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Dietary Diversity, Food Security, and Body Image among Women and Children on San Cristobal Island, Galapagos

Megan F. Pera[1] · Beth N. H. Katz[1] · Margaret E. Bentley[2,3]

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Abstract
Objectives: We conducted a study of the food environment and nutritional status among women and children living on a Galapagos Island. Anthropometric and body silhouette data give insight into body size perceptions for women and their young children. We frame our findings in the context of the nutrition transition. *Methods*: A convenience sample was recruited via word-of-mouth for in-depth interviews and assessments of household food security, dietary intake, anthropometrics, and body image. Interviews took place in 2011 on San Cristobal Island, one of four inhabited islands in the Galapagos archipelago. Twenty women with children between the ages of one and six participated, all permanent residents of San Cristobal Island. *Results*: Most women (60%) reported limited availability of fresh produce due to an unreliable food supply shipped from mainland Ecuador. Despite reported food insecurity in our sample (55%), more than half of the children (55%) experienced high dietary diversity measured by 24 h recall. Women tended to report less dietary diversity than their children, which may be linked to a stated desire to be thinner. Eighty percent of children were classified as normal weight, while 75% of women were overweight or obese. *Conclusions for Practice*: Results provide an initial survey of the food landscape on one Galapagos Island. By combining qualitative interviews with indicators of nutritional status, the narrative data allow an interpretation of issues of food security, dietary intakes, dietary diversity, and body size. This study forms the basis for a larger examination of these issues in the Galapagos islands.

Keywords Dietary diversity · Nutrition transition · Food security · Body size silhouettes · Mother–child dyad

Significance

The Galapagos Islands are known for research on evolution, ecology, and the natural environment. Human life and the experience of permanent residents on the islands is limited in the literature. This article seeks to provide a brief study of the food environment, diets, and body images of women and young children who live on one Galapagos Island. Findings are placed in the context of the global nutrition transition, adding to the body of research describing shifting dietary habits worldwide related to a globalizing food system (Freire et al. 2014; 2018a, b; Page et al. 2013). The nutrition transition is characterized by a shift from traditional diets high in fiber and complex carbohydrates to diets high in fats, sweeteners, and processed foods (Popkin 2002). Shifting dietary patterns yield a shift in disease burden, with increasing rates of overweight, obesity, and noncommunicable disease.

Objectives

We examine the food environment on San Cristobal Island and describe indicators of nutritional status for women and children. Problems associated with food access shed light on barriers to food security on the island, the diets of women and children are described, and anthropometric data are evaluated. Body silhouette data provide insight into body

✉ Margaret E. Bentley
pbentley@unc.edu

[1] Department of Nutrition, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

[2] Department of Nutrition, Gillings School of Global Public Health & Institute for Global Health & Infectious Diseases, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

[3] UNC Gillings School of Global Public Health Campus, 130 Rosenau Hall, Campus Box 7400, Chapel Hill, NC 27599-7400, USA

size perceptions and ideals for women and young children, which may influence food consumption.

Study Setting

The study setting is San Cristobal, one of four inhabited islands with approximately 5400 permanent residents at the time of the study. Most Galapagos residents emigrated from mainland Ecuador, many seeking economic opportunity in the tourism industry (Epler 2007; Taylor et al. 2006). Our work primarily took place in Puerto Baquerizo Moreno, the capital of the Galapagos Province. We also traveled into the highlands, speaking with residents of El Progreso and other small communities.

Methods

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving human subjects were approved by the institutional review boards of the University of North Carolina at Chapel Hill and the Universidad San Francisco de Quito. Prior to inclusion in the study, participants were given a description of the study and its purpose, were invited to ask any questions, and then provided their informed consent. None of the women who agreed to meet with the researcher decided not to participate during the consent process or later. Field notes were recorded by the researcher after each interview. The research team believes that saturation was reached for the primary research questions. To the extent possible for this study, the research team followed the COREQ criteria for reporting qualitative research (Tong et al. 2007).

Semi-structured in-depth interviews (IDIs) were conducted during May–June 2011 with a convenience sample of twenty women living on San Cristobal with children aged 20 months to 6 years. Interviewees were recruited by word of mouth. Interviews were conducted in Spanish by a trained American doctoral student (B.N.H.K.), and respondents chose whether the interview took place in their homes, places of business, or elsewhere. Spouses, other family members, children, or friends were sometimes present during the interviews according to the participants' preferences. Interviews took approximately 45 min to complete, and respondents were compensated US$10 for their time. The interviews were audio recorded and later transcribed and translated into English by a third party.

Single non-quantified 24 h dietary recalls, anthropometric data, and body satisfaction data were collected, and food security status was assessed during the IDIs. Interview questions asked about life on the island, maternal and child body perceptions, and food-related behaviors. IDIs were analyzed using a content analysis framework. A trained research assistant (M.F.P.) coded the interviews, followed by spot-checking from (B.N.H.K.). The research team developed the codebook using topics from the interview guide and themes that emerged in the data. Dedoose qualitative analysis software was used for data management and analysis (Dedoose, 2018). Quantitative analyses were limited to descriptive statistics due to the small sample size. The research team has not had the opportunity to share results back with participants for feedback on our findings.

Food Security Questionnaire

Food security is commonly defined as the condition in which all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active lifestyle (Coleman-Jensen et al. 2013). The Spanish version of the validated USDA Household Food Security questionnaire was administered to each woman and scored according to USDA guidelines (Bickel et al. 2000). Food secure households report experiencing little to no trouble obtaining food throughout the past year, while food insecure households report experiencing reduced quality, variety, or desirability of the diet, resulting in disrupted eating patterns.

24 h Dietary Recalls

Dietary recalls were collected for each woman and child. Dietary diversity (DD) was assessed using the Food and Agriculture Organization of the United Nations (FAO) scoring guidelines. This methodology includes thirteen food groups: cereals; vitamin A-rich vegetables and tubers; white tubers; dark leafy green vegetables; other vegetables; vitamin A-rich fruits; other fruits; organ meat; flesh meat; eggs; fish; legumes, nuts, and seeds; and milk and milk products. A DD score is the total number of food groups represented in an individual's diet. The FAO defines low DD as <3 food groups consumed, medium DD as 4–5 food groups, and high DD as >6 food groups. Using these categories, DD is an effective tool for approximating dietary quality and child nutritional status in the absence of quantitative data (Arimond and Ruel 2004; Daniels 2006; Kant 1996). Like the FAO, we used a 24 h reference period because it is easier for the participant and less prone to recall error (FAO, 2008). Our study scope did not allow for repeated visits to each participant for multiple 24 h dietary recall collection.

Anthropometric Data

Height and weight were collected using a bodyweight scale and measuring tape. BMI was calculated as: BMI = weight (kg)/height $(m)^2$. For women, BMI <18.5 kg/m^2 is classified as underweight, 18.5–24.9 kg/m^2 normal, 25.0-29.9 kg/m^2 overweight, and ≥ 30.00 kg/m^2 obese, per

World Health Organization (WHO) adult guidelines. For children, age-specific BMI *Z*-scores and growth charts from the WHO were used to assess underweight (BMI < 5th percentile), normal weight (5th–85th), overweight (85th–95th), and obesity (> 95th); stunting (height-for-age *Z*-score > 2 standard deviations below the mean); and wasting (weight-for-age *Z*-score > 2 standards deviations below the mean). WHO Anthro software was used to assess percentiles and Z-scores (WHO Anthro, 2011).

Body Satisfaction

Female body silhouettes were used to assess body satisfaction for all participants (Williamson et al. 1993). Women were also asked to evaluate their child using the Toddler Silhouette scale (Hager et al. 2010). Body dysphoria (BD), the difference between perceived self and desired self, was assessed. A BD score of zero indicates satisfaction with current body image (Katz et al. 2004). A positive score indicates a desire for weight loss, and a negative score indicates a desire for weight gain.

Table 1 Sample demographics

Demographic Variable[1]	Sample ($n = 20$)
Participant age, median (IQR)	30 (23.5–36) years
Participant BMI, median (IQR)	26.5 (24.8–29.2) kg/m^2
Child sex	
Male	10 (50%)
Female	10 (50%)
Child age, median (IQR)	3.5 (3–4.5) years
Child BMI percentile, median (IQR)	65 (37.25–75) kg/m^2
Percentile range	13–97
Wasted Children, *n*	0
Stunted Children, *n* (%)	1 (5%)

[1]"Participant" refers to woman interviewed, and "child" refers to index child of woman interviewed

Results

Demographic data for our sample are summarized in Table 1. Due to the small sample, results are presented as medians and interquartile ranges.

Food Security

Food insecurity was prevalent in the study sample (Fig. 1).

Limited availability of acceptable produce was cited as a problem on the island by 60% of women. The participant with the highest monthly household income (≥ 4000 USD) was classified as having "marginal" food security due to an affirmative response to one question ("(I/we) couldn't afford to eat balanced meals." Was that often, sometimes, or never true for (you/your household) in the last 12 months?). She indicated that this statement was sometimes true, not due to lack of financial resources, but because food can be limited on the island:

"Well, it's not because we don't have enough for us specifically, it's just that sometimes there is not enough on Galapagos. So sometimes, yes, there was a time when all the food on the barges went bad, so there were no fruits and there were no vegetables. […] When there are barges, there is enough of everything, but when there's not, it's bad." (38 years old, marginal food security).

Many participants echoed this frustration with the island's unreliable food supply, linking limited quantity and variety

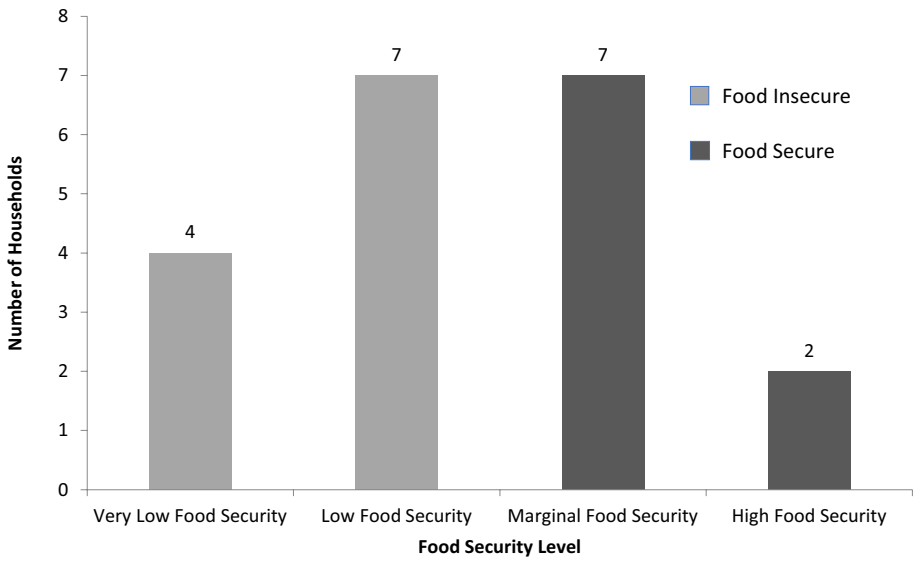

Fig. 1 Household food security distribution

to the fact that most fresh produce is shipped from mainland Ecuador:

"[…] sometimes on the boat, [the vegetables] don't reach here. They go to other islands, and then it gets here all rotten. Only a month ago, there was problem with a boat, and everything arrived rotten." (35 years old, marginal food security).

We asked participants if they felt that local gardens would be a positive and reliable supplement to the limited food produced locally. Many women responded favorably, some with the caveat that local foods are more expensive than food shipped from the mainland:

"Well, yeah, the problem with here is that here...well, the products from outside are cheaper than the products from here. Because the local stuff is more expensive. For example, if you buy broccoli grown here, it's more expensive than the stuff from outside. That is the problem. If the things from here were less expensive, it would be better. There is no control over that. From there I think if we all got together and agreed, we could eliminate the need for bringing things from outside if things were at a more reasonable price." (21 years old, low food security).

Another participant compared the potential quality of produce grown at home to the current produce supply. She stated:

"The thing is that there are people who prefer food from outside, but it doesn't come over with the same quality, the same freshness. For example, it takes a long time. Look at all the time it takes for the boat to come in from outside. Like 3 days, 3 days where they don't even refrigerate it. For example, for a sack of potatoes, about a fourth of the sack can come over rotten, and the rest comes over alright but not in the same state of freshness. But if you had a vegetable garden here where you could pick the products fresh, it would be better." (23 years old, low food security).

Dietary Diversity and Typical Dietary Intake

A wide range of DD was reported in our sample, summarized in Fig. 2. For children, DD scores ranged from 2 to 9, with a mean of 5.9 food groups/day. No trends were observed between child age and DD.

Women tended to think that their children were well fed and related this idea to their children's good health:

"She is a strong girl… she eats very well, eats very well. She eats everything that we give her." (39 years old, low food security, child BMI Z-score −0.6).

"[His health is] good, I think…. It's because of his nutrition and everything I give him. Lots of vegetables and fruit smoothies." (35 years old, marginal food security, child BMI Z-score −0.83).

Among children, the most commonly consumed foods included cereals (consumed by 100% of children), dairy products (90%), and soup (90%) (Table 2). Soup was typically homemade and included a variety of ingredients like animal protein (meat or fish), grains (noodles or rice), and vegetables. The majority of children (65%) consumed a snack, and 40% consumed fried foods. Soda and sweets were relatively uncommon; only 10% reported consuming soda, and 25% consumed a dessert.

Typical 24 h dietary recalls for children in our sample are represented by the following quotes:

"For breakfast, she had cereal and milk and fried plantains that she brings to school, and apple and chips and a bar of chocolate. For lunch, she had a vegetable cream soup with carrots and broccoli. She also ate rice and beans. At night she ate rice and a fried egg and juice." (3-year-old child, high food security).

"In the morning, she had milk and she had it with egg, and at midday she had some rice soup with vegetables. [And] apple, like always, and then more apple. [For dinner]

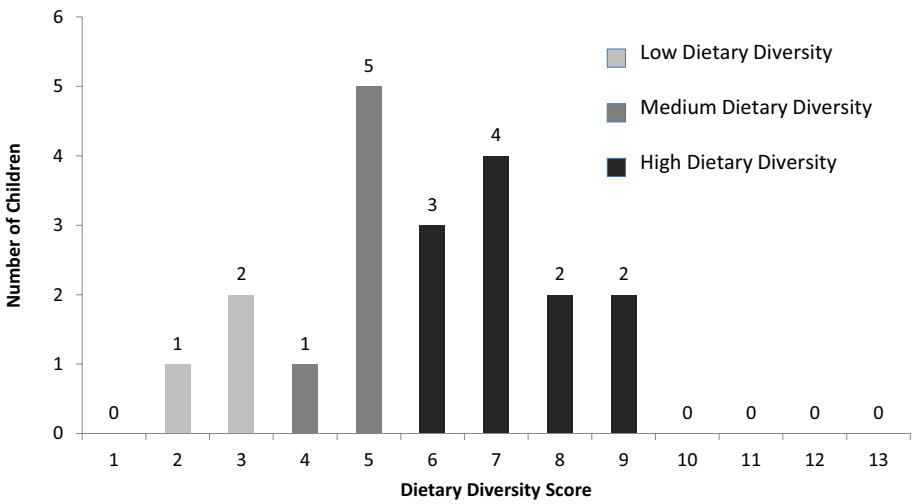

Fig. 2 Child dietary diversity score distribution

Table 2 Foods consumed by ≥ 50% of children in each dietary diversity category

Low Dietary Diversity (1–3), $n=3$	Medium Dietary Diversity (4–5), $n=6$	High Dietary Diversity (6+), $n=11$
Cereals	Cereals	Cereals
Other vegetables	Other vegetables	Other vegetables
	Meat	Meat
	Milk and milk products	Milk and milk products
	Eggs	Eggs
	Other fruits	Other fruits
		Vitamin A-rich fruits
		Legumes, nuts and seeds

she had milk and oatmeal and bread." (4-year-old child, low food security).

The mean DD score for women was 4.7, and only three women reported having more diverse diets than their children. Seven women (35%) reported consuming 3 fewer food groups per day than their children. Commonly consumed foods for women were similar to those for children, but the majority of women did not report eating eggs or fruit, and women reported consuming more meat and fish than their children.

Child DD was correlated with household food security status. On average, children in households with high food security consumed 3.5 more food groups per day than children in households with very low food security. Maternal DD, however, did not appear to be correlated with food security (Fig. 3).

Compared with the two households reporting high food security, the four households with very low food security reported simpler diets with fewer snacks and processed foods. Both children in the high food security households had snacks during the day (three each), but only 25% of children from the very low food security households consumed a snack. Low food security households consistently reported rice and soup, while the high food security households reported more processed foods like hot dogs and sausages (Table 3).

Body Weight and Body Satisfaction

In the study sample, 80% of the children were a healthy weight according to WHO standards. There were no underweight children, three children (15%) were overweight, and one child (5%) was obese. One child (5%) was stunted, and the remaining 95% of children were of normal height for age. There were no cases of wasting. None of the women were underweight, 25% fell into the normal BMI category, 55% were overweight, and 20% were obese. Key participant characteristics, including BMI and desire for weight loss, are presented in Table 4.

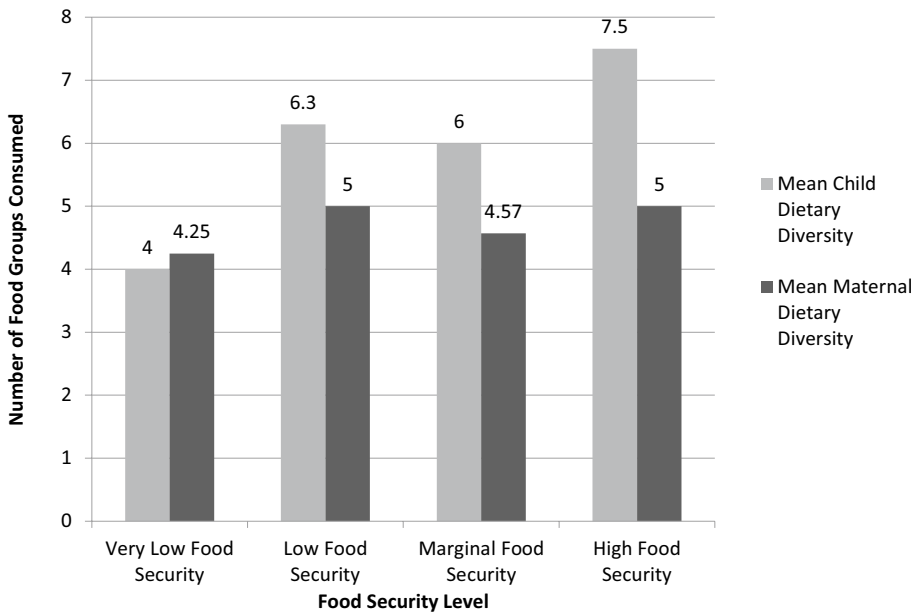

Fig. 3 Mean dietary diversity by food security level

Table 3 Comparing dietary patterns of households with 'high' and 'very low' food security

Dietary Pattern	High Food Security, n = 2	Very Low Food Security, n = 4
Commonly reported foods	Hot dogs, sausages, cake	Rice, soup
Processed foods	75%	33%
Soup	25%	100%
Child snacks	100%	25%

The mean BD score for children according to their mothers was −0.35, indicating that on average, women wanted their children to be larger than they were. One participant said:

"I wish he was a little thicker. I mean, the doctor just weighed him… He told me that it's better that they be skinny rather than fat. Because they say that being fat can come from an irritated belly and high sugar levels, but on the other hand, I think he needs to gain a little weight." (35 years old, marginal food security).

Only 25% of women indicated that they would like their children to be thinner on the body silhouette scale; however, although women generally wanted larger children, some women understood that chubbiness is not synonymous with health:

"Fatness is not necessarily an indicator of health because now, just because they are filled out doesn't mean that they are healthy. Sometimes we are a little fat, but we are sick." (21 years old, low food security).

"…if she has more of a belly, it means she is bigger. If she eats too much, she starts to get a belly. She should be eating healthier." (23 years old, low food security).

The average maternal BD score was 0.6, indicating a desire to be thinner. More than half of the respondents (n = 12) had a positive BD score. Two women, both from "very low food security" households, reported wanting to gain weight. One stated:

Table 4 Key participant characteristics[1]

Age	BMI	Desire for weight loss (Y/N)	Food security status	Educational attainment	Employment status	Marital status	Household monthly income (# people in household)
27	21.6	No (trying to gain weight)	Very low	Primary	Full time	Married	≤2,499 USD (4)
30	22.3	No (trying to gain weight)	Very low	Primary	Full time	Civil union	≤2,499 USD (5)
20	29.6	Yes	Very low	Primary	Not employed	Married	≤2,499 USD (4)
31	30.2	Yes	Very low	Primary	Not employed	Married	≤2,499 USD (5)
39	23.1	Yes	Low	Secondary	Full time	Married	≤2,499 USD (4)
26	25.3	No	Low	Primary	Full time	Married	≤2,499 USD (4)
23	25.4	Yes	Low	Primary	Full time	Married	≤2,499 USD (4)
34	25.9	Yes	Low	Some university	Full time	Separated	≤2,499 USD (3)
24	27.1	No	Low	Secondary	Full time	Married	≤2,499 USD (3)
38	31.0	Yes	Low	University	Full time	Married	≤2,499 USD (5)
21	32.0	Yes	Low	Primary	Not employed	Married	≤2,499 USD (5)
22	22.3	No	Marginal	Primary	Full time	Sngle, never married	≤2,499 USD (2)
26	23.3	No	Marginal	University	Full time	Married	≤2,499 USD (3)
21	25.5	Yes	Marginal	Secondary	Full time	Separated	≤2,499 USD (2)
37	25.5	Yes	Marginal	Primary	Full time	Married	2,500–3,999 USD (3)
35	28.2	Yes	Marginal	Primary, 2-year degree	Full time	Civil union	≤2,499 USD (4)
28	29.0	Yes	Marginal	Secondary	Full time	Cvil union	≤2,499 USD (5)
38	29.0	Yes	Marginal	Secondary	Full time	Civil union	≥4,000 USD (4)
32	27.7	Yes	High	University, enrolled in graduate program	Full time	Married	2,500–3,999 USD (3)
44	34.2	Yes	High	Some university, currently enrolled	Full time	Married	2,500–3,999 USD (4)

[1]Participants are grouped by food security status and sorted by BMI

"I think I want to gain some weight to look better." (30 years old, very low food security).

Respondents who wanted to lose weight often referred to themselves as "plump" or "fat." The desire to lose weight was prevalent across food security levels. When asked if they would like to gain, lose, or maintain their current weight, women in our sample often responded with statements like the following:

"I would like to lose some weight because I feel fat this way." (31 years old, very low food security).

"I have eaten less to lose weight… not because of money." (35 years old, marginal food security).

Conclusions for Practice

In our sample of 20 women with young children, we observed high rates of food insecurity on San Cristobal Island, as measured by the USDA food security questionnaire. This finding is consistent with observations elsewhere in Latin America (Bernal et al. 2016; Hernández et al. 2011; Bernal and Lorenzana 2007; Isanaka et al. 2007). Food security is a measure of food access, which reflects both the economic situation of the household and physical access to food on the island (Coleman-Jensen et al. 2013). As was observed on Isabela Island, food availability and access are prevalent problems (Page et al. 2013). Women reported not always having access to the types and variety of food that they desired because the barges do not reliably ship acceptable produce to the island. The high level of food insecurity was not only due to a lack of financial resources; rather, living on the island may have yielded a baseline level of food insecurity due to dependence on barges, which was particularly the case for access to micronutrient-rich, perishable fruits and vegetables.

While most food is shipped in, there is some agricultural production on San Cristobal, primarily in the highlands. Many participants indicated a preference for food grown on the island because of freshness and the organic growing practices encouraged by limitations on pesticide use (Rousseaud et al. 2017; O'Connor and d'Ozouville 2015). However, locally grown food is more expensive than food shipped from the mainland and is often used for personal consumption rather than sold for income. In our sample, access to farmland was more common in higher-income households with multiple working adults. This additional food source may insulate wealthier families from some of the uncertainty of the shipped food supply, thereby yielding greater food security in an otherwise insecure food system. Wealthier residents can also more easily afford to purchase locally grown foods when shipped foods are scarce. Of the two participants with high food security in our study, one had a farm in her family and the other reported purchasing food from farms and farm restaurants in the highlands.

Overall child DD on San Cristobal Island was high. Even children living in households with low food security reported diverse diets, and children experiencing very low food security consumed diets classified as "medium" DD. These results should be interpreted with some caution, as our small sample size may not be representative of the broader Galapagos population, and there is potential for social desirability bias in maternal reporting of child dietary intake. Still, basic indicators of nutritional status were positive: the majority of children were at a healthy weight, and only one case of stunting was observed in this population. Mainland Ecuador, in contrast, has a prevalence of stunting in children < 5 years of 29% (WHO, n.d.). The case of stunting in our sample was a child from a "very low food security" household. Micronutrient deficiencies may be present and contributing to stunting, along with diarrheal disease morbidity from contaminated water (Gerhard et al. 2017). As in the present study, women on Isabela Island reported a high level of food scarcity, but they also reported feeling that they and their children were able to get adequate nutrition from the food that was available (Page et al. 2013).

Maternal DD was consistently lower than their children's. Other studies have found that in food insecure households, adults will consume lower-quality diets so their children can maintain high-quality diets (Hanson et al. 2007; Olson 2005). Many women in our sample, however, indicated a desire for weight loss, which may provide an alternative explanation for this finding. We do not have quantitative dietary intake data and cannot measure total energy intake.

Though women on San Cristobal and Isabela tended to desire thinner figures for themselves, they wanted their children to be larger (Page et al. 2013; Waldrop et al. 2016). This finding may reflect shifting cultural ideals along with a shifting dietary pattern. Women want their bodies to look thin, in line with the current Western ideal, but they still want their children to be "chubby," a traditional indicator of health. Households with higher food security and socioeconomic status reported consuming processed foods, which may indicate a shift away from traditional eating patterns and evidence of the nutrition transition.

There are limitations to the present study. Our small sample of 20 women has provided initial insight into the food landscape and nutrition-related behaviors on one Galapagos Island, but results may not be representative of the population. We described trends in food security status, DD, and BMI, but our sample size does not allow for statistical testing for significance. The interviews strengthened our ability to interpret the context of our data. Non-quantified 24 h dietary recall and DD scoring are imperfect methods for assessing diet quality, and one dietary intake assessment may not capture usual intake. However, this limitation does

not jeopardize the study's ability to describe the general dietary patterns of our sample. Using DD scores to assess diet quality from a 24 h recall has potential biases. An individual may not eat very many food groups on the day in question, but they may consume a greater variety of foods over the period of three days or a week. However, DD scores were averaged and used as a basis for comparison between food security levels, and the potential errors in DD are therefore of less concern. Strengths of this study include the mixed-methods analysis and in-depth interviews, which provided context for the quantitative data.

We have provided initial insight into the food landscape and nutrition-related behaviors on San Cristobal Island. Findings indicate that future research into the health, nutrition, and wellbeing of permanent residents on this island is warranted, and larger samples should be recruited to confirm the patterns observed in this investigation.

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Author Contributions B.N.H.K. and M.E.B. formulated the research questions and designed the study. B.N.H.K. carried out the study. B.N.H.K. and M.F.P. analyzed the data and wrote the article. All authors contributed to finalizing the manuscript and have approved its content.

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Compliance with Ethical Standards

Conflict of interest None.

Ethical Approval This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the institutional review boards of the University of North Carolina at Chapel Hill and the Universidad San Francisco de Quito. Written informed consent was obtained from all subjects.

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