STORE AVAILABILITY AND IN-STORE AVAILABILITY OF BASIC DIABETIC-HEALTHY FOOD OPTIONS IN SELECTED BARANGAYS IN DAVAO CITY, PHILIPPINES

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ABSTRACT: This study seeks to characterize the local food environment in selected barangays in Davao City, Philippines. Specifically, it is designed to describe the availability of food stores as well as the in-store availability of basic diabetic-healthy food options in these areas. Store presence, location and store inventory were assessed by groundtruthing using an observation checklist and survey questionnaire in the 6 selected barangays in Davao City. Descriptive analysis was used to show the different types and number of food sources at the community level as well as the presence or absence of diabetic-healthy food options that should be available for purchase. A total of 2,315 food sources participated in the survey. Majority of the food sources (79%) were food retailers while the rest were categorized as food establishments (sold cooked food). Among food retailers, bread, eggs, brown sugar and coffee were the most available diabetic-healthy food options while the availability of fresh meats, fruits, vegetables and reduced fat milk were limited at best. Although more than half of the food establishments served vegetables dishes, low-fat and low-salt dishes were not available. Although results indicate that most diabetic-healthy food options are being sold in food stores at the community level, the proliferation of small size food stores constrained the availability of healthier food options, particularly fresh produce and low-salt, low fat dishes. Further research on the policy mechanisms to increase the availability of these products should be explored further.

Keywords: Food environment, In-store availability, Diabetic-healthy food, Philippines

INTRODUCTION

Diabetes has become one of the major public health concerns globally [1]. In 2010, the global prevalence of diabetes was estimated to have reached 6.4% [2]. This translates to roughly 246 million diabetics. It is projected that the prevalence rates would range from 4.4% [3] to 7.7% [2]. Unfortunately, developing countries experience a disproportionately high burden of diabetes. The number of death attributable to diabetes was almost twice than those in developed countries [4]. By 2025, 2 out of 3 diabetics worldwide will come from developing countries [5].

Over the past few decades, there has been substantial focus on the food environment and its influence on various health outcomes. The availability of food stores as well as the type of food products being sold shapes one's diet. The results of the Multi-Ethnic Study of Atherosclerosis (MESA) study indicate that participants that did not live near supermarkets were 25-46% less likely to have healthy diet compared to those who lived near one [6]. Residents of urban neighborhoods with a higher concentration of small grocery stores were more likely consume more calories since these stores tend to offer more unhealthy food options [7]. Studies have also focused on the effect of the types of stores on fruits and vegetable consumption of certain groups, such as children and specific ethnic groups [8, 9]. Furthermore, the in-store availability has been found to vary depending on factors such as socio-economic status of residents [10, 11] and urbanicity [12]. Even the availability of diabetic healthy food option was found to be different for richer neighborhood compared to a less affluent one [13]. This is consistent with studies that suggest that factors such as socio-economic status of residents, race/ethnicity, transportation options as well as security situation have shaped the type and location of elements in the food environment. Wealthier, predominantly white

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Table 1 Food source categories

Category	Description
Food retailers	
Mobile vendor	Mobile seller
Sari-sari store	Had no cash register
Grocery	Had 1-2 cash registers
Supermarket	Had more than 2 cash registers
Food establishments	
Mobile vendor	Mobile seller
Fast food, karinderia, turo-turo	Serves pre-cooked and short order food, with eating area
Food cart, kiosk, stall	Serves pre-cooked and short order food, without eating areas
Restaurant	Serves food ala carte, with eating area

neighborhoods have four times more supermarkets [14, 15] and fewer chain supermarkets [16]. Residents in these neighborhoods live within an 8-10 minute ride to supermarkets [17]. In contrast, the food environment in poorer, minority neighborhoods is markedly different. Studies have shown that these neighborhoods have many small grocery stores [14, 16], non-chain supermarkets [16] but fewer fruit and vegetable markets, bakeries, specialty stores and natural food stores [14]. Unlike their wealthier counterparts, residents here have closer access to fast food outlets [17].

One of the pillars of diabetic education is diet and nutrition. Diabetic patients are often taught how to manage their diet during nutrition counseling sessions. Although there are no foods that cannot be eaten, patients are encouraged to control and manage the type of foods that they eat. Therefore, it is critical that the foods that they need are readily available to them in order for them to live healthy lives and mitigate complications. Researches on the influence of the local food environment and diabetes have been few and far between. This study seeks to add to the wealth of knowledge on this relationship, specifically in a developing country like the Philippines. This study was designed to characterize the availability of diabetic healthy food options in the local food environment in the selected barangays in Davao City. Specifically, it sought to illustrate the availability of food sources as well as describe the in-store availability of the diabetic-healthy food options at the community level. This study is part of a bigger study on the local food environment in Davao City.

MATERIALS AND METHODS

This study was conducted in 6 selected barangays in Davao City: Dumoy, Bago Aplaya, Talomo Proper, Matina Pangi, Matina Aplaya and Matina Crossing. The total population in these barangays was pegged at 164,616 in 2007 spread over 28.26 square kilometers.

Food environment survey

A two-part survey instrument in Bisaya was developed for this study. The first part collected background information about the store. Participating food sources were classified into different categories based on its dominant business line and its Business Bureau classification. The food sources were further classified either as food retailers or food establishments. Food retailers were those that sold fresh and/or dry processed food. These were then categorized based on the number of cash registers in the store (Table 1). Food establishments were food sources that sold cooked food. These were classified further based on the food service and presence/absence of an eating area.

The second part was an observation checklist to assess the in-store availability of diabetic healthy food options. A survey enumerator walked through the store or looked through the store front to determine the presence or absence of the identified diabetic healthy food options. For food establishments, the food server or waitress was asked about the dishes that were being served. The survey instrument was pre-tested and retested in May 2012 in Barangay Agdao. The food environment survey was conducted from May to June 2012. The Chulalongkorn University Ethics Review Committee reviewed and approved the protocol of this study.

Diabetic healthy food options

During a workshop among Nutrition Officers, they were asked to identify recommended, affordable and readily available diabetic-healthy food options that households with diabetics should have. Eleven diabetic healthy food items were shortlisted. Common but acceptable alternatives were also identified (rice-corn and sweet potatoes for rice). For food establishments, common food categories were identified. Low-fat and low-salt categories were added to the checklist to represent diabetic-

Table 2 Number and proportion food stores by barangay and by food store category

Food stores (N=2,315)	Barangay						
	Bago Aplaya	**Dumoy**	**Matina Aplaya**	**Matina Crossing**	**Matina Pangi**	**Talomo Proper**	**Total**
Number of Food Retailers (%)	**152 (8%)**	**231 (13%)**	**241 (13%)**	**427 (23%)**	**105 (6%)**	**664 (36%)**	**1,820 (79%)**
Mobile vendor	0 (0%)	1 (0.44%)	1 (0.44%)	2 (0.44%)	0 (0%)	5 (0.77%)	9 (0.44%)
Sari-sari store (0 cash register)	149 (98%)	228 (98%)	236 (98%)	420 (98%)	105 (100%)	653 (98%)	1,791 (98%)
Grocery (1-2 cash registers)	3 (2%)	2 (1%)	4 (2%)	3 (0.66%)	0 (0%)	6 (0.88%)	18 (0.99%)
Supermarket (≥3 cash registers)	0 (0%)	0 (0%)	0 (0%)	2 (0.44%)	0 (0%)	0 (0%)	2 (0.11%)
Number of Food Establishments (%)	**25 (5%)**	**21 (4%)**	**59 (12%)**	**238 (48%)**	**7 (1%)**	**145 (29%)**	**495 (21%)**
Mobile vendor	11 (8%)	11 (4%)	35 (6%)	104 (0.44%)	0 (0%)	88 (2%)	253 (2%)
Fast food, karinderia, turo-turo	12 (44%)	9 (52%)	21 (60%)	123 (44%)	3 (58%)	54 (60%)	222 (52%)
Food cart, kiosk, stall	2 (48%)	1 (42%)	3 (36%)	1 (52%)	0 (42%)	3 (38%)	10 (44%)
Restaurant	0 (0%)	0 (0%)	0 (0%)	10 (4%)	0 (0%)	0 (0%)	10 (2%)

Table 3 Land area, population, number of food stores and geographic and population-based store density by barangay

Barangay	Land area (Sq. Km)	Population	Number of food sources	Food stores (n=2,315)	
				Geo*	Pop**
Talomo Proper	6.50	53,212	809	124.5	15.20
Matina Crossing	4.92	36,642	665	135.2	18.10
Matina Aplaya	3.16	31,641	300	95.1	9.50
Dumoy	5.31	19,389	252	47.5	13.00
Bago Aplaya	2.20	13,532	177	80.4	13.10
Matina Pangi	6.18	10,200	112	18.1	11.00
Total	**28.26**	**164,616**	**2,315**	**81.9**	**14.10**

**Geographic store density = Number of food source per 1 square kilometer*
***Population-based store density = Number of food source per 1,000 population*

healthy food dishes. Fish and meat dishes were not categorized as diabetic-healthy because a nutritional assessment of each dish was not conducted to determine whether this was indeed diabetic healthy.

Sampling methodology

All food sources in the community that were open at the time of the survey were asked to participate in the survey. A total of 407 food sources refused to participate in the study. The generalizability of the study results was not affected by the refusals.

Data analysis

Descriptive statistics such as the number and proportion of different kinds of food sources were computed. Two indicators of store density were computed to further illustrate store availability: geographic store density (number of stores per square kilometer) and population-based store density (number of stores per 1,000 population). Frequencies were used to summarize the availability of specific food items or their substitutes. Only food items that were visible at the time of the survey were classified as available. Survey responses were encoded using Epi Info v.7 (Centers for Disease Control and Prevention, Atlanta, Georgia, USA) and analyzed using Microsoft Excel (Microsoft Corporation, Redmond, Washington, USA).

RESULTS

Store availability

A total of 2,315 food sources participated in the study where 79% were classified as food retailers and the rest were food establishments. The most available food source in the community is the *sari-sari* stores (98%) while close to half of food establishments were karinderias/turo-turo and food stalls/ kiosks (Table 2). The distribution of food stores followed that of population size where the more populous the barangay, the more food stores can be found.

There were 81.9 food stores per square kilometer in the selected barangays and 14.1 food stores per 1,000 population (Table 3). Barangays with a bigger population had a relatively higher the geographic store density. But this does not hold true for the population-based store density (number of food category per 1,000 population). Interestingly, the geographic store density of Bago Aplaya was close to those of larger barangays despite being the smallest and less populated barangay.

Table 4 Number of food stores, geographic and population-based store density by food store category

Food store category	Number of food stores (n=2,315)	Geographic store density (store per km2)	Population-based store density (store per 1,000 population)
Food retailers	**1,820**	64.40	11.06
Mobile vendor	9	0.32	0.05
Sari-sari store (no cash register)	1,791	63.38	10.88
Grocery (1-2 cash register)	18	0.64	0.11
Supermarket (more than 2 cash register)	2	0.07	0.01
Food establishments	**495**	17.52	3.01
Mobile vendor	10	0.35	0.06
Fast food, karinderia, turo-turo	253	8.95	1.54
Food cart, kiosk, stall	222	7.86	1.35
Restaurant	10	0.35	0.06

Table 5 Proportion of food retailers that sell diabetic healthy food options, by food retailer category

Food items	Mobile vendor *(n=9)*	Sari-sari store *(n=1791)*	Grocery *(n=18)*	Supermarket *(n=2)*	Total *(n=1820)*
Coffee	2 (22%)	1556 (86%)	15 (84%)	2 (100%)	1575 (86%)
Sugar	1 (12%)	1525 (86%)	18 (100%)	2 (100%)	1546 (84%)
Eggs	2 (22%)	1519 (84%)	17 (94%)	2 (100%)	1540 (84%)
Bread	4 (44%)	1506 (84%)	18 (100%)	2 (100%)	1530 (84%)
Oil	1 (12%)	1040 (58%)	13 (72%)	2 (100%)	1056 (58%)
Mongo	1 (12%)	751 (42%)	7 (38%)	2 (100%)	761 (42%)
Rice	0 (0%)	676 (38%)	14 (78%)	2 (100%)	692 (38%)
Fruits	2 (22%)	241 (14%)	0 (0%)	2 (100%)	245 (14%)
Vegetables	1 (12%)	201 (12%)	1 (6%)	2 (100%)	205 (12%)
Meat	5 (56%)	127 (8%)	0 (0%)	2 (100%)	134 (8%)
Low-fat/ Non-fat Milk	0 (0%)	25 (2%)	9 (50%)	2 (100%)	36 (2%)

Table 6 Proportion of food establishments that sell diabetic healthy food dishes, by food establishment categories

Food dish category	Fast food, karinderia, turo-turo *(n=253)*	Food cart, kiosk, stall *(n=222)*	Mobile vendor *(n=10)*	Restaurant *(n=10)*	Grand total *(n=495)*
Chicken dishes	216 (86%)	71 (32%)	0 (0%)	10 (100%)	297 (60%)
Vegetable dishes*	207 (82%)	67 (30%)	0 (0%)	9 (90%)	283 (58%)
Pork dishes	202 (80%)	68 (30%)	0 (0%)	10 (100%)	280 (56%)
Fish dishes	205 (82%)	62 (28%)	0 (0%)	9 (90%)	276 (56%)
Steamed rice*	198 (78%)	37 (16%)	0 (0%)	10 (100%)	245 (50%)
Pasta or pancit dishes	70 (28%)	41 (18%)	0 (0%)	6 (60%)	117 (24%)
Fresh fruits*	73 (28%)	37 (16%)	2 (20%)	4 (40%)	116 (24%)
Diet/ low sugar drinks*	6 (2%)	19 (8%)	0 (0%)	4 (40%)	29 (6%)
Low fat alternatives*	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Low salt alternatives*	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

**diabetic healthy dishes*

Table 4 shows the store density of the different types of food sources. Small food sources such as sari-sari stores and karinderias/ fast food had a higher geographic store density rate compared to their bigger counterparts (supermarkets and restaurants).

In-store availability

Food retailers sold an average of 5 diabetic healthy food options. Among food retailers, the most available diabetic healthy food options are coffee, sugar, eggs and bread (Table 5). Four out of five food retailers sold these items. This pattern was consistent across the different types of food retailers, except for mobile vendors. Supermarkets located in the study areas sold all of the selected food items.

On the other hand, the least available diabetic healthy food options were the fresh and highly perishable produce (fruits, vegetables and meats) as well as low-fat or non-fat milk. These were only available in supermarkets.

Chicken dishes were the most commonly served

dish in food establishments (Table 6). Around half of the food establishments served chicken, pork or fish dishes but these were not necessarily diabetic healthy. On the other hand, the most available diabetic healthy dish served in food establishments were vegetable dishes. Low-fat or low-salt dishes were not available across all food establishment categories.

DISCUSSION

The survey results indicate that store availability at the community level is quite high. There are a significant number of places where food is sold in the community.

More populous barangays had more food sources located within its boundaries. But when it comes to store density rate, the results are mixed. More populous barangays had more food sources per square kilometer. But this pattern does not hold true for the population-based store density. This inconsistency between the two measures of store density could be attributed to other neighborhood-level factors that can influence the feasibility and sustainability of running a food store. In the United States, Moore and Diez-Roux [14] found that the type and location of food stores vary along racial/ ethnic and socio-economic lines. They found that lower-income neighborhoods tended to have more grocery stores and liquor stores but fewer fresh markets and natural food stores. This is consistent with the earlier findings of Morland, et al. [15] and Powell, et al. [17]. In a developing country like the Philippines, neighborhood-level factors could include urbanicity, economic activities in the community as well as the socio-economic status of its residents. In a multi-site study by Krukowski, et al. [18], they found that median household income was significantly associated with the Nutrition Environment Measures Study (NEMS) healthy food availability score.

Urbanization as well as the increasingly diversified economic activities brings about a more robust local economy. In turn, this would attract more investments, including investments in different types of food sources. With a more robust local economy, residents in these barangays are more likely to have a higher purchasing power.

When it comes to the type of food sources available at the community-level, one is more likely to find more smaller-sized food sources such as *sari-sari store* or *karinderias*. This is consistent with the findings of other studies that have inventoried food stores at the community level i.e. Bovell-Benjamin, et al. [19], Liese, et al. [20]. This type of food source is easier to put up and sustain because it requires only a small investment in terms of financing, manpower and space. On the other hand, these factors can also constrain the availability of some diabetic healthy food options, including fresh and highly- perishable produce. This can be seen in the limited availability of fresh meats and low-fat/ non-fat milk food options in smaller-sized stores. Similarly, Bovell-Benjamin, et al. [19] found that healthy options such as yellow and dark green vegetables as well as low-fat dairy products were not available among convenience stores in Tuskagee. Other studies that have shown that there is a limited availability of healthy food options, particularly fresh fruits and vegetables, low-fat dairy products and fresh meats, in convenience stores [20], single-aisle [21] and small independent stores [22] compared to larger food stores such as supermarkets. The limited availability of fresh and highly-perishable produce among smaller stores could be attributed to the need for additional investments including storage equipment, additional manpower and time to buy fresh produce. This could also be driven by competition between food retailers as well as the weak demand for these food options.

The picture of in-store availability of diabetic healthy food options was not optimistic as expected. Although most of the diabetic healthy food options are available among food retailers, the most available ones are the fast-moving and non-perishable ones. These items are ones that are consumed for breakfast or snacks. In contrast, highly-perishable food options are more available in larger stores, such as supermarkets. Unfortunately, there are only two supermarkets within the study area and all are located in one barangay. Patients will then have to travel far to get to a supermarket to buy some diabetic healthy food options that are not readily available in their local store such as low-fat milk and fresh produce. This creates an added economic, logistic and time burden on patients and their caregivers when it comes to adhering to their diet.

The situation is even worse when it came to the in-store availability of diabetic healthy dishes among food establishments. Low-salt and low-fat dishes were not available. For patients who prefer buying cooked food for their meals, they end up eating food that is not necessarily good for them. This is not surprising since there is not enough demand for food establishments to serve low-salt and low-fat dishes.

Oftentimes, patients would have to make do with what is available in their areas which are not necessarily good for them [21]. This has implications

on the patients' ability to maintain their diet because the fresh produce used for cooking, i.e. meats and vegetables, are not readily available. Even if they buy cooked food, they are less likely to find low-salt and low-fat dishes. Bovell-Benjamin, et al. [19] posit a similar observation as to the impact of the limited availability of healthier food options among small food stores which are commonly located at the community level.

CONCLUSION

The local food environment in selected barangays in Davao City, Philippines is characterized by the proliferation of small food sources, *sari-sari* stores. In turn, this drives the in-store availability of diabetic healthy food options. Fast-moving and non-perishable food options were found to be the most available among food retailers while fresh and highly-perishable produce such as fresh meats and non-fat/ low-fat milk could only be found in larger food retailers such as supermarkets. Among food establishments, low-fat and low-salt dishes were not available although most offered vegetables dishes. These patterns brings to light that, despite the high availability of diabetic healthy food options, the healthier food options have limited availability.

Despite this, there is still a lot of room for expansion. With a high density rates for smaller-sized stores, this presents an important avenue through which diabetic healthy food options could be made available for diabetic patients.

This study has some limitations. The number of food sources that participated in the study is underestimated. Since the survey was conducted during the summer (May), there were food sources, particularly those near schools, which were not open during the survey period. The day and time of the survey also had an impact. There were food sources that opened only during certain times of the day (i.e. early in the morning and late in the afternoon when the fishermen arrived with their catch). There would also be more food stores around the church on Sundays compared to ordinary days. Colloquially, these food sources were referred to as "*sira-sira*" stores or stores that are not regularly open. Food sources such as these were not captured in the survey. Another limitation was in the classification of food sources to either food retailers or food establishment. Although it is more common that food sources have only one business line, there are still those sold dry or processed food products and served meals at the same time. Since the focus was on the dominant or main business line, the food options available under the other business line were not captured. Lastly, no attempt was made to assess the "healthy-ness" of the pork, fish and chicken dishes served in food establishments. This limits the inclusion of such dishes in the in-store availability assessment.

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