitment appeared to be influenced by the short time commitment required to complete the dietary recall (20 minutes), since once women were told the time their participation would take they seemed to be more willing to participate. The pre-existing level of trust between the community where recruitment occurred and the University of Costa Rica also appeared to be important for recruitment, as evidenced by the attention women paid to the researchers' identification badges and the University logos when they were approached.





Women appeared comfortable allowing researchers into their homes and openly shared information about their dietary intake. Some dietary recalls were conducted in the presence of family members and this appeared to be beneficial for two reasons. First, women seemed more comfortable talking to the investigators and, second, the reported food intake may have been more accurate because family members provided additional details regarding the food intake of women enrolled in the study.

Women from low- and high-SES cantons seemed equally forthcoming about their dietary intake. Many women in both groups reported consuming foods that they perceived to be “unhealthy”, “low-status” or “junk food”, suggesting that women were not omitting stigmatized foods from the self-reported intake. Women were able to visualize the quantities of foods and beverages consumed, but some had a hard time articulating the quantity in standard units of measurement, such as ounces or milliliters. Many women were not able to remember the specific type of cooking oil used during food preparation.

For most women, dietary intake reported as part of the dietary recalls (e.g. “I ate cereal for breakfast yesterday”) was consistent with the usual dietary habits reported during the structured interviews (e.g. “I usually eat cereal for breakfast”). Twenty percent of women said that the intake they reported as part of the recall did not reflect their usual diet. The most common reason reported for this discrepancy was attendance at a celebration where foods and beverages not part of their usual diet were served. Other reported reasons included being too busy to eat their usual diet, premenstrual syndrome, illness, and boredom with the usual diet.

## 3.2. Food Availability: Structured Interviews

In response to questions from the Interview Guide, women discussed: (1) their ideal meals, (2) challenges to consuming their ideal meals, (3) coping with high food prices, and (4) change in food availability over the last 10 years.

### 3.2.1. Ideal meals

Women from both cantons had similar ideas about what constitutes an ideal meal. When asked about their ideal meals or what they would eat if cost were not a barrier, women from the low-SES canton frequently reported that they would eat more fish, chicken, eggs and salad. Some women from the high-SES canton reported that they would eat more fish, shrimp, salad and whole wheat products as part of their ideal meal. Other women from the high-SES canton reported that cost was not a barrier and their ideal meals were available and part of their usual dietary intake.

In addition to the types of food described above, women in both cantons were in agreement about the food qualities that are part of an ideal meal. Food qualities that women valued included nutritious, balanced, trustworthy, diverse, flavorful, convenient, traditional and non-traditional.



- “[I eat] a lot of salad, grilled chicken, everything that’s fat free.” (*Participant 2, L-SES*)
- “Something balanced, right. Carbohydrates, proteins. We try to eat something from each one. For breakfast in general we have, what can I say, well, the famous *gallo pinto* from here, Costa Rica, and because it’s considered a carbohydrate, [we eat it] with a protein that would be egg” (*Participant 15, H-SES*)
- “I say it’s divided. One half is healthy, but [the other half] junk food. For us, junk food... One proportion of us [eat] food like *picadillos*, rice, always beans, or beef or chicken in sauce, but there is a majority of us that eat garbage; because of poor nutrition in junk food.” (*Participant 9, L-SES*)

### 3.2.2. Challenges to consuming ideal meals

Women were asked questions requesting that they talk about the challenges associated with consuming ideal meals. Many women reported that the high relative cost of animal source foods restricted their access to those foods.

- “At lunch, if it were cheaper I would like to eat fish. I love filet of tilapia, but it is expensive and you can’t eat that if you’re a big family.” (*Participant 7, L-SES*).
- “If food were free, I would like to follow a diet. I started being overweight. Then I would like to... following a food regimen that is very healthy it requires money. Salads, grilled fish, grilled chicken...but in a big family, in our case we’re five, and it is two of them who work, then there’s a budget and there are two kids and we prefer to give the food to the kids.” (*Participant 9, L-SES*).
- “We like to eat seafood, but economically this isn’t always possible. So, we buy more vegetables because it’s cheaper. We eat rice and beans because it is easy to prepare and cheap. What else? Always, I mean, what we eat and buy is what we can afford.” (*Participant 13, H-SES*)

Some women reported eating rice and beans at breakfast, instead of bread because of the relatively high cost of bread:

- “In the morning, we never lack for gallo pinto because to buy bread it costs a lot of money.” (*Participant 8, L-SES*)



### 3.2.3. Coping with high food prices

When asked what they would do if the foods they eat were too expensive or difficult to obtain, women reported a variety of adjustments they make to their diet to cope with high food prices. Many of these adjustments were related to the high perceived price of animal source foods, especially among women living in the low-SES canton. These adjustments included (1) eating smaller portions of the most valued foods, (2) preparing the same food for lunch and dinner, (3) eating cheaper cuts of meat, (4) buying seasonal produce, (5) eating at home instead of spending money at restaurants, and (6) shopping at food stores with lower prices even if it means bypassing stores closer to home. Women in the low-SES canton reported using six all of these strategies, while women in the high-SES canton only reported using two (buying seasonal produce and eating at home) (Table 1).

- “If food is less expensive than in the supermarkets I’ll go to San José and I’ll buy the vegetables and the meat there. I do it this way because the place I live doesn’t serve me.” (*Participant 9, L-SES*)

Women were specifically asked about what a woman would cook for dinner if she couldn’t afford to include meat. Eggs were the most common replacement food reported by women in both cantons. Women in both groups suggested that gallo pinto and cheese could serve as replacements for animal meat. Low-SES women also said that chayote (an inexpensive vegetable similar to summer squash), plantains, pasta or potatoes could be used as a replacement when meat was not available.

- “People eat what is most accessible – rice and beans. All these types of food that are inferior” (*Participant 15, H-SES*)



**Table 1**  
Adjustments Women Make to Cope With High Food Prices

Adjustments	Typical quote
Eating smaller portions of the most valued foods	"I would eat less chicken or different parts of the chicken." (P6, L-SES)
Preparing the same food for lunch and dinner	"Because of the economic situation I prepare the same food for lunch and dinner." (P1, L-SES)
Eating cheaper cuts of meat	"Meat broth and chicken parts [offal] are cheaper. So I give them this to eat. It is food that is not very "wow", but this is what we eat here, right, in our house." (P4, L-SES)
Buying seasonal produce	"For example, if tomatoes are very expensive then I don't buy it. It's the same with, for example, in this season, broccoli is very expensive, so I don't eat it." (P14, H-SES)
Eating at home instead of spending money at restaurants	"Economically, we eat more in the house. Going out is more expensive." (P14, H-SES)
Shopping at stores with lower prices even if it means bypassing stores closer to home	"If food is less expensive than in the supermarkets I'll go to San José and I'll buy the vegetables and the meat there. I do it this way because the place I live doesn't serve me." (P9, L-SES)

### 3.2.4. Change in food availability over 10 years

Women's perceptions of how food availability changed over time varied by canton. Most women living in the low-SES canton perceived negative changes in the diet over the last 10 years and were concerned about decreases in food quality and increases in food prices, especially for meat.

- "I say it has changed a mountain, right. In the sense that perhaps the type of food that they give...it's not the same as before. It used to be trustworthy. Now there are some bacteria you can catch from the meat. So, it's changed a lot. [Now I eat] less meat." (Participant 5, L-SES)



- “Now things are more expensive...less meat now than before because it’s more expensive.” (*Participant 7, L-SES*)

In contrast, women from the high-SES canton focused on changes in the availability of seafood over the last 10 years.

- “The people eat more rice with seafood, before no, before it was the basics like rice and beans, now people eat different things. There are many people here who don’t eat rice and beans but eat salads or chicken or fish instead because it’s healthier.” (*Participant 17, H-SES*)
- “The only difference is we now eat seafood more frequently. We eat more ceviches, more raw things than before. I think that here, [there are] so many advertisements and things like that and we learn to eat more raw things, more natural things.” (*Participant 13, H-SES*)
- Seafood is more expensive. And one has less access. In many places they aren’t that fresh, so we don’t use them much. Normally where you find them fresh they are expensive...For me, seafood is less accessible.” (*Participant 14, H-SES*)

Some women from the high-SES canton also reported that their diet has improved because they are more health conscious now.

- “It has changed a lot because now I try to take better care of myself in terms of food. Maybe fifteen years ago I ate everything but now one needs to be more conscious. Say, I don’t eat junk food anymore. I try to eat more salad. I care for myself better.” (*Participant 15, H-SES*)
- “Fifteen years ago I ate more street food. Not now, no. Now I eat more vegetables and salads...I can’t eat anything packaged.” (*Participant 13, H-SES*)

### 3.3. Dietary Intake: Structured Interviews

In response to questions in the Interview Guide, women described what they usually eat during and between meals. The most commonly reported breakfast items among women in both cantons were coffee, *gallo pinto* (mixture of beans, rice and spices) and bread. During breakfast, it was common for women living in the low-SES canton to report spreading margarine on their bread, while women in the high-SES canton reported consuming their bread with cheese or eggs. Typical lunch foods in both groups included beans, meat, and *picadillo* (minced vegetables with or without beef cooked with seasonings and broth). At lunch time, women from the low-SES canton reported more often that they consume *chayote*, rice, plantains and pasta. For between-meal snacks, women from the high-SES canton reported more often consuming fruit, while women in the low-SES canton reported more often consuming



crackers or cookies. For dinner, women from the low-SES canton most frequently reported eating food leftover from lunch and women from the high-SES canton most frequently reported eating a sandwich with processed meat and cheese.

Women described the factors that influence variation in their diet and most of these factors were family-related. Several women reported that their dietary intake varied during family holidays, like Christmas. Some women reported that on weekends, they ate more frequently in restaurants, cooked bigger meals, cooked less, or ate less because more family members were around the house on the weekend. However, a greater number of women reported that their diet did not vary between weekdays and weekends. Two women reported that their dietary intake was influenced by whether or not their children were in school or at home during weekends or school vacations. While lunch has traditionally been the main meal of the day in Costa Rica, a few women from both cantons reported that dinner was their main meal because that is the time of the day when their husbands are at home.

### 3.4. Dietary Intake: 24-hour dietary recalls

Dietary intake evaluated through dietary recalls is reported in Table 2 for the full sample of women. Mean energy intake in the full sample was 1,779 kilocalories (kcal). Mean macronutrient composition of the diet in the full sample was 15% protein, 25% fat, and 60% carbohydrate. Nearly one half of protein intake (48%) came from dairy and meat products.

**Table 2**

Dietary intake in the full sample. Urban women from San José, Costa Rica (n=30)

Dietary intake category	Median	Mean	SD	95% IC	Min	Max
Energy intake (kcal)	1.616	1.779	882	(1.450 - 2.109)	601	5.174
Protein (g)	58	62	24	(53 - 70)	26	114
Carbohydrate (g)	247	267	131	(217 - 316)	56	763
Fat (g)	43	51	38	(37 - 65)	10	201
Protein (%)	14	15	4	(13 - 16)	8	29
Carbohydrate (%)	63	60	10	(57 - 64)	37	76
Fat (%)	23	25	10	(21 - 29)	9	48
Protein intake from dairy and meat products (g)	26	30	19	(22 - 37)	0	86
Protein intake from dairy and meat products as a percent of total protein intake (%)	46	48	21	(40 - 56)	0	81
Sugar-sweetened beverages (kcal)	86	162	252	(68 - 256)	0	1.285
Bread and bakery goods (kcal)	224	301	288	(193 - 408)	0	998

SD: Standard Deviation

95% CI: 95% Confidence Interval



Table 3 reports a breakdown of dietary intake data by canton. Energy intake was lower in the high SES canton although the difference was not statistically significant (1,552 kcal SD=584 vs. 2,007 SD=1,076,  $p = 0.16$ ). In terms of absolute macronutrient intake, carbohydrate intake (g) was lower in women from the high-SES canton (221 g SD=82 vs. 312 SD=157,  $p = 0.05$ ), but the absolute intake of protein and fat did not vary by canton.

**Table 3**

Dietary intake by canton of residence. Urban women from San José, Costa Rica

Dietary intake category	High SES-Escazú (n=15)			Low SES-Alajuelita (n=15)			p-value
	Mean	SD	95% CI	Mean	SD	95% CI	
Energy intake (kcal)	1.552	584	(1.228 - 1.875)	2.007	1.076	(1.411 - 2.603)	0,16
Protein (g)	62	26	(48 - 76)	61	22	(48 - 73)	0,88
Carbohydrate (g)	221	82	(176 - 266)	312	157	(226 - 399)	0,05
Fat (g)	44	24	(31 - 58)	58	48	(31 - 85)	0,33
Protein (%)	17	5	(14 - 19)	13	3	(11 - 15)	0,02
Carbohydrate (%)	57	10	(51 - 63)	63	9	(59 - 68)	0,07
Fat (%)	26	10	(21 - 32)	24	10	(19 - 29)	0,54
Protein intake from dairy and meat products (g)	38	22	(26 - 50)	21	11	(15 - 28)	0,02
Protein intake from dairy and meat products as a percent of total protein intake (%)	59	16	(50 - 67)	38	20	(27 - 49)	<0.01
Sugar-sweetened beverages (kcal)	125	148	(43 - 207)	199	327	(18 - 380)	0,43
Bread and bakery goods (kcal)	157	168	(64 - 250)	445	315	(270 - 619)	<0.01

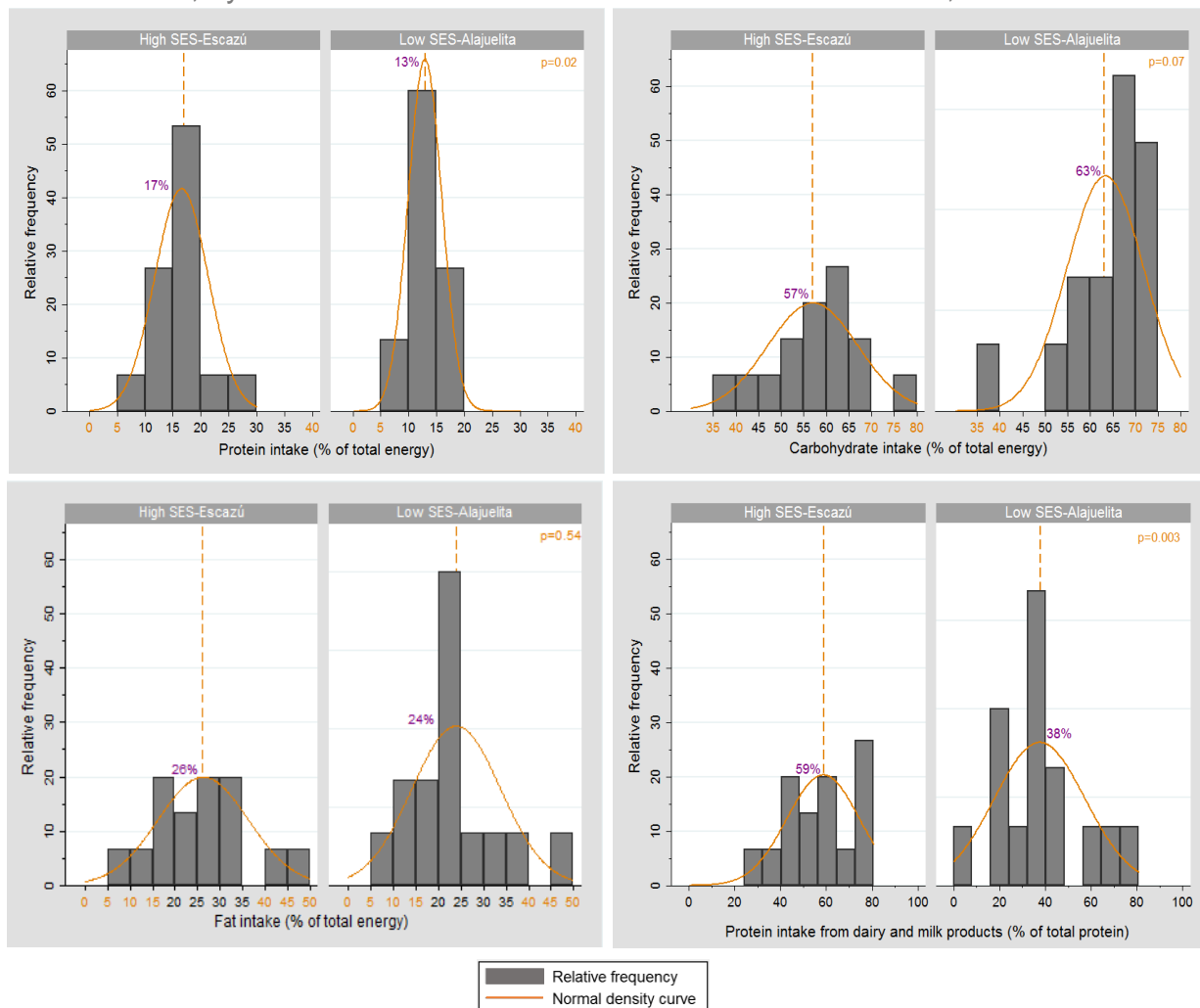
SD: Standard Deviation      95% CI: 95% Confidence Interval  
p-value based on two-tailed Student's t-test

Protein intake from animal source foods was significantly greater in women from the high-SES canton in both absolute terms (g) (38 SD=22 vs. 21 SD=11,  $p = 0.02$ ) and as a proportion of total protein intake (59% SD=16 vs. 38 SD=20,  $p = 0.003$ ). Intake of bread and bakery goods was significantly lower in women from the high-SES canton of Escazú (157 kcal SD=168 vs. 445 SD= 315,  $p = 0.004$ ). Intake of sugar-sweetened beverages did not vary by canton.

Figure 1 shows the relative distribution for intake of each macronutrient as a proportion of total energy intake. As a proportion of total energy intake, protein intake was significantly greater in the high-SES canton of Escazú, but carbohydrate and fat intake did not vary by canton.

**Figure 1**

Relative distribution of protein, carbohydrate, fat intake as a proportion of total energy intake; and protein intake from dairy and meat products as a proportion of total protein intake, by canton of residence. Urban women from San José, Costa Rica



Mean intake (%) indicated in purple.

Horizontal axes: values outside the recommended ranges for intake are shown in orange.

Mean values for dietary intake are close to their corresponding median values. The mean macronutrient intake for each canton fell within the recommended Dietary Reference Intakes (DRI) ranges for protein (10 to 35%), fat (20 to 35%) and carbohydrate (45 to 65%) established by the Institute of Medicine for non-pregnant, non-lactating women (2005). Values outside the recommended ranges for intake are shown in orange in the horizontal axes of Figure 1. One out of 15 women in the high-SES canton versus two out of 15 women in the low-SES canton failed to meet the minimum requirement for protein intake as a proportion of total energy intake. Three out of 15 women in the high-SES canton versus nine out of 15 women in the low-SES canton exceeded the recommended range for carbohydrate intake.





## 4. Discussion

This study (1) evaluated perceptions of food availability and (2) described dietary intake in women from low- and high-SES cantons. Additionally, this paper described the feasibility of measuring dietary intake in the study population. Women from both low- and high-SES cantons openly shared information about their dietary intake and were able to report brand names, recipes, and portion sizes in the amount of detail required to estimate intake of energy and macronutrients. Future studies measuring dietary intake with dietary recalls should alert potential subjects to the institutional affiliations of the researchers to increase subjects' comfort level.

In order to improve the accuracy of the dietary data, researchers using dietary recalls should also: (1) conduct dietary recalls in subjects' homes when possible so subjects can refer to their own food labels or serving utensils, (2) include subjects' household members while collecting dietary data, (3) provide locally relevant measuring tools or photos of different food portions for subjects to reference during data collection and, (4) clarify that the purpose of the visit is research and not health promotion to limit the possibility that subjects will underreport foods they perceive to be unhealthy. Given that 20% of women said their reported intake did not reflect their usual diet, future studies that aim to identify habitual dietary intake should collect multiple dietary recalls from each subject.

A recent study in urban Colombia evaluated dietary intake using a dietary recall among low-SES women of reproductive age (Dufour et al., 2015). Among low-SES women in Colombia and women from a low-SES canton in Costa Rica, mean intake was strikingly similar for carbohydrate (314 g vs. 312), with Colombian women consuming slightly less energy (1,905 kcals vs. 2,007), protein (53 g vs. 61), and fat (49 g vs. 58). A study by Kabagambe et al. which evaluated dietary intake using 24-hour recalls in older Costa Rican adults in the 1990s documented slightly higher energy (1,872 kcals vs. 1,779) and fat intake (59 g vs. 51), but similar carbohydrate (275 g vs. 267) and protein (65 g vs. 62) intake compared to the full sample of women in the current study (Kabagambe et al., 2001).

Using canton of residence as a proxy for SES, several findings from our study suggest that protein intake may be limited among low-SES women. Mean protein intake as a proportion of total energy intake among low-SES women was at the bottom end of the range recommended by the Institute of Medicine (2005). Additionally, protein intake as a proportion of total energy intake was lower in low- versus high-SES women. This variation in protein intake by SES may be due to lower intake of dairy and meat products in low-SES women. The observed differences in dairy and meat intake by SES are unlikely due to differences in food preferences, as low-SES women reported in the structured interviews that they would include more animal source foods in their diet if cost were not a barrier. The observed variation in protein intake is more



likely due to the relatively high cost of dietary protein, and specifically animal meats, compared to dietary carbohydrate and fat.

Protein quality, a measure of a protein's amino acid composition and digestibility, is greater in dairy and meat products than plant-based foods (Boye et al., 2012; Tome, 2012; Hoffman and Falvo, 2004). Consequently, greater intake of dairy and meat products in the high-SES canton may contribute to a diet with greater protein quality. However, traditional dietary practices in Costa Rica pair plant-based foods together that contain complementary proteins, such as beans and rice. In this case, beans are high in the amino acid lysine and low in the amino acid methionine (Young et al., 1994), while the reverse is true for rice (Shekib et al., 1986). The protein quality of complementary proteins is greater than either food alone (Woolf et al., 2011). Since no women in this study reported limited access to beans or rice, the protein quality of the diet will not necessarily vary by canton even though intake of dairy and meat products varied by canton in this study.

The findings from this study raise questions about whether limited access to some dietary proteins is connected to greater consumption of dietary carbohydrate. We found greater carbohydrate intake and intake of bread and bakery goods among women from the low-SES canton. We also found that carbohydrate intake as a proportion of total energy exceeded the DRI recommended range for more than half of women from the low-SES canton. We speculate that when access to dietary protein is limited, women may replace expensive protein rich foods with more affordable carbohydrates.

According to the Food and Agriculture Organization, between 1992 and 2011 the availability of dairy products, chicken, pork, fish and crustaceans increased at the national level in Costa Rica (Food and Agriculture Organization, 2015). Our finding that women from a low-SES canton perceive decreases in the availability of animal source foods over time is inconsistent with national trends. This could draw into question the value of relying on national trends as a proxy for the experience of individuals. Our study suggests that measuring at the individual level is particularly important when determining the availability of relatively expensive foods among low-SES populations.

The current pilot study had several limitations. First, we used a non-random sample so the results are not generalizable to the wider population of urban Costa Rican women. Second, we conducted only one dietary recall per woman and dietary intake on the day she reported may not represent her usual intake. Third, recall bias and intentional under- or over-reporting of food intake, which are common limitations of dietary recalls, may have influenced the accuracy of the data. Fourth, although our small sample size was sufficient for a pilot study, the study was not designed to test hypotheses about variation in dietary intake by SES. Finally, canton of residence is a crude measure of SES and canton of residence may not reflect actual socioeconomic conditions.

Future studies that aim to provide a more representative picture of variation in food availability and dietary intake by SES should use a random sampling strategy, multiple



dietary recalls per woman, and a precise measure of SES that includes multiple social and economic dimensions. Given the trend towards greater energy intake in women from a low-SES canton observed in this study and the larger body size of low- versus high-SES women documented in other countries, future studies should evaluate variation in energy intake and body size by SES using a larger sample. Future studies in Latin America should explore if and how the availability and intake of dietary protein among low-SES women may be related to rising body size among this population.



## 5. Conclusion

Our results from this pilot study in San José, Costa Rica show that among a group of Costa Rican women of reproductive age, food availability and dietary intake may vary by SES. Protein intake was greater in women from a high-SES canton and this appears to be influenced primarily by the affordability of animal source foods. Trends in food availability at the national level are useful for generating hypotheses about trends in dietary intake, but are too distal from an individuals' dietary intake to be a valid proxy for what people eat. Future studies should evaluate variation in body size and dietary intake by SES in a larger sample, with careful consideration of the importance of dietary protein.



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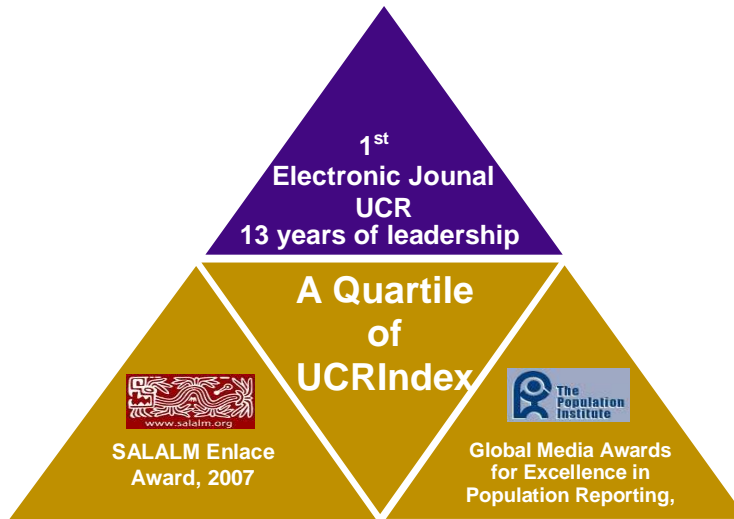


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