

# *Lime for Chest Congestion, Bitter Orange for Diabetes: Foods as Medicines in the Dominican Community in New York City*

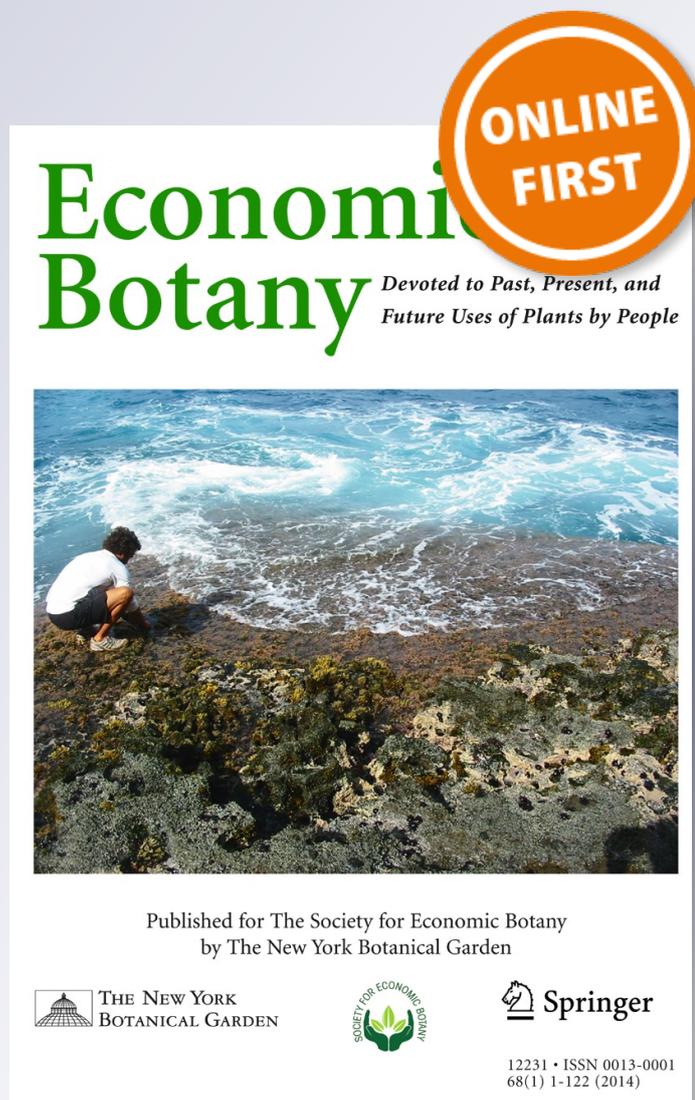
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# Lime for Chest Congestion, Bitter Orange for Diabetes: Foods as Medicines in the Dominican Community in New York City<sup>1</sup>

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Lime for Chest Congestion, Bitter Orange for Diabetes: Foods as Medicines in the Dominican Community in New York City. Several plants serve a dual purpose as foods and medicines in the Dominican immigrant community in New York City. Data show that foods used for self-medication by this community are plants that are well known and readily available in an urban environment, such as lime, bitter orange, garlic, cinnamon, onion and shallot, coconut, watercress, ginger, soursop, and radish. These plants are significant for Dominicans in New York City for treatment of non-communicable diseases, colloquially called "lifestyle diseases" (such as diabetes, obesity, high cholesterol, hypertension, and asthma/chest congestion), self-limiting diseases (including common cold, flu, cough, acute bronchitis), and female reproductive health (such as vaginal infections and infertility). Our findings emphasize the contemporary role of traditional medicine as an alternative and parallel healthcare system that dynamically adapts to current urban epidemiological trends. The double use of foods as medicines has important implications for urban outreach projects, such as Green Carts and community gardens, that play a role in disease prevention of vulnerable populations, especially those living in areas identified as food deserts.

El Limón para Pecho Apretado, la Naranja Agria para Diabetes: Plantas Alimenticias como medicinas en la Comunidad Dominicana en Nueva York. Varias plantas tienen un doble propósito como alimentos y medicinas en la Comunidad inmigrante Dominicana en la ciudad de Nueva York. Los datos demuestran que estas plantas Alimenticias utilizadas para automedicarse por esta Comunidad son plantas que son bien conocidas y fácilmente disponibles en el entorno urbano, como Limón, Naranja Agria, ajo, canela, cebolla y cebollín, coco, berro, jengibre, guanábana y rábano. Estas plantas son importantes para la Comunidad Dominicana en Nueva York para el tratamiento de las enfermedades no transmisibles, coloquialmente llamadas "enfermedades de estilo de vida" (como Diabetes, sobrepeso, colesterol alto, hipertensión y asma/Pecho Apretado), enfermedades auto-limitadas (incluyendo resfriado, gripe, tos, bronquitis aguda) y la salud reproductiva de la mujer (como infecciones vaginales e infertilidad). Estos resultados enfatizan el papel contemporáneo de la medicina tradicional como un sistema alternativo y paralelo de salud que se adapta dinámicamente a las tendencias actuales de la epidemiología urbana. El doble uso de las plantas Alimenticias como medicinas tiene implicaciones importantes para proyectos de extensión urbana, tales como los Carritos Verdes ("Green Carts") y los jardines comunitarios, que desempeñan un papel en la prevención de las enfermedades en poblaciones vulnerables, especialmente las comunidades que viven en áreas identificadas como desiertos alimentarios ("food deserts").

**Key Words:** Traditional medicine, urban ethnobotany, migrants, non-communicable diseases, self-limiting diseases, female reproductive health, food deserts, Green Carts, community gardens, *botánicas*, medical education, cultural competency training, Dominican Republic.

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## Introduction

“Let food be thy medicine and medicine be thy food”

—A phrase of unconfirmed origin that expresses the medical philosophy of Hippocratic medicine.

Ethnobotanical studies around the world have documented the link between plants used as foods and medicines in various cultures (Cavender 2006; Ceuterick et al. 2011; Cruz-García and Price 2011; Etkin and Ross 1982, 1991; Pieroni 2000; Pieroni et al. 2002, 2007; Pieroni and Price 2006, and papers in that volume; Rivera et al. 2005; Volpato and Godínez 2004). Anthropologist Dr. Nina Etkin dedicated much of her career to understanding how plants are concomitantly used as foods and medicines. She observed that scholars who investigate medicinal plants often forget to mention whether these plants also have dietary roles, and vice versa. Dr. Etkin also advocated biological screening of the extra-nutritive aspects of foods (Etkin and Ross 1991). In our ethnobotanical research with the Dominican community in New York City (NYC), we found a positive effect of migration on knowledge of food plants used as medicines (Vandebroek and Balick 2012). We defined these plants as food medicines. Their primary uses are culinary and their secondary uses are therapeutic, in contrast to plants that are exclusively used as medicines. Following this definition, some species, such as lemongrass (*limoncillo*, *Cymbopogon citratus* [DC.] Stapf), were excluded as food medicines in our study because, although their culinary use is popular in several cultures, they are not popular Dominican food plants. For some species, such as Mexican mint (*orégano poleo*, *Plectranthus amboinicus* [Lour.] Spreng.), basil (*albahaca*, *Ocimum basilicum* L.), or spearmint (*hierba buena*, *Mentha spicata* L.), this distinction may not be all that clear cut, and it is possible that some Dominican immigrants have recently begun using these species as condiments in addition to their well-known therapeutic uses. However, since their use in Dominican cuisine is not widespread and their medicinal uses clearly predate more recent food applications, these species were not classified as food medicines in Vandebroek and Balick (2012), nor in this study.

In the present paper, we provide a more in-depth characterization of these food medicines in the transnational Dominican community and attempt to answer the following questions: (1) Which plants are the most popular food medicines for Dominicans living in NYC as compared to the Dominican Republic?; (2) How are they used?; (3) Which health conditions do they treat?; (4) Where are they obtained?; and (5) How does migration influence their use?

## Methods

Institutional Review Board (IRB) approval for this study was granted by the City University of New York (IRB# 04–06–0599; PI Michael J. Balick). Interviewers received Human Subjects Certification prior to interviewing. We interviewed 165 Dominicans in NYC who were born in the Dominican Republic (105 women and 60 men), and 128 Dominicans currently living in the Dominican Republic (79 women and 49 men). These individuals were lay persons who use medicinal plants for self-care but who do not identify themselves as plant specialists or traditional healers, or are not identified as such by others. Participants were recruited through subjective sampling. This non-random sampling technique includes convenience sampling (people who are available at certain locations and willing to be interviewed), and snowball sampling (prospective participants are recommended by others) (Tongco 2007). Inclusion criteria were: age 18 or older, born in the Dominican Republic, and self-reported knowledge of some medicinal plants. Further details about the study design can be found in Vandebroek and Balick (2012).

The questionnaire comprised 84 questions in NYC and 53 in the Dominican Republic. Verbal informed consent was obtained from each participant prior to interviewing. The interview took place between a participant and an interviewer at the place where the participant was recruited, at the participant's home, or in rare cases at The New York Botanical Garden's Institute of Economic Botany. To guarantee anonymity, an ID number was assigned to each interview and no personal identifying details were recorded. Questions were asked in Spanish by the interviewer who recorded the answers on the questionnaire. The interview was also tape recorded if the participant granted consent. From a list of 29 conditions, for each condition the interviewer asked: “Do you know medicinal plants, leaves, or

home remedies to treat this condition?” (In Spanish: “¿Conoce Ud. plantas medicinales, hojas o remedios caseros para tratar esa enfermedad?”). If this was the case, the Spanish local name(s) of the plant, plant part used, preparation, and mode of administration were recorded. A final question gauged whether participants knew of plants other than the ones they had mentioned previously to guarantee comprehensiveness of data collection.

New York City participants were asked the following two questions related to plant procurement: “When you lived in the Dominican Republic, where did you obtain or buy medicinal plants?” (In Spanish: “¿Cuando Ud. vivía en la República Dominicana, ¿dónde conseguía o compraba plantas medicinales?”). Further along during the interview, in the section that belonged to the current living situation of the participant, we asked: “Since you have been living in NYC, where do you obtain or buy medicinal plants?” (In Spanish: “¿Desde que Ud. está viviendo en la Ciudad de Nueva York, ¿dónde consigue o compra plantas medicinales?”). After completion of the questionnaire, participants received a remuneration or gift.

Since these plants are well-known food plants, they were documented by means of photographs. When plant parts other than those used as food were sold, for example the leaves of soursop (see Table 1 for common and scientific plant names), or the bark of tamarind (*tamarindo*, *Tamarindus indica* L.), offered for sale in *botánica* shops (Reeser and Cintrón-Moscoso 2012; Viladrich 2006), then a sample was purchased, curated, deposited at the herbarium of The New York Botanical Garden, uploaded to the C.V. Starr Virtual Herbarium, and made freely available for consultation on the web at <http://sciweb.nybg.org/science2/hcol/ethno/index.asp.html>. Plant and author names were verified with the International Plant Names Index ([www.ipni.org](http://www.ipni.org)). Family names followed the Angiosperm Phylogeny Group classification (APG III 2009).

Statistical tests were computed with Sigmatstat v2.01 (Jandel Scientific Software) and consisted of two-tailed Chi-squared ( $\chi^2$ ) and Z-tests for comparison of proportions, with Yates correction for continuity (which renders the tests more conservative; i.e., it increases the P-value and reduces the chance of a false positive conclusion). The data described and discussed here did not undergo Bonferroni correction. However, in the tables, P-values that remain significant after Bonferroni correction (based on the number of

individual statistical comparisons) are underlined for purposes of comparison without correction. Our aim was not to examine the null-hypothesis that there did not exist an overall relationship between the type of plant, health condition, and country; rather, it was to examine the specific relationship between individual health conditions or symptoms, and a plant's (or plant type's) frequency of mention in NYC and the Dominican Republic. It may be debatable if the “same hypothesis” is being analyzed repeatedly if one focuses on different plants and health conditions. Failing to use Bonferroni correction in the case of multiple comparisons of the same hypothesis inflates Type I error rates (the null hypothesis is rejected while it is true), whereas overzealous use of Bonferroni increases Type II error rates (the null hypothesis is accepted while it is false). It may be considered problematic that Bonferroni adjustments imply that a given comparison will be interpreted differently according to how many other tests were performed since re-grouping of data would reduce the number of tests and result in a smaller correction factor. Our approach was to forego Bonferroni correction and to look for logical patterns that emerged from the results of the analysis instead of blindly applying this correction.

## Results

### COMPARISON OF POPULAR FOOD MEDICINES BETWEEN NEW YORK CITY AND THE DOMINICAN REPUBLIC

Eight of the ten most frequently reported food plants used as medicines overlap between NYC and the Dominican Republic (Table 1). Of these plants, onion and shallot, watercress, and radish were reported more often in NYC than in the Dominican Republic. In contrast, lime, bitter orange, cinnamon, Spanish thyme, and guava were reported more frequently in the Dominican Republic. Finally, garlic, coconut, ginger, and soursop were reported equally between NYC and the Dominican Republic.

More plant parts were used as medicines than for culinary purposes. Different parts were used in varied modes of administration (Table 2). Dominicans in NYC and the Dominican Republic used food medicines in similar ways. It was not always the part ingested as a food that was used therapeutically; for example, leaves of

**Table 1.** RANKING OF FOOD PLANTS MENTIONED AS MEDICINES IN NEW YORK CITY AND THE DOMINICAN REPUBLIC\*.

Species Latin name, plant family, common names in English and Spanish	% NYC	% DR	Z-value	P-value
<i>Citrus aurantiifolia</i> (Christm.) Swingle (Rutaceae) English: lime; Spanish: <i>limón, l. verde, l. agrío</i>	8.8	10.5	2.23	0.026
<i>Allium cepa</i> L. (Amaryllidaceae) English: onion; Spanish: <i>cebolla, c. blanca, c. roja</i>	7.1	5.6	2.34	0.020
<i>Allium cepa</i> var. <i>aggregatum</i> G. Don (Amaryllidaceae) English: shallot; Spanish: <i>cebollín</i>				
<i>Citrus aurantium</i> L. (Rutaceae) English: bitter orange; Spanish: <i>naranja agria</i>	5.6	6.9	2.07	0.038
<i>Cinnamomum</i> spp.* (Lauraceae) English: cinnamon; Spanish: <i>canela</i>	4.9	6.6	2.84	<u>0.004</u>
<i>Allium sativum</i> L. (Amaryllidaceae) English: garlic; Spanish: <i>ajo</i>	4.2	3.5	1.35	Ns
<i>Cocos nucifera</i> L. (Arecaceae) English: coconut; Spanish: <i>coco, c. indio</i>	4.0	4.4	0.72	Ns
<i>Nasturtium officinale</i> W.T. Aiton (Brassicaceae) English: watercress; Spanish: <i>berro</i>	3.2	1.4	4.47	<u>&lt;0.001</u>
<i>Zingiber officinale</i> Roscoe (Zingiberaceae) English: ginger; Spanish: <i>jengibre, j. dulce, j. Caribe, j. blanco, j. picante</i>	2.9	2.2	1.64	Ns
<i>Raphanus sativus</i> L. (Brassicaceae) English: radish; Spanish: <i>rábano</i>	2.7	1.9	1.98	0.048
<i>Annona muricata</i> L. (Annonaceae) English: soursop, graviola; Spanish: <i>guanábana</i>	2.7	2.3	0.92	Ns
<i>Lippia micromera</i> Schauer (Verbenaceae) English: Spanish thyme; Spanish: <i>orégano, o. chiquito, o. de cocinar, o. de comer, o. fino, o. pequeño</i>	2.0	2.8	1.99	0.046
<i>Psidium guajava</i> L. (Myrtaceae) English: guava; Spanish: <i>guayaba</i>	0.8	2.1	4.33	<u>&lt;0.001</u>

\*Percentages represent the proportion of times each plant was mentioned in recipes during lay interviews (the total number of recipes reported by all interviewees in the Dominican Republic was 2,610 and in New York City 3,729). Latin binomials and author names were verified with IPNI, the International Plant Names Index. Family names correspond with the Angiosperm Phylogeny Classification (APG III 2009). Local Spanish names include all synonyms recorded during interviews.

P-values > 0.05 are not significant (Ns). P-values listed do not represent Bonferroni correction. With Bonferroni correction for 12 individual comparisons the critical P-value becomes 0.0042 and only the underlined P-values remain significant.

lime, bitter orange, guava, and soursop can be drunk as a tea, or applied. In some cases, the edible part is applied (such as the fruit of lime and bitter orange, the oil or milk of coconut). In other cases, the roots (for example, of coconut) are combined with other woody parts from various species and non-plant ingredients in a popular Dominican mixture, called *botella* (Vandebroek et al. 2010).

#### CONTRIBUTION OF FOOD MEDICINES TO ALLEVIATE SPECIFIC HEALTH CONDITIONS

Appendix 1—Electronic Supplementary Material (ESM)—provides an overview of conditions

for which food plants listed in Table 1 were used, either in NYC or in the Dominican Republic. Some species were used significantly more frequently for certain conditions in NYC than in the Dominican Republic, such as lime for asthma and chest congestion, bitter orange for sinusitis and diabetes, and garlic for hypertension. In the Dominican Republic, as compared to NYC, lime was used more frequently for bruises, bitter orange for shingles and wounds, cinnamon for cough, and garlic for parasitic infections.

In Appendix 2 (ESM), illnesses are compared transnationally in relation to their treatments with food versus nonfood medicines. For more than

**Table 2.** PLANT PARTS USED IN DOMINICAN TRADITIONAL MEDICINE AND THEIR MODES OF ADMINISTRATION\*.

Plant	New York City	Dominican Republic
Lime	fruit / juice (69) fruit / applied (38) fruit / tea (35) leaves / tea (6)	fruit / juice (62) fruit / applied (61) fruit / tea (11) leaves / tea (10)
Onion and shallot	bulb / juice (92) bulb / tea (8) bulb / botella** (6) bulb / syrup (5) bulb / eaten (3)	bulb / juice (38) bulb / tea (11) bulb / botella** (8) bulb / eaten (5) bulb / syrup (4)
Bitter orange	leaves / tea (47) fruit / applied (45) fruit / juice (36) leaves / applied (15) seeds / swallowed (4)	fruit / juice (37) leaves / tea (35) fruit / applied (28) leaves / ritual (11) leaves / vapor bath (5) leaves / applied (4) fruit / tea (4) seeds / swallowed (3)
Cinnamon	bark / tea (29)	bark / tea (14)
Garlic	clove / eaten (71) clove / tea (23) clove / applied (15)	clove / eaten (37) clove / tea (6) clove / applied (6)
Coconut	water / drunk (43) oil / drunk (17) fruit shell / tea (10) milk / drunk (8) oil / applied (4) milk / applied (3) root / botella* (3)	water / drunk (30) milk / drunk (12) oil / drunk (8) fruit shell / tea (4) root / botella** (4) oil / applied (3)
Watercress	plant / juice (41) plant / syrup (13) plant / tea (9) plant / eaten (5)	plant / juice (8) plant / syrup (4) plant / tea (3)
Ginger	root / tea (55) root / applied (11)	root / tea (25) root / applied (6) root / juice (4)
Radish	root / juice (24) root / syrup (10) root / tea (5) root / eaten (3)	root / juice (5) root / syrup (3)
Soursop	leaves / tea (49) leaves / applied (4)	leaves / tea (22)
Oregano	leaves / tea (43)	leaves / tea (15)
Guava	leaves / tea (9) fruit / juice (6) fruit / eaten (4) fruit / tea (3) bark / tea (3)	leaves / tea (19) shoots / tea (11) fruit / tea (9) fruit / juice (7) fruit / eaten (4)

\*Values represent the total number of recipes that pertained to a combination of plant part and administration. Only combinations that were reported at least three times are listed. Absolute values are given between brackets to illustrate the importance within the same country for different combinations of plant parts and their administration.

\*\*The Dominican botella was defined in Vandebroek et al. (2010) as a bottled herbal mixture that consists of a combination of woody plant parts or exudates from different plant species, culinary spices, and frequently also non-plant ingredients. Its local name in Spanish reveals that the bottle has become a metaphor for its medicinal ingredients.

half of all conditions in NYC (17 of 29 conditions, or 59 %), food plants represented more than 50 % of all plant remedies mentioned for treatment. Significantly more food medicines were reported in NYC than in the Dominican Republic for backache, bronchitis, common cold, cough, diabetes, flu, infertility, and vaginal infections.

#### OBTAINING PLANT MEDICINES

Migration to NYC has clearly influenced procurement of medicinal plants in general. Figure 1 contains data for both food and nonfood medicines. In the Dominican Republic, plants were easily obtained close to homes. Almost two-thirds of the interviewees (67 %) reported manmade environments, such as backyards, gardens, or farmland, as their source of medicinal plants. In these places, plants either grow wild (for example, the bellyache bush, *túa túa*, *Jatropha gossypifolia* L.), or they are cultivated, such as lemongrass, aloe (*sábila*, *Aloe vera* [L.] Burm. f.), bitter orange, and soursop. More than half of all respondents (54 %) also indicated markets as important places to obtain medicinal plants, followed by wild harvesting (38 %). Some participants (8 %) bought plants from street vendors in the Dominican Republic; for example,

watercress (Fig. 1). The place where NYC immigrants grew up (rural or urban area in the Dominican Republic) affected their procurement of plants while they were still living in the Dominican Republic (Chi-square=13.2;  $P=0.022$ ). A Z-test for proportions without Bonferroni correction showed that urban people obtained significantly more plants from markets and greengrocers in the Dominican Republic than rural people ( $Z=2.16$ ;  $P=0.031$ ), whereas the reverse was true for wild harvesting of plants ( $Z=2.08$ ;  $P=0.038$ ). No significant urban-rural difference was found in relation to plants harvested from manmade environments such as patios, gardens, or farmlands. These significant relationships did not maintain after application of Bonferroni correction due to the number of comparisons, which decreased the critical  $P$ -value to 0.008.

In NYC, most people (72 %) purchased plants from *botánicas*. Golden shower tree (*caña fistula*, *Cassia fistula* L.), rue (*ruda*, *Ruta* spp.), and rosemary (*romero*, *Rosmarinus officinalis* L.) were just a few examples of plants purchased in *botánicas*. Almost one-fourth (23 %) of the interviewees purchased their plants from NYC markets (called *marquetas* in Spanish) and

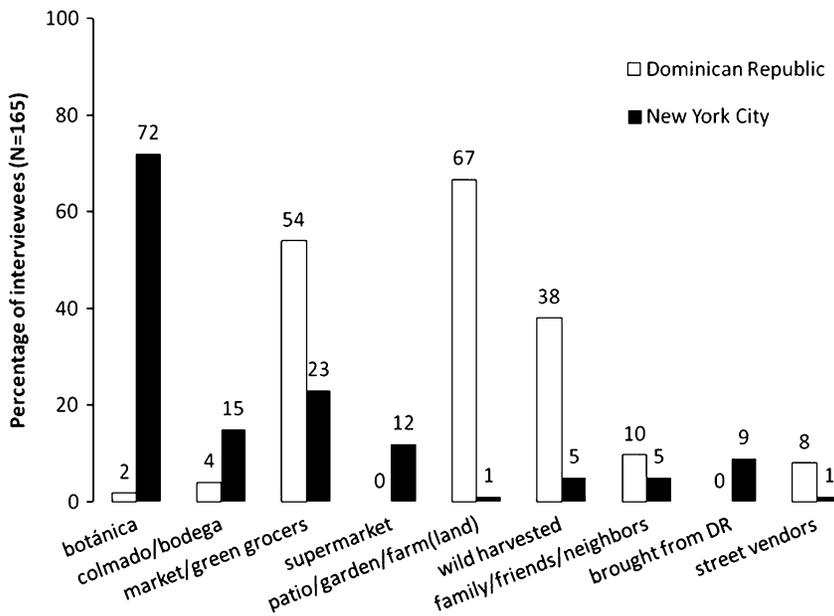


Fig. 1. New York City interviewees were asked where they obtained or bought medicinal plants while they were living in the Dominican Republic and now that they are living in New York City. Different answers were possible, therefore combinations add up to more than 100 %.

greengrocers, some of Asian origin. Chinese and Korean greengrocers and markets were mentioned as places to obtain plants such as horsetail (*cola de caballo*, *Equisetum* spp.), cucumber (*pepino*, *Cucumis sativus* L.), bitter orange, aloe, celery (*apio*, *Apium graveolens* L.), and fresh spearmint. *Bodegas* were the third most cited source of plants in NYC (15 %) (*colmados* are their counterparts in the Dominican Republic). *Bodegas* and *colmados* are small Latino and Caribbean neighborhood stores that carry products for daily use, including limited fresh produce and sometimes medicinal plants, such as aloe.

Supermarkets were a new source of medicinal plants for Dominican immigrants in NYC (Fig. 2) and were mentioned by 12 % of the interviewees. Plants purchased in supermarkets included ginger, lime, aloe, laurel (*laurel*, *Laurus nobilis* L.), star anise (*anis de estrella*, *Illicium verum* Hook.f.), linden (*tilo*, *Tilia* spp.), coconut, and others. It is difficult and often illegal to import plants into the United States, yet 9 % of interviewees asked friends and family members to bring plants from the Dominican Republic. Even though at first sight an urban environment may not be conducive to wild harvesting, 5 % of people collected plants such as common plantain (*llantén*, *Plantago major* L.) from NYC green

spaces, including parks. An equal proportion of people obtained medicinal plants from their families, neighbors, or friends in NYC, and only 1 % mentioned buying medicinal plants from street vendors. No participants mentioned growing plants in community gardens in NYC. A Chi-square analysis did not reveal any relationship between the type of area NYC immigrants grew up in (rural or urban Dominican Republic) and the places where they procured plants from in NYC.

#### NEW FOOD MEDICINES AND NEW MEDICINAL USES IN NEW YORK CITY

Some food medicines were unique to NYC, even though they were reported infrequently. These species were not recorded during our interviews in the Dominican Republic. Among these are plants such as broccoli (*brocoli*, *Brassica oleracea* L. [Italica group]) for treatment of high cholesterol and fungal skin infections; the leaves of *caimito* (*Chrysophyllum cainito* L.), dandelion (*diente de león*, *Taraxacum* sp.), and pear (*pera*, *Pyrus communis* L.) for kidney problems; spinach (*espinaca*, *Spinacia oleracea* L.) for fungal skin infections; kiwi (*Actinidia deliciosa* (A.Chev.) C.F.Liang & A.R.Ferguson) for high cholesterol and hypertension; lemon (*limón amarillo*, *Citrus*



Fig. 2. A supermarket aisle in New York City's Bronx neighborhood showing a variety of culturally important plants, including aloe, ginger, and bitter orange.

*limon* (L.) Osbeck) for asthma, vaginal infections, and high cholesterol; marjoram (*mejorana*, *Origanum majorana* L.) to dispel evil spirits; melon (*melón*, *Cucumis melo* L.) to refresh the blood; passion fruit (*parcha*, *Passiflora edulis* Sims) for hypertension; and peach (*Prunus persica* (L.) Batsch) for impotence. Peach and kiwi were reported by Dominicans directly by their English common names. Most of these species (except *Chrysophyllum cainito*) are easily available in NYC supermarkets. These NYC citations may constitute new species that expand the Dominican traditional pharmacopoeia.

In addition, some food species also acquired new uses in NYC that were not mentioned in the Dominican Republic. Examples of these are the use of cucumber for slimming and hypertension; oats (*avena*, *Avena sativa* L.) for slimming and diabetes; celery (*apio*, *Apium graveolens* L.) for bronchitis and hypertension; pineapple (*piña*, *Ananas comosus* (L.) Merr.) for cholesterol, slimming, diabetes, arthritis, and intestinal problems; eggplant (*berenjena*, *Solanum melongena* L.) for slimming; and annatto (*bija*, *Bixa orellana* L.) for diabetes, labor pain, and vaginal infections.

## Discussion

Food medicines of the transnational Dominican community are versatile therapeutics made from differed plant parts and administered in multiple ways. They are important medicines for treating non-communicable diseases such as asthma, sinusitis, diabetes, and hypertension, especially in the urban environment.

### GENERALLY KNOWN FOOD PLANTS

Most of the popular food plants identified in this study are not restricted to the Dominican community, but are used in many cultures. The multicultural environment of NYC offers migrants novel plants or new knowledge of their uses that will likely create shifts in the popularity of some plant medicines and bring about changes in their traditional practices (Viladrich 2006) and pharmacopoeias (Medeiros et al. 2012). Several studies in the United States have highlighted Latino migrant traditions of consulting with healers (Balick et al. 2000), visiting *botánica* shops for spiritual and physical health (Gomez-Beloz and Chavez 2001; Hodges and Bennett 2006; Reeser and Cintrón-Moscoso 2012), adherence to *Santería* practices (Brandon 1991), and the role of cultural beliefs in healthcare seeking

behavior (Risser and Mazur 1995; Sullivan et al. 2010). However, relatively few studies have focused on the botanical characterization of herbal remedies used for self-medication, and no study in the United States has looked into patients' own assessment of the outcome of those plant-based treatments (Diallo et al. 2006). Foods also represent important medicines for South American immigrants in London. Respectively, 70 %, 62 %, and 57 % of all medicinal species used by Colombians, Peruvians, and Bolivians living in London had a primary function as foods or condiments (Ceuterick et al. 2008; 2011). Given their popularity already observed in several immigrant communities, more studies need to focus specifically on the importance of foods as medicines, as well as on the health threats these communities face as their dietary habits rapidly change after migration (Pieroni et al. 2007). In addition, these types of studies can generate health benefits for the public at large, through extension to non-immigrants suffering from the same diseases, and help alleviate the global epidemic of non-communicable diseases (World Health Organization 2013).

### CURRENT DISEASE TRENDS

Our results indicate that food medicines are used to treat many of the most frequently diagnosed conditions (see Hsiao et al. 2010) in ambulatory care visits to physician's offices in the United States. Our results also show that Dominican migrants seek home remedies for self-medication of these prevalent conditions as part of their healthcare strategies. Even more, they are doing so by finding remedies that are relatively easily accessible in an urban environment, either in markets, supermarkets, or *botánicas*. What remains to be explored is to what extent patients use these food medicines as an alternative to biomedicine, or concomitantly, and how this impacts their health. Food plants are Generally Regarded As Safe (GRAS) by the U.S. Food and Drug Administration. However, this does not exclude the possibility of plant-drug interactions. For example, grapefruit juice can lead to increased serum concentrations of several medicines, including statins and cyclosporine, and the high content of vitamin K in broccoli and other green vegetables can be counter-effective in anti-coagulant therapy (Bailey et al. 2013).

A discussion on the potential safety of food medicines inevitably raises questions about

their efficacy. Several authorities, such as the Natural Standard Research Collaboration ([www.naturalstandard.com](http://www.naturalstandard.com)) and the American Botanical Council (<http://cms.herbalgram.org/commissione/HerbIndex/approvedherbs.html>), have published evidence-based systematic reviews for 9 of the 12 plants listed in Table 1 (the three exceptions being *Lippia micromera*, *Raphanus sativus*, and *Psidium guajava*). In clinical trials, ginger reduces the severity and duration of nausea and vomiting during pregnancy (Dante et al. 2013). Garlic attained the same rating for elevated blood cholesterol levels. However, some studies of garlic, ginger, and other Dominican food medicines provided equivocal or negative results. Importantly, most medicinal use claims made for food plants by the Dominican community in this survey have not been studied. More randomized human trials need to be conducted on the diverse medicinal uses of these plants. Food chemistry, the study of the bioactive components of foods, may help explain differences in therapeutic action between closely related species, such as those between onion and garlic, which both belong to the genus *Allium*. Whereas onions are rich in flavonoids (antioxidants), the chemistry of garlic is based on allicin and its derivatives. On the other hand, onions do not produce allicin whereas flavonoids are virtually absent from peeled garlic cloves. Therefore, if considered for their medicinal value, these closely related species target different diseases (Griffiths et al. 2002).

#### WHY ARE FOODS RECONSIDERED AS MEDICINES AFTER MIGRATION?

Food plants are very accessible and available in the urban environment, and therefore people can easily experiment with them. The Dominican-Spanish words *curioso/curiosa* (someone who is curious) and *inventar* (to invent) refer to people who like to experiment with medicinal plants. Ceuterick et al. (2008; 2011) also explain the predominance of foods as medicines among South American immigrants in London in terms of their wide availability, among others in supermarkets. Another reason for the increased popularity of food plants after migration may lie in the complexity of multicultural interactions that characterize the immigrant experience in NYC. On the one hand, food traditions become

symbolic representations of Dominican identity in NYC that reinforce “Dominicanness”; on the other hand, culturally diverse food knowledge and practices are easily shared across diverse ethnic communities through jobs, intermarriage, and food shopping (Marte 2011). Knowledge about food plants used as medicines may be transmitted through similar cultural exchanges. From our own experience, it is not uncommon in NYC to stand in line at Latino greengrocers and overhear women exchanging food plant recipes for specific health conditions in Spanish. Knowledge about such generally known plants as foods does not appear to be proprietary and hence not subject to secrecy, as is often the case with less familiar plants known mainly by specialist healers. Knowledge about these plants, therefore, may be quite easily exchanged. The food–medicine hype of the last decade is also widely spread by the Internet, overwhelming the general public with articles about which foods to eat for health purposes; for example, to reduce inflammation.

#### FOOD DESERTS, GREEN CARTS, COMMUNITY GARDENS, AND MEDICAL EDUCATION

Areas in NYC, including the South Bronx where many Dominicans live, have been identified as “food deserts” (Bader et al. 2010), grocery-store deprived zones lacking in access to fresh fruits and vegetables that often coincide with low-income neighborhoods. These areas correlate with high rates of morbidity, particularly diabetes and obesity. One of the New York City Department of Health and Mental Hygiene’s initiatives that took off during our project, has been to bring healthy food to these areas through the NYC Green Cart Project consisting of (immigrant) street vendors who sell raw fruits and vegetables on mobile carts in designated areas of the city in need of these products (Fig. 3). An initiative such as this may represent a good opportunity for future collaboration between Green Cart vendors, customer community members, ethnobotanists, and physicians, in order to better understand the food–medicine continuum in migrant communities and help promote the (preventive) health benefits of foods sold on Green Carts through evidence-based information of these foods’ cultural uses, health-promoting potential, and recipes. At the same time, the results of such research can also be used in



**Fig. 3.** Green Cart in New York City's Bronx neighborhood selling fresh produce, including the food medicines onions, ginger, and garlic.



**Fig. 4.** Urban gardener from Puerto Rico showing his harvest of tomatoes and cucumbers in El Flamboyán community garden, located in New York City's Bronx neighborhood, to Institute of Economic Botany intern Gabriela Alvarez.

cultural competency training of medical students, residents, and practicing physicians, especially those who are serving large immigrant populations, in order to be better aware of, and more sensitive to, the plant medicines that these communities may be taking to promote well-being and alleviate ill health (Vandebroek 2013; Whelan and Dvorkin 2006). Also, forthcoming is a Spanish language guidebook to the medicinal uses of plants by Dominicans living in NYC as a way of returning the findings of this study to the community. This guidebook will include 50 plant monographs with local and scientific plant names, a picture of each plant, its cultural uses, and a summary of precautions, adverse reactions, herb–drug interactions, and toxicity (where known) summarized from the biomedical literature. The audience intended for this guidebook is the Dominican and other Latino and Caribbean communities in the United States.

Another opportunity for ethnobotanists to work together with local communities is to document ongoing activities in urban community gardens in NYC where immigrants from different countries grow and exchange foods in shared gardens (Fig. 4) (Saldivar-Tanaka and Krasny 2004). *The New York Times* (17 October 2012, pp. D1–D8) featured an article called “The Seeds They Carried” that reported on Caribbean/West Indian/African foods, such as *callaloo* (green amaranth, *Amaranthus viridis* L.) and *dasheen* (taro, *Colocasia esculenta* [L.] Schott). These and other culturally important plants are grown in NYC community gardens by a diverse immigrant population for their own use, or to sell at local farmers’ markets, where other immigrants come to buy the produce for food or medicine.

### Conclusion

We suggest that the observed increase in the use of food medicines by Dominicans in NYC reflects the different socio-cultural, ecological, and epidemiological environment in their new home country. Even though this study focused on the Dominican community in NYC, the discussion on food and health should not be restricted to one cultural group, especially given the global importance of these food plants in many human diets and considering the global trends in non-communicable diseases.

Non-communicable diseases represent a worldwide epidemic burden, accounting for more than 36 million deaths (out of 57 million global deaths) each year (World Health Organization

2013). Four categories—cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes—are responsible for most of these deaths. Our results are promising in that they show how a Caribbean community, through its cultural use of food plants, has developed a strategy to respond to this health crisis. Sharing these results with the broader community—at-large provides an opportunity to develop an action plan to attack global non-communicable diseases through diet combined with other lifestyle changes, such as exercise.

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