

Article

Household Food Consumption Patterns and Food Security among Low-Income Migrant Urban Farmers in Delhi, Jakarta, and Quito

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Abstract: As growing populations in urban areas demand greater food supplies, the poor—particularly poor migrants—may be at higher risk for food insecurity. Evidence suggests that the urban poor who pursue agriculture in the city as a livelihood are more food secure. Thus, it could be assumed that migrants involved in urban agriculture are also in a better position to meet nutritional needs. The aim of this research was to explore household food security among migrant urban farmers using data from studies conducted in three rapidly urbanizing cities: Delhi, India; Jakarta, Indonesia; and, Quito, Ecuador. Surveys and semi-structured interviews were conducted with market-oriented small-to-medium scale farmers in each city to understand livelihood and migrant status, household food consumption patterns, and food security. In general, we found that participation in urban agriculture had a positive impact on household food security among participants through direct (self-consumption) and indirect (improved income, improved access) means. Although each case city expressed a different form of low-income migrant practice of urban agriculture, findings suggest that growing food in the city offers some protection against food insecurity through improved quantity, quality, and diversity of food options. This study is particularly relevant in the context of the Sustainable Development Goals (SDGs) to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture. These factors guide development goals and priorities. Given that rural-urban migrant trends are predicted to continue, this exploratory study offers empirical evidence related to rural-urban migrants, food security, and urban agriculture.

Keywords: urban agriculture; household food security; rural-urban migration; market-oriented agriculture; Delhi; India; Jakarta; Indonesia; Quito; Ecuador

1. Introduction

The proportion of the world's population living in urban areas is increasing dramatically. As of 2007, more people live in urban than rural areas [1]. It is predicted that, by 2030, the worldwide population of urban dwellers will be nearly five billion [1], with approximately 92% residing in developing countries [2]. A substantial portion of urban growth can be attributed to a global trend of rural to urban migration [1]. Urban centers offer improved access to employment, education, healthcare, goods and services, and cultural and intellectual developments. However, urbanization is occurring at a rate that exceeds many city governments' ability to meet growing needs, which burdens infrastructure and provisions for basic needs and services [3,4]. As growing populations in urban

areas demand greater food supplies, coupled with a rise in rural to urban migration and the need to create livelihood options, there has been an increase in urban agriculture worldwide [5,6]. The rural poor who migrate to urban centers to fill the needs for low or unskilled labor often face food insecurity. There is some evidence that suggests that urban poor who pursue agriculture in the city as a livelihood are more food secure [7]. Could migrants who participate in urban agriculture also be in a better position to meet nutritional needs?

The Food and Agriculture Organization of the United Nations (FAO) defines food security as “when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food, which meets their dietary needs and food preferences for an active and healthy life” [8]. There are various types of food insecurity and nutrient deficiency, such as undernutrition, micronutrient deficiency, and malnutrition, with negative health implications [9]. Rural food insecurity is often the result of scarcity (lack of food), which manifests in undernutrition while, in the urban environment, food insecurity is often the result of poor quality food leading to micronutrient deficiency and malnutrition [10]. Previous research suggests that the urban poor can be more vulnerable to food insecurity than the poor in rural areas. Notably, since the 2007–2008 global food price crisis, rising food prices have impacted the urban poor more negatively than the rural poor because the urban poor tend not to produce their own food, and depend on the market for their food purchases [11]. In the city, fresh and nutritious foods are usually sold at high prices, hindering the poor’s ability to purchase such foods [12,13]. Perishable fruits and vegetables that come from rural areas or are imported from abroad may also lose freshness along the way, which lowers nutritional value [14].

Previous research has found that the urban agriculture can help improve food security by increasing dietary quantity, quality, and diversity [7]. Households involved in agricultural activities tend to enjoy greater quantities of food (sometimes up to 30%), consume more fruits and vegetables, and have a more diverse diet [15–18]. Furthermore, positive impacts of self-sustaining agricultural activities on the nutritional balance and micronutrient intake of the households can be promoted with education and assistance in their crop selections [19]. There is also some evidence that urban agriculture can improve malnutrition and contribute to household food security for the urban poor. This is largely based on small case studies in the context of Africa [7,20]. Recently, there is also evidence that households who engage in urban agriculture are not significantly more food secure than households not actively engaged [21]. Frayne et al. conclude in their study of 11 African cities that household engagement in urban agriculture is not an effective strategy for improving household food security. However, the authors acknowledged that effectiveness varied based on the urban context. Within this growing body of research, there is a lack of focus on urban migrants. Given that rural-urban migrant trends are predicted to continue, a better understanding of food security among migrants who pursue urban agriculture is warranted.

This research contributes evidence that suggests migrants who pursue agriculture in the city could meet nutritional needs and achieve relative food security. Specifically, this research investigated household food security among migrant urban farmers in three rapidly urbanizing cities: Delhi, India; Jakarta, Indonesia; and, Quito, Ecuador. This exploratory study emerged based on findings from a larger research project to explore characteristics, benefits, and barriers of urban farmers in Delhi, India. Quito, Ecuador and Jakarta, Indonesia were selected to provide a cross-sectional case-study approach to strengthen the reliability and validity of small-sample cases. We conducted semi-structured interviews with market-oriented small-to-medium scale farmers in each city to understand (1) migrant history and farm practices, (2) household food consumption patterns, and (3) household food security. Despite social and political contextual differences across the three case cities, a cross-comparison of trends lends credence to the reliability of the individual cases. This study is particularly relevant in the context of the Sustainable Development Goals (SDGs) put forth by the UN, which guide development goals and priorities. However, despite the SDG’s emphasis on food security and agriculture, there has been criticism in that the SDGs fail to address the increasing urban context of food insecurity [10]. This

exploratory study offers empirical evidence related to an important and under-researched area linking rural-urban migrants, food security, and urban agriculture.

2. Study Context

2.1. Delhi and Food Security

In the past two decades, India has experienced unprecedented growth in gross domestic product (GDP) per capita, which expands 40% between 1998 and 2006 [22]. Despite economic progress, severe nutrition deprivation persists [22]. India currently ranks 74 out of 113 countries on the Global Food Insecurity Index (GFS), which ranks countries based on availability, affordability, quality, and safety of food [23]. It is estimated that 54.6% of the workforce is employed in agriculture (as cultivators or laborers), which makes it the largest source of employment [24]. Among women in the workforce, 65.1% are either primary cultivators or work as agricultural laborers.

As the capitol of India, the second most populated country in the world, Delhi NCT (National Capital Territory) has 26.5 million people and is one of the fastest growing cities in the world [25]. Changes in India's international and domestic agricultural policies and increasingly severe droughts due to climate change are important drivers of rural-urban migration to Delhi [26–28]. With such a large percent of its workforce reliant on agriculture for employment, even small changes in policies and climate conditions have deep and far-reaching impacts across the population. This is combined with Delhi's growing development of urban and peri-urban land pushing agriculture farther from the city, which results in steeply rising food prices due to greater food transport distances. *The Report on the State of Food Insecurity in Urban India* recommends exploring the potentials of urban agriculture, in addition to other measures, in order to overcome food insecurity in the urban areas by providing food and income [29].

It is estimated that Delhi receives 1000 rural migrants daily. The vast majority find employment in the informal sector, and shelter in informal settlements or tent encampments [30]. There is, however, a notable population of migrants who cultivate the land on the Yamuna River floodplain (Figure 1). Following India's 1947 Independence, the Delhi Development Authority (DDA) was established to deal with rapid population growth [31]. At that time, the floodplain of the Yamuna River supported informal settlements. In 1949, the Delhi Improvement Trust was formed, and given the responsibility to allot more than 5000 acres of land along the Yamuna River to the Delhi Peasants Co-operative Multipurpose Society (the Society). The Society parceled out the land to Society members (in effect, the informally settled households), which gives them the right to cultivate the land. Today, the vast majority of urban farmers continue to cultivate the Yamuna River floodplain.

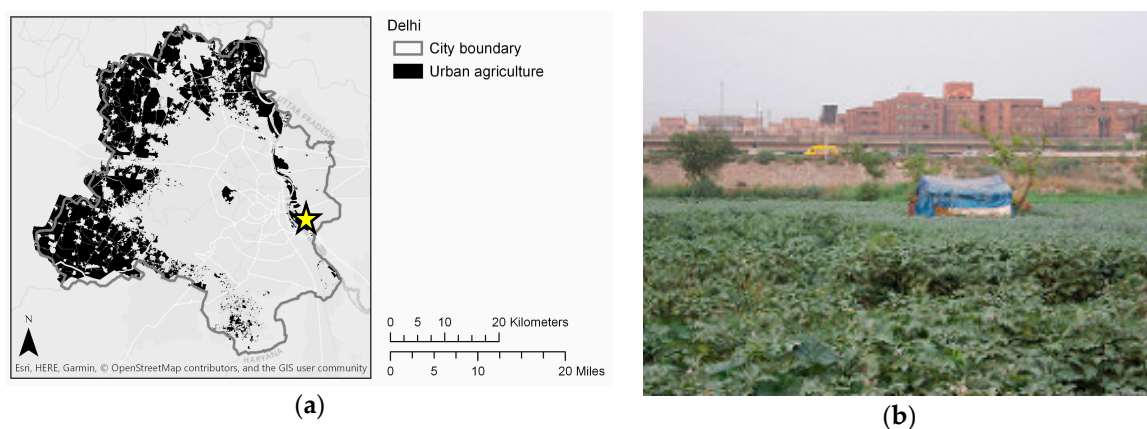


Figure 1. Context of urban farming in Delhi: (a) City context showing locations of urban farms with a yellow star indicating the research site. (b) Image of a typical migrant urban farm.

2.2. Jakarta, Migration, and the Global Food Crisis

Jakarta is the capital of Indonesia with a population of 10.5 million. Most of urban food demand in Jakarta is met through rural and peri-urban sources [25]. Indonesia was particularly hard hit during the global economic crisis in 1998 and again in 2007, which led to rising food prices and food insecurity. In 1998, the governor of Jakarta introduced a policy to utilize vacant lands for agricultural development as a temporary solution to satisfy food demands [32]. In addition, government regulation was introduced in 2002 to strengthen food production, promote equitable food distribution, and stabilize food prices [33]. When the second crisis occurred in 2007, a new law for spatial planning was established to mandate the development of ‘agropolitans’, or agricultural towns in rural areas to facilitate the supply of agricultural products from rural to urban centers [34]. In 2009, a law was enacted to protect agricultural land for food production. However, the mechanism through which the land can be protected is still unclear [34].

Jakarta has been under the pressure of over-population since independence from colonial rule in 1945, primarily due to the migration of rural populations to the city in search of jobs and better economic opportunities [35]. However, urban migrants face limited job opportunities for those with an inadequate education background, which makes it difficult to meet basic daily needs. Those who cannot afford the higher urban cost of living in Jakarta often find domiciles in informal dwellings, which exposes them to unhygienic living conditions that cause various health problems, malnutrition, and hunger. Some migrants engage in urban agriculture as a way to produce their own food and to earn some income [36].

The rapid development of Jakarta’s peri-urban fringe is driven by rapid change in the land-use policy to bolster economic development in rural areas traditionally in agricultural use, and has resulted in a mix of commercial and high-rise residential properties [34]. Notably, the satellite cities of Bogor, Depok, Tangerang, and Bekasi have consumed large areas of prime agricultural land as they urbanize [37]. The current masterplan of the Metropolitan Priority Area (MPA 2010–2030) favors the growth of Jakarta and its satellite cities. There is pressure to use land for development of high-density housing, trade and services, and non-polluting and market-oriented light industry [38]. Despite high density development, there is some agriculture practiced within the urban boundary of Jakarta. However, the vast majority is non-registered and outside the formal economy (Figure 2). The majority of informal practitioners are low-income individuals and households who produce for self-consumption [39]. These urban farms are predominantly with limited tenure status on land marked for future development. As Jakarta urbanizes its peri-urban fringes, many farmers face a lack of skills to get a job in the urban sector [40]. Thus, they continue to farm, but often on land where they have lost the security of tenure rights or by moving to vacant land without legal rights (as squatters).

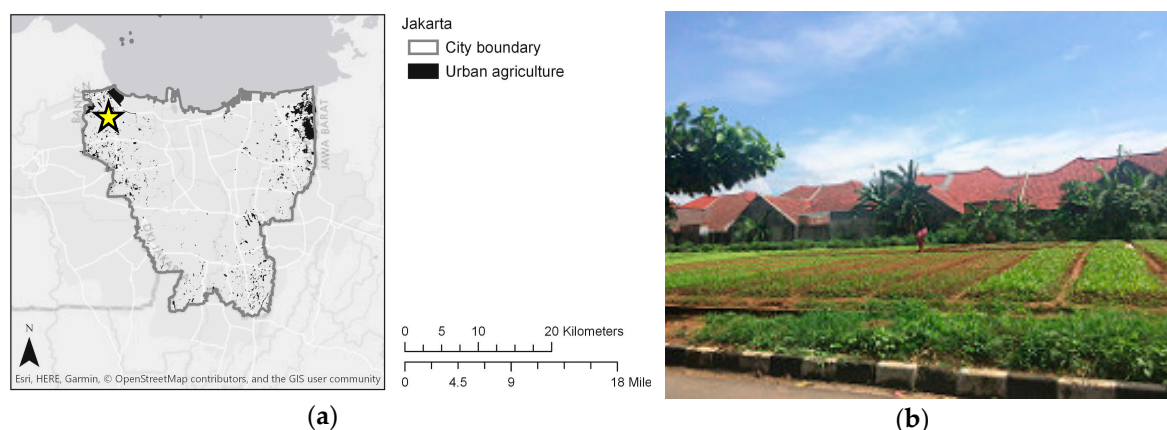


Figure 2. Context of urban farming in Jakarta: (a) City context showing locations of urban farms with yellow star indicating the research site. (b) Image of a typical migrant urban farm.

2.3. Quito's AGRUPAR Training Program

Ecuador, like most other countries is steadily urbanizing. Between 1950 and 2010, while the country's total population increased fivefold, the urban population increased tenfold [41]. By 2009, 65% of Ecuadorians lived in urban areas [42]. The primary urban center in Ecuador is the capital city, Quito, which had approximately 1.7 million residents as of 2015 [43]. While smaller than the other two case cities in this study, Quito is experiencing substantial growth, with a growth rate of 1.66% a year (approximately an additional 28,000 people per year) [43]. This increase in urban populations is largely due to immigration since Quito is one of the primary destinations for internal migrants as well as refugees [41,44] even though increased life expectancy and steady fertility rates contribute as well [45].

The continued increase in population has strained Quito's ability to accommodate and provide for newcomers. Approximately 53% of the settlements in the city are informal, and, because of the mountainous terrain surrounding the city, many are located in hazardous areas vulnerable to flooding and landslides [17]. In some newly established neighborhoods, infrastructure, such as streets and water/sewage systems, are often incomplete and services, including solid waste removal, are unavailable. Furthermore, population increases are outstripping the availability of job opportunities, which leaves many un-employed or under-employed. Research also indicates that many urban residents struggle with food insecurity. Weigel et al. found that, among households in low-income neighborhoods in Quito, 81% had experienced some level of food insecurity within the last year [46]. While high, this does appear to be an improvement compared to rural communities, where household food insecurity was a nearly universal experience [47,48].

To address the dual challenges of urban poverty and food insecurity, the municipal government of Quito developed the AGRUPAR program (*Agricultura Urbana Participativa* "Participatory Urban Agriculture"). The AGRUPAR program uses urban agriculture as a means toward economic development and to decrease food insecurity among households in poor neighborhoods (Figure 3). The program provides training, extension services, and resources for organic, agro-ecological small-scale agriculture. The program has trained thousands of city residents and had established nearly 2500 gardens as of 2015 [49].

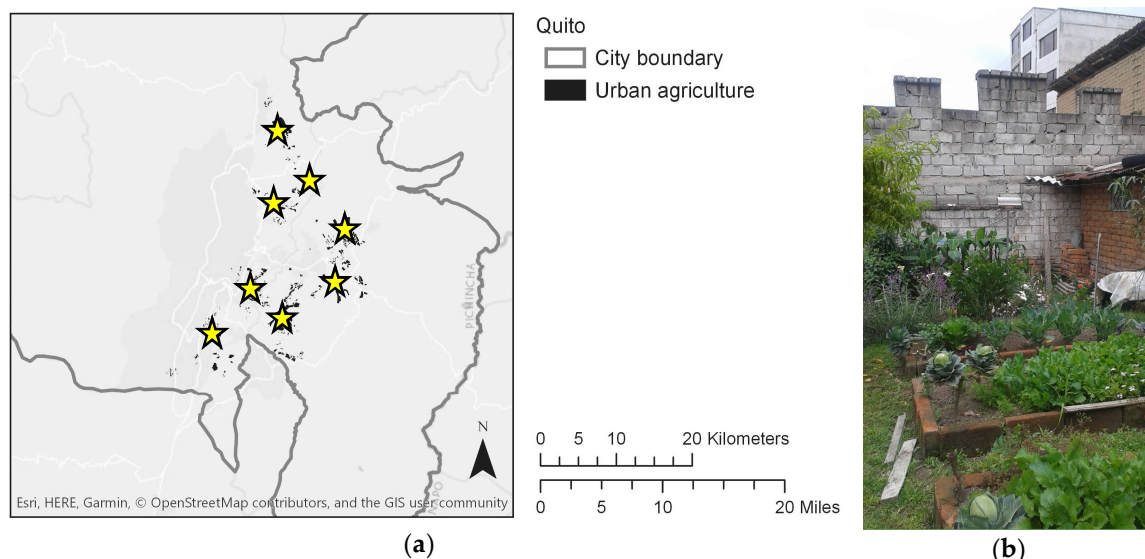


Figure 3. Context of urban farming in Quito: (a) City context showing locations of urban farms with yellow stars indicating the multiple research sites across the city. (b) Image of a typical migrant urban farm.

3. Materials and Methods

Each case city was part of a larger research project to understand various aspects of urban agriculture related to agricultural land use policy and planning, food sovereignty, and livelihood sustainability of urban farmers. The Colorado Multiple Institutional Review Board (COMIRB) and corresponding Delhi/Quito research ethics authorities approved research in Delhi and Quito. The National University of Singapore (NUS) Institutional Review Board approved research in Jakarta. In each case city, data were collected primarily through semi-structured interviews supplemented with observation, photography, memo-ing, and, in the case of the Quito study, a survey. A Hindi-English translator facilitated interviews in Delhi while the research principal investigator (PI) in Jakarta was a native Indonesian speaker and the Quito PI spoke Spanish as a second language.

3.1. Household Sampling

This research focused on market-oriented small-scale to medium-scale urban farms operated by low-income individuals or households who represented a mix of recent to generational rural migrants. In Delhi, this particular type of farming was almost exclusively located along the Yamuna Floodplain. A single, large cultivated area on the floodplain was selected as a typical case site: located adjacent to a middle-income residential neighborhood and within a few kilometers of the central business district of the city. The site was geographically bounded: bordered by the Yamuna River to the west, and major roadways to the north, east, and south. It was approximately 2.5 km² supporting an estimated 300 households. The larger research project interviewed 165 families selected using convenience and adjacent sampling methods (i.e., approaching the first person in the field, and moving on to the next-door neighbor). Of those, 121 households were actively farming and 44 occupied a dwelling on agricultural land but were employed in non-agricultural jobs (rickshaw driving, domestic work). Based on findings from the farming sample (n = 121), a small purposive sample of ten migrant households were selected for this study that represented households varying by size of plot, land status (renting, sharecropping), and length of tenure. Households were visited by the research team in July 2014 (original interviews conducted between 2012–2013).

In direct contrast to Delhi's large expanse of land farmed on the vast city floodplain, the analogous farm typology in Jakarta was a peri-urban patchwork of discontinuous farms. Because conducting interviews required the PI to access the farm plots to talk to farmers, the research sites were purposefully selected to meet the following criteria: public access, actively farmed, and farmers present on-site. Combining GIS (geographic information systems) mapping of satellite imagery and ground-sleuthing (on-the-ground visits) enabled selection of six agriculture fields within close proximity to one another. The sites were located near the border of Kalideres and Cengkareng districts in northwest Jakarta, adjacent to *kampung*s (informal settlements or housing clusters) where some of the farming households were assumed to reside. A convenience sample of two to five households at each site (20 total) were interviewed in December 2017 and June 2018. Interviews with all migrant farmers were included as the sub-sample for this study.

Unlike the other case cities, urban agriculture in Quito is practiced throughout the city and takes many different forms, from small container gardens on terraces, to raised beds in backyards, to open-fields in peri-urban neighborhoods. The research focused on farmers who had participated in the city's urban agriculture program AGRUPAR. Research participants were selected randomly from a list of participating gardens. A total of 192 surveys were conducted with AGRUPAR participants (migrants and non-migrants), of which 18 also completed in-depth, semi-structured interviews, between January and July of 2015. Surveys and interviews with all migrant farmers were included as the sub-sample for this study.

3.2. Data Collection

Interviews were recorded with pen and paper due to the potentially vulnerable situation of households including illiteracy and unknown legal status. Participants were compensated with a small household item or consumable dry goods for their time. Interviews were semi-structured, conducted in a conversational format, and covered topics that included: (1) migrant history and farm practices, (2) household food consumption patterns, and (3) household food security. The Quito study included a survey and collected quantitative data on these same topics. The questions were derived based on the USDA Household Food Security Survey Module (2012 Revision) and other reliable validated food security questions.

We first asked households about their migrant history including past farming experiences. Then we asked participants to describe current farm practices, prompting the following activities: plowing, planting, applying fertilizers and pesticides, harvesting, cleaning, and selling. We next asked who decided which crops to plant, and which inputs (fertilizers, pesticides, irrigation) to use and when. To understand household food security, we asked a variety of questions about consumption patterns, dietary diversity, and experiences of hunger. Participants were asked to describe specific food items they had consumed and how their eating habits had changed as a result of participating in urban agriculture. They were also asked to describe where they got their food (i.e., whether they grew what they ate or purchased it at the market) and how much of their own food was for personal consumption versus market sales. Lastly, we asked about specific experiences of hunger, whether they had sufficient food, and if food availability varied throughout the year.

3.3. Data Analysis

Interview notes were typed up as raw notes and checked for accuracy and completeness by the respective PI and/or translator. The research team then used the research topics to create a template to organize notes for each household into a standard order of responses. Standardized interview notes were imported to ATLAS.ti (version 1.6.0) (ATLAS.ti GmbH, Berlin, Germany) for qualitative coding. Team members iteratively coded and analyzed the interviews using ATLAS.ti to improve reliability and validity. The quantitative data from the Quito study were analyzed using Stata (version 11.1) (StataCorp, College Station, TX, USA). The analysis of the data is descriptive. Frequency distributions were used to understand the experience of food security among participants.

4. Results

4.1. Delhi

Among the migrant households interviewed in Delhi, all ($n = 10$) had migrated from villages near Badayun in the state of Uttar Pradesh, where the India State Hunger Index, similar to the GHI in calculating hunger and malnutrition but at the regional level in India, is reported as alarming [50]. Refer to Table 1 for a comparison of sample and sub-sample demographic data for the three case cities. Eight (80%) households had been living on or near their current plot between four and 10 years. The other two (20%) households had a multi-generational length of tenure. The typical household had six to 10 members across two or three generations. Most families (90%, $n = 9$) lived on the land they farmed even though one family owned a house in their village of origin. Dwellings included tents and informal woody structures. Farm plot sizes varied, but eight (80%) ranged from 1.0 to 2.5 acres (0.4 to 1.0 hectares). The farmers produced a wide variety of vegetable crops. The most common crops were high-value crops including eggplant, okra, and cilantro grown over three annual seasons. Harvested crops were sold through one or more of the local markets or *mandis* (vegetable wholesalers) as well as through roving third party vendors. Many participants reported, “We can sell something every day” and, “There is a market for every quality of vegetable.”

Table 1. Household sample and sub-sample demographic comparison.

Title 1	Delhi Sample ¹ (n)	Delhi Subsample (n)	Jakarta Sample (n)	Jakarta Subsample (n)	Quito Sample (n)	Quito Subsample (n)
Total farmers	121 ²	10	20	11	192 survey/18 interviews	74 survey/5 interviews
Migrant status	97% (117)	100% (10)	55% (11)	100% (11)	39% (74) survey/27% (5) interview	100% (75/5)
Length of tenure (years)	17% (21) <4 40% (49) 4–10 35% (42) >10	0% <4 80% (8) 4–10 20% (2) >10	100% (20) >10	100% (11) >10	35% (66) ⁴ <4 58% (111) 4–10 7% (13) >10	42% (31) <4 54% (40) 4–10 4% (3) >10
Land status	54% (65) rent 36% (44) sharecrop 6% (7) mix	70% (7) rent 20% (2) sharecrop 10% (1) mix	85% (17) rent ³ 15% (3) public land	91% (10) rent 9% (1) public land	78% (150) own 9% (19) rent 3% (6) public	86% (62) own 11% (8) rent 3% (2) public
Land size(acre)	45 (37%) <1 49 (40%) 1–1.5 15 (12%) 1.5–2.5 7 (6%) >2.5	2 (20%) <1 5 (50%) 1–1.5 3 (30%) 1.5–2.5 1 (10%) >2.5	65% (13) < 0.5 35% (7) >0.5	55% (6) < 0.5 45% (5) >0.5	No data	No data
Crop type	100% (121) vegetable	100% (10) vegetable	75% (15) vegetable 25% (5) fish/goats	82% (9) vegetable 18% (2) fish/goat	22% (42) vegetable 78% (150) vegetable and small animals	30% (22) vegetable 70% (52) small animals
Market orientation	100% (121) primarily for sale	100% (10) primarily for sale	100% (20) primarily for sale	100% (11) primarily for sale	53% (102) primarily home consumption 24% (46) split 23% (43) primarily for sale	62% (42) primarily home consumption 20% (15) split 18% (13) primarily for sale

¹ Some demographic data were missing so not all categories total n = 121 (100%). ² Of the total 165 households interviewed in Delhi, 121 were actively farming. The 44 households living on the agricultural land but employed in other jobs were excluded from the subsample selection. ³ The term “rent” is used to differentiate farming on privately (or corporate) owned land versus public/owned land. The farmers in Jakarta do not pay rent to the private owner. ⁴ Data on length of tenure were not collected. This is the date when participants started their garden.

Based on recent estimates that 40% of households in Delhi are self-employed, three-quarters live in unplanned settlements [30], 22% live in *jhuggies* (informal structures) [51], and 9.84% are below the poverty line [52], urban farmers in this study did not represent the extreme poor. Furthermore, households might be considered typical poor Delhi residents except that they were cultivators and agricultural laborers rather than the more common construction workers, rickshaw drivers, and domestic help. In reality, more than one-quarter (27%, $n = 44$) of the larger sample ($n = 165$) of farming households were also employed in construction, drove a rickshaw, or worked as domestic help. Although the location on the Yamuna River floodplain was unique—only an estimated 2500 households live-work on the floodplain within Delhi NCT [53] in a city of many millions of people—the study population could be considered representative of many other informal and marginalized communities in Delhi and other large cities in India.

4.1.1. Household Food Consumption Patterns

Regarding household food consumption patterns, four households (40%) reported that they consumed two meals per day, whereas six (60%) consumed three per day (Table 2). Five (50%) households consumed eggs, nearly all consumed dairy and fruits except the poorest households (20%; $n = 2$) because of the cost, and half (50%; $n = 5$) consumed meat and/or fish (three stated they were vegetarian). Households consumed less food in the summer months, and also cut back on food that spoiled more quickly (meat, fish) during the hot months. At least one meal each day was a vegetable dish and at least one was a dal (pulse/lentil) dish. All households ate roti and/or rice daily, and usually with each meal.

Table 2. Household food security among migrant farmers in Delhi.

Question	Indicator of Food Security ¹ (n)	Indicator of Food Insecurity (n)
Quantity		
How many meals per day do you eat?	60% (6) 3 per day	40% (4) 2 per day
Diversity		
How many days in the last week did you eat: (1) Staples (wheat, rice, potatoes, cereals); (2) Eggs; (3) Dairy; (4) Fruit; (5) Vegetables (specific vegetables—including the ones they grow)?	80% (8) Daily: staples, dairy, harvest vegetables; 2–3 x/week: eggs, fruit	20% (2) Daily: staples, harvest vegetables; Dairy and fruit too expensive
Access		
Access: What was the main source of your food?	90% (9) Self, other farms and market	10% (1) Market only
Hunger		
Is there ever a time of the year that you worry more about if you'll have enough food or about being hungry?	10% (1) No change	90% (9) Monsoon season
Quality		
How does your diet change during times when you're not growing/harvesting food?	60% (6) Market only	40% (4) Rely on government food

¹ Participant responses were dichotomized as relatively more or less food secure based on measures used to define food security.

4.1.2. Household Food Security

Half of (50%, $n = 5$) households consumed a little of what they grew, a few (20%, $n = 2$) planted crops only for household consumption (in addition to what they grew to sell at the market), many (40%, $n = 4$) exchanged crops with neighbor farmers, and all went to the market to buy staples and other vegetables to supplement what was being harvested. Only one (10%) household reported that they only sourced their food from the market. All reported it was cheaper to buy food in the market when compared to earnings from selling crops. One household reported that they ate better [in Delhi]

than in their home village. They spent less on transporting their crops to the market so they were able to buy more.

During the monsoon season, if the land flooded (it did not flood every year, but it had flooded more frequently and more severely in recent years), households moved to the main road into government provided tents, or they returned to their natal villages for a break. Those who stayed in tents were provided government food staples, which was reported as low quality by most households. Households usually had saved enough money to buy their food at the market during that time. Households reported that they generally did not worry about food any time of year, but that, during flood periods, it might impact what they ate. The two poorest households reported buying less food during that time. Furthermore, one family noted, 'It is more difficult to get food in the summer because no one is growing anything'. They had to buy everything in the market, but they did not go hungry.

4.2. Jakarta

Of the 20 households that participated in the Jakarta study across six sites, 11 (55%) were migrants from across the island of Java (Table 1). There was no clustering of farm plots based on migrant status. In other words, migrants and locals were interspersed across the six sites. Migrant farmers' fields varied in size from 0.1 to 1.3 acres (0.04 to 0.51 hectares). With the exception of one site, the farmers grew vegetables and horticulture crops, with a total of 23 different crops grown across all fields. The most common crops were *kangkung* (water morning glory), *bayam* (Chinese amaranth), and *caisim* (bok choy). At one site, instead of vegetable and horticulture crops, farmers (18%, $n = 2$) raised catfish, male goats, and ducks.

4.2.1. Household Food Consumption Patterns

Almost every household reported that they consumed three meals per day. Two (10%) that reported skipping breakfast was based on personal preference rather than scarcity (Table 3). All households consumed eggs, dairy, fruit, meat, and fish. There was no change in dietary intake due to seasonality. Participants reported that there were occasional harvest failures during the monsoon season, but the main source of household food was from the market, not the farm.

Table 3. Household food security among migrant farmers in Jakarta.

Question	Indicator of Food Security ¹ (n) Quantity	Indicator of Food Insecurity (n)
How many meals per day do you eat?	100% (11) 3 per day ²	0%
Diversity		
Do you eat: (1) Eggs, (2) Dairy, (3) Fruit, (4) Meat or fish? ³	100% (11)	0%
Access		
What is the main source of household food?	82% (9) Market plus some harvested vegetables	18% (2) ⁴ Market only
Hunger		
Is there ever a time of the year that you worry more about if you'll have enough food or about being hungry?	100% (11) No	0% Monsoon season
Quality		
How does your diet change during times when you are not harvesting?	100% (11) No	0% Yes

¹ Participant responses were dichotomized as relatively more or less food secure based on measures used to define food security. ² Includes two farmers who skip breakfast due to personal preference. ³ All farmers reported eating each of these food items. However, no information was given regarding the frequency of consumption. ⁴ These farmers raised animals for market only. They did not consume the animals.

4.2.2. Household Food Security

The farmers were generally satisfied with their household food security. To a limited extent, farmers growing vegetables consumed a small amount of their vegetable crops (82%, $n = 9$). Primarily to provide variety from what was offered in the local markets. On the other hand, the farmers raising fish, ducks, and goats (18%, $n = 2$) did not consume their crops. There was no exchange among farmers. However, two households (18%) reported giving crops for free to nearby residents if they were requested to do so.

All farmers reported that they were able to purchase food from local *warung* (small convenience shops) and cook at home, which shows their capability to obtain other types of food besides their own produce to meet nutritional needs. The income generated from agricultural practice was generally enough to support their daily life including purchasing food. An emergent finding was that, despite repeated eviction, three (27%) of the migrant farmers persisted by finding other nearby vacant lands to be farmed.

4.3. Quito

Among the 192 participants that were included in the sample population, 74 (39%) had migrated to Quito (Table 1). Migrants did not vary significantly from participants who were from Quito in terms of the level of education, income, land ownership, or health indicators. Migrants were often from rural provinces and cited that as a motivating factor for them to participate in a program on urban agriculture. They had grown up helping their parents with agricultural work and wanted to continue the practice in an urban setting. Most migrants had a garden for the purpose of feeding their families, with 62% ($n = 45$) consuming all or most of their garden products. Migrants did vary from non-migrant participants in that they were less likely to sell their garden products. Just over 80% ($n = 95$) of participants from Quito sold some garden products, compared to 65% ($n = 48$) of migrants. Furthermore, when migrants did sell their products, they were more likely to be in the bottom quartile of sellers compared to producers from Quito (33%, $n = 15$ vs. 17%, $n = 15$). They made less than \$25 in sales per month.

4.3.1. Household Food Consumption Patterns

In household food consumption patterns, migrants varied little from non-migrant participants. A large majority of migrants (86%, $n = 63$) said that they had learned a great deal about healthy eating because of their participation in the AGRUPAR program (Table 4). Interviews with participants revealed that, prior to entering the program, many of them ate a starch heavy diet (rice and potatoes) and did not understand the importance of a diverse diet. As a result of their participation in the program, the vast majority of migrants said that they had changed their eating habits (97%, $n = 71$) and that they now ate foods that they did not eat before joining (86%, $n = 62$). In addition, 90% ($n = 66$) of migrants said that they now ate more vegetables than they did prior to joining the program. Participants felt that these changes in household food consumption patterns had a meaningful impact on the health of their families. Nearly all migrant participants (99%, $n = 71$) felt that the nutrition of their families had improved because of their garden.

Table 4. Household food consumption patterns among migrant farmers in Quito.

Question	Yes (n)	No (n)	
Since starting a garden, have you changed your eating habits?	97% (71)	3% (2)	
Since starting a garden, do you eat new foods that you did not eat before?	86% (62)	14% (10)	
	A great deal	A little	No (nothing or not at all)
Through your participation in AGRUPAR, how much would you say you learned about healthy eating?	86% (63)	12% (9)	1% (1)
Do you believe having a garden has improved the nutrition of your family?	92% (66)	7% (5)	1% (1)

4.3.2. Household Food Security

Food insecurity appeared to be relatively rare among participants, with no meaningful differences between migrants and non-migrants. Participants were asked how much they had worried in the past month about having enough food to eat. Among migrants, the vast majority (74%, $n = 54$) said they had not worried at all, 22% ($n = 16$) said they had worried a little, and just 4% ($n = 3$) said they had worried frequently (Table 5). To understand if any families had suffered from hunger, participants were asked if anyone in the family had gone hungry in the past month because there had not been enough food. Nearly all participants (96%, $n = 70$) said no, with just 4% ($n = 3$) saying that it had happened a few times. No one said it happened frequently. Furthermore, participants felt that having a garden had made them more food secure. Participants were asked if they worried less about having enough food to eat that they had a garden, compared to before, when they did not have a garden. Among migrants, a strong majority (75%, $n = 55$) said they worried less now and just 3% ($n = 2$) said they had the same level of worry. The remaining 22% ($n = 16$) said that they had never worried about having enough food.

Table 5. Household food security among migrant farmers in Quito.

Question	A great deal (n)	A little (n)	Not at all (n)
In the last month, how much did you worry that you or your family would not have enough food to eat?	4% (3)	22% (16)	74% (54)
	Often	A few times	Never
In the last month, has anyone in your household gone hungry because there was not enough food to eat?	0%	4% (3)	96% (70)
	Less worry	Same worry	Never worried
Do you worry less about having enough food to eat, now that you have a garden?	75% (55)	3% (2)	22% (16)

5. Discussion

The aim of this research was to explore household food consumption patterns and food security among migrant urban farmers in three rapidly urbanizing cities. Findings contribute to evidence that urban residents who participate in urban agriculture may be in a better position to meet nutritional needs through increased quantity, quality, and diversity of food. In general, we found that participation in both market-oriented and non-market oriented urban agriculture had a positive impact on household food security among participants through direct (self-consumption) and indirect (improved income, improved access) means. Given the different profiles of migrant farmers and data collection methods

employed in each case city, we first highlight key findings that are case-specific and then compare trends across the three cases to generalize more broadly in terms of the current state of the research.

Beginning with Delhi, the key findings were that households ate a variety of vegetables, ate chicken, fish and/or meat, and some consumed three meals per day. In the summer monsoon season, when farmers were not growing crops due to heavy rains and flooding, they were less food secure. During that time, many families reported that they had saved enough to continue to buy their own food items and did not have to rely on “low-quality” foodstuff provided through government aid. Even though the majority of households bought most of the food they consumed in the local market, the fact that it was ‘more difficult to get food in the summer’ is an indication that having access through farming enabled them to be more food secure. In the urban context, farmers lived closer to each other and grew different vegetable crops (as compared to the rural context where they were more physically distant due to larger plot sizes and often grew the same cereal or grain crops). Proximity and variety allowed for exchange, which increased quantity, quality, and diversity in diets. It also prevented gaps in access between harvests since someone was always growing something except during the monsoon season. Although not directly asked, one household reported that they ate better in Delhi than in their home village because they spent less on transporting their crops to the market, and were, therefore, able to buy more, which could be true for other households. This could also be a reason that non-vegetarian families were able to afford and consume chicken, fish, and/or meat regularly.

There were some similarities with the context of Jakarta in terms of a primary focus on market-sale and limited self-consumption. In general, however, the migrant farmers in Jakarta were relatively food secure, buying food at the local markets and not relying on the neighbor exchange. This could be due to different market rates, or a variety of other background characteristics that were not captured in this study. Another difference was that there is almost no seasonal variety in Jakarta. Although there were occasional harvest failures during the monsoon season (due to flooding), the farmers’ food security was generally not greatly impacted as compared to Delhi with consistent annual monsoon flooding, which could last more than a month. Lastly, the finding that evicted migrant farmers continued to farm by finding other nearby vacant land indicates that farming was a valuable job for the migrants. In addition, this is a potentially stable source of income.

While different from the market-oriented practice in Delhi and Jakarta, Quito, participants also appear to have decreased their food insecurity through urban agriculture. First, home gardens provided a consistent, accessible food source. Nearly half of the participants said that having a garden helped them because, even when they did not have money available to purchase food, they could always eat from the garden. One participant said that, before she started her garden, “*si no había plata, no había nada* (if you didn’t have money, you did not have anything)”, but now she could just go outside and grab a few things to make a soup. Second, having a garden increased participants’ food security by saving them money on food purchases. Because participants used products from their gardens, they did not have to purchase as much from local markets, which saved them money each month. When asked what they used these savings for, nearly half of all participants said that the savings was used to buy additional food. Participants used the money they saved to purchase better quality foods and food they could not afford previously, such as meat or fruit, which is similar to Delhi farmers. The findings from this research indicate that food insecurity among urban agricultural producers in Quito appears to be much lower than expected among this population. Weigel and colleagues conducted a comprehensive study of food insecurity in Quito in many of the same neighborhoods as this research, and found much higher levels of food insecurity [46]. Among the 794 households that were included, the vast majority (81%) were food insecure to some degree. Given that Weigel et al.’s study was much more comprehensive (gathering extensive data on household characteristics, anthropometric measures, and even blood hemoglobin levels), it is difficult to compare the two studies. However, if our findings are even somewhat reflective of food insecurity, it appears that having a garden contributes positively to household food security.

Although each case city expresses a different form of low-income migrant practice of urban agriculture and data collection methods varied, findings show a similar trend that growing food in the city offers some protection against food insecurity. The literature highlights the higher cost of fresh and nutritious foods in the city [12,13], and the lower quality resulting from perishable fruits and vegetables transported from rural areas or imported from abroad [14]. In all three cases, households reported either earning or saving more because of participation in urban agriculture, which they used to purchase quality food. In Delhi and Jakarta, this was likely due to the shorter supply chain from the urban farm to the urban market, which decreased the price differential between farmers and consumers [54]. Conversely, in the case of Quito, producers were actually at a disadvantage in terms of price because their products (organic/agro-ecological) sold for significantly more than conventional products at the market. However, they had advantages in terms of quality and of being integrated in the community (and developing relationships with their customers/consumers). Households that consumed crops directly from their garden/farm or from a neighbor potentially improved the nutritional quality of their diets. Our findings also support the literature that finds households involved in agricultural activities tend to enjoy greater quantities of food, consume more fruits and vegetables, and have a more diverse diet [7,15,16,18,55].

5.1. Implications and Significance

There are notable implications that could be inferred from this exploratory case-study. Although much of the literature views urban agriculture as an important direction for the sustainability of cities, urban agriculture can benefit both the urban poor and more affluent city-dwellers by targeting gaps in the food system, have a positive impact on urban development, and raise the quality of life and livelihoods through increased employment opportunities and improved access to high quality food and social opportunities [56]. Thornton asserts that the “general sweeping statements of [urban agriculture’s] importance and potential to benefit the environment and household food security have been based on ‘fragmentary research’, as opposed to its actual impact ‘on the ground’” [57]. Through these three cases, we offer empirical evidence that urban agriculture can positively impact household food security of practitioners through both direct (self-consumption) and indirect (increased income and savings) pathways. Given that we did not specifically ask about earned/saved income or food purchases, the consistency with which participants mentioned food purchases indicates that having a farm/garden, and the earning/savings that accompany it, have a notable impact on food purchasing power. Based on these initial findings, more research should be done to explore the economic intricacies of urban agriculture and food security. Another area of inquiry we suggest is to investigate the link between production and consumption of fruits and vegetables among urban migrant farmers to more fully understand decision-making related to increased income earning potential versus importance as a dietary source for macronutrients and micronutrients.

5.2. Limitations

Despite the varied context and methods applied to each case city, the overall consistent findings strengthen each individual case. However, there are notable limitations related to a small sample size in the case of Delhi and Jakarta. These limitations include sampling methods (in the case of Quito, migrants who did not participate in AGRUPAR were not included) and lack of cross-sectional comparison to non-migrant farmers and non-farming low-income urban residents. Another limitation is the cross-sectional design. Therefore, a longitudinal comparison of food security pre-migration and post-migration would fill an important gap.

Exploratory qualitative research with small sample sizes has potential limitations that may influence the reliability and validity of findings. The notable limitations to reliability in this research relate to completeness, culture, language, and fatigue. Because of the conversational nature of the household interviews, and the translation to English, there could be biases related to stability and consistency of the research measures. Lastly, interviews were designed to be limited to less than 30 min,

but may still have been considered time-consuming by participants. Some responses may have been offered after reaching a level of fatigue that we (the interviewers) may not have noticed.

6. Conclusions

As growing populations in urban areas demand greater food supplies, coupled with a rise in rural to urban migration and the need to create livelihood options, there has been an increase in urban agriculture worldwide. Agriculture is a livelihood for nearly half of the global population, with an estimated 25% to 30% of urban populations involved in the agro-food sector [58]. Therefore, it is unsurprising that rural migrants pursue agriculture in the urban context when given the opportunity. The evidence linking participation in urban agriculture and household food security suggests that migrants who pursue agriculture in the city as a livelihood could be in a better position to meet nutritional needs, which makes this a promising area of research to pursue. The findings from this exploratory study suggest an important and under-researched link between rural-urban migrants, food security, and urban agriculture. Despite limited land availability, production of high-value vegetable crops enables small plots to produce yields sufficient to contribute meaningfully to family food consumption and profit in the short urban supply chain.

These findings are particularly relevant in the context of the Sustainable Development Goals (SDGs) put forth by the UN, which guide development goals and priorities. The second SDG is to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture [59]. Despite the SDG's emphasis on food security and agriculture, there has been some criticism in that the SDGs fail to address the increasing urban face of food insecurity by focusing on the rural context of scarcity (under-nutrition) without responding to the critical issues of urbanization and nutrition transition of nutrient poor food (malnutrition) [10]. Given that rural-urban migrant trends are predicted to continue, which puts increased pressure on rural agricultural landscapes as well as urban food systems, we call for more case studies to expand the evidence based on the potential far-reaching impacts that urban agriculture has in the lives of low-income urban residents.

However, we highlight contextual nuances that predicate urban agriculture as an effective strategy for addressing household food security of urban migrants and the urban poor in general. Underlying the positive contribution to household food security through direct (self-consumption) and indirect (improved income, improved access) means, a variety of barriers and limitations were noted by participants in this study. One of the most obvious was insecure land tenure. Farmers in Delhi and Jakarta risked eviction and potential crop loss—but noted the benefits outweighed the risks. Another risk, particularly to Delhi farmers, was crop loss due to annual monsoon flooding, which continues to increase in frequency and severity due to climate change. Even with government aid, Delhi farmers found themselves less food secure when they and/or their neighbors were not harvesting crops daily. Shifting to Quito, we found education to play an important role in the transition from the rural to the urban environment. Participation in AGRUPAR taught farmers organic growing practices and healthy eating, which gave them tools to improve their eating habits. Rural migrants often come from places where food is less diverse but fresher since they are closer to their food source. In the urban environment, this relationship with food inverses with access to more diverse, but less fresh food. The opportunity to participate in urban agriculture—whether a kitchen garden or small-scale farm—could prevent rural migrants in a state of undernutrition to transition to a state of malnutrition in the move to the urban environment. If further research supports this hypothesis, the implications are multiple and point to a need for substantial and systemic support through policy change, infrastructure improvements, and outreach/education.

The aim of this research was to explore household food security among migrant urban farmers in three rapidly urbanizing cities: Delhi, India; Jakarta, Indonesia; and, Quito, Ecuador. Our findings add to previous research and provide further support showing that urban agriculture can help improve food security by increasing both quantity and quality of food. This is particularly relevant for low-income migrants. In light of increasing urban populations and urban poverty, we suggest a greater emphasis

on understanding food insecurity and the potential of agriculture as a pathway to realizing the SDGs in the urban context.

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