Emirates Journal of Food and Agriculture. 2021. 33(6): 465-474
doi: 10.9755/ejfa.2021.v33.i6.2712
http://www.ejfa.me/

RESEARCH ARTICLE

The study of the practice of growing food at home in the UAE: Role in household food security and wellbeing and implication for the development of urban agriculture

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ABSTRACT

Home-grown food products are getting more and more prominence around the world owing to many factors including the increasing demand for fresh food materials, consumers' awareness of food-health nexus, and the increasing public awareness of environmental impacts of food production at home and resource-saving, and others. The main objective of this study is to assess the nature of the homestead food production system in the UAE and determine its significance for household food security and identify the factors that affect households' engagement in food production at home. Primary data was collected through reconnaissance in communities, online survey, and face-to-face interviews. The findings show that 88% of a sample of households (N = 196) interviewed produce various food products in homestead gardens. Home-grown food products are fruits, vegetables, spices, eggs, and small ruminants. The use of modern production methods like hydroponics and aquaponics is still uncommon. The sample households produce on average 21 kg of fruits and vegetables, 26 kg of mutton per month, and 30 pieces of eggs per week. The home-grown food products are mainly used for home consumption; some part is given to relatives and friends. Reasons for producing food at home include the need for self-sufficiency, reduce food purchase expenses, environmental awareness, the food being healthy, and as a hobby. The majority of the sample households would see continue producing in the future. Many factors influence the household's decision to grow food products in their homestead. Among these, availability of space, environmental awareness, availability of farmworkers, the need to reduce food purchase bills, and knowledge of home-grown food safety requirements. Analysis of the logistic model reveals that households who have not enough garden space are less likely to practice while those who consider reduction of food purchase expense, have environmental awareness, are able to hire workers for garden activities, and have knowledge of home garden food production tend to have a high likelihood of practicing homestead production. This study concludes that homestead food production is important for the urban households in the UAE and has a potential to be a basis for the development of urban agriculture. It needs more public awareness raising about its importance, technical support in demonstration of best practices and use of modern technologies (like a mini hydroponics and aquaponics), the food safety requirements of homestead based for products.

Keywords: Food products; Food security; Homegrown; UAE; Urban agriculture

INTRODUCTION

Home-grown food (food production in the backyard) has been increasingly practiced in countries of the world owing to many reasons including the increasing demand for fresh food materials, consumers' awareness of food-health nexus, and the increasing public awareness of environmental impacts of food production at home and resource-saving, the need for continued attachment to nature and heritage. There is an emerging trend of urban agriculture not only related to the production and supply of fresh own-grown food but also becoming part of the greening of the urban landscape and the system of urban agriculture. The Food and Agricultural Organization (Veenhuizen and Danso, 2007) report shows that an estimated 200 million urban residents produce food for the urban market, providing 15 to 20 percent of the world's food. Altieri (2019) wrote on how urban agriculture can improve food security in US cities. The research report further noted that Urban farming has grown by more than 30 percent in the United States in the past 30 years.

The practice of own fresh food production by the UAE farmers is a common practice. The small farms in the

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Received: 15 April 2021; **Accepted:** 02 June 2021

UAE are largely hobby farms that are not commercially oriented. A survey conducted by International Center for Biosaline Agriculture ICBA in 2012 (not published) in the Northern emirates revealed that 70% of the surveyed farms are hobby farms where the main purpose of these farms is the production some vegetables and meat animals for home use as well as for sharing with relatives and friends but not for the business or commercial purposes. These and other evidence in the UAE remind us that the practice of home-grown food is prevalent in the UAE if not well-accounted for.

Although not systematically studied or documented, there is ample evidence for the presence of the practice of growing food at home or homestead in the UAE. Andrews (2012) explained the urban agriculture experience of the UAE reporting about the case of a Farm at the Al Barari Estate. Hamburgh (2019) discussed a 'guide to growing your own vegetable' in the UAE. It says that the guide provides the tips and tricks one needs to know to get a delicious harvest. Some simple tools used in garden cropping are described while examples of planting materials (seedlings) suppliers are also given. In a news article for The National, Dennehy (2018) reported that at least 20 percent of the fruit and vegetables consumed in the UAE are now grown domestically. This may include fruits and vegetables grown in the backyard or at home gardens. It is mentioned in the same report that the UAE Ministry of Climate Change and Environment is working to increase the amount of local produce grown locally by 5 to 10 percent a year.

A news paper in the UAE named Lifestyle (Tusing, 2021) has reported an extensive account of various individuals' experience about growing own food products at home in the UAE. It states that UAE residents expound the health, monetary and environmental advantages of harvesting their own vegetables and herbs.

This study attempts to address the following research questions: which urban households in the UAE grow food products in homestead? What are the drivers of home growing of food? How do households perceive home-grown food? Is homegrown food significant in the family food supply?

The main objective of this study is to assess the nature of the practice of home-growing of food by households in the, and to determine its significance for household food security and wellbeing in the UAE. It has the following specific objectives:

i. Investigate the types of food products produced and the quantity produced
ii. Assess the contributions of home-grown foods to household food needs
iii. Study the perception and attitude of urban households about home-grown food
iv. Investigate the drivers and determinates of the practice of producing food products at home
v. Draw recommendations for expanded adoption of the practices of growing own food at home.

MATERIALS AND METHODS

Data source and method of collection

This study of the practice of home-grown food in the UAE communities took a socio-economic approach. A preliminary *reconnaissance or exploratory* survey was made by the research team to assess the prevalence of practices of home growing of food. An online survey of the public was made to generate primary data on the perception and attitude about home-grown food products and their practices. University students who come from different cities and emirates also participated in the survey by undertaking a face-to-face interview with their parents using a survey questionnaire. The survey included questions on the socio-demographic characteristics of urban households, the practice of crops and animal production in home gardens, the rationale of homestead food production, types of food products (crops and livestock), output, the challenges faced, the future outlook of interviewees about growing food at home, etc. The survey questions also include the perceived impacts of home-grown food: environmental, economic, nutrition and health, etc. Such procedure benefited from initial exploratory surveys in selected locations like Al Ain city of Abu Dhabi emirate. 210 households were surveyed from all the emirates of the UAE. Of these, 196 have valid data. Data was compiled using Excel Spreadsheet. The Statistical Package for Social Sciences (SPSS) and Stata software were used for data analysis.

Model specification

Descriptive statical methods are employed to assess the practices of growing food products at the homestead by the households. In Addition, an econometric model was developed to analyze the factors that influence households' practice or adoption of producing food products in the homestead. For this purpose, a logistic regression model is found to be appropriate to fit the survey data. The rationale for selecting this model is the fact that the response variable (i.e. practicing home production of food) is a binary one. The linear logistic model (Cramer, 2002) assumes a dichotomous dependent variable Y with probability π, where for the i^{th} case,

$$\pi_i = \frac{\exp(n_i)}{1+\exp(n_i)}$$

Or

$$\ln\frac{\pi_i}{1-\pi_i} = n_i = \grave{X}i\,\alpha$$

Hence, the likelihood function l for n observations $y_1 \ldots y_n$ with probabilities $\pi_1 \ldots \pi_n$ and case weights $h_1, \ldots, h_n$ can be written as

$$l = \prod_{i-1}^{\eta} \pi_i^{\,hi\ yi}(1-\pi_i)^{hi(1-\ yi)}$$

Taking the logarithm of *l*:

$$L = ln\ (1) = \sum_{i=1}^{n}(h_i\ \ y_i \ln\ (\pi_i)$$
$$+h_i\ (1-y_i)\ln\ (1-\pi_i))$$

and the derivative of L with respect to *j* is

$$L^* X_i = \frac{\partial L}{\partial \alpha_j} = \sum_{i=1}^{n} h_i\ (y_i - \pi_i)$$

The a tells us how a one-unit increase in the independent variable increases the log-odds of being higher than category j (due to the negative sign). The dependent variable in the model is practicing home garden food production. Independent variables that are hypothesized to have influence on home garden food production are the availability of space for growing crops and rearing animals, need to reduce food purchase expenditure, hobby, self-sufficiency, environmental awareness, having knowledge and experience about home food production, availability of labor, and constraints including the high heat in summer and water salinity.

RESULTS AND DISCUSSION

The results and discussion presents the descriptive analysis and the logit model analysis. Data were collected from a sample of 210 households interviewed during the survey. Of these households, 196 have valid data and included in the analysis. 62% of the sample are from Abu Dhabi while the remaining are distributed over the other six emirates. (see Fig. 1 and Table 1). 88% of the sample households responded that they produce different kinds of food products at home while 12% said they do not.

Characteristics features of homegrown food products and production system

The surveyed households produce 10 types of vegetable crops and 15 types of fruit crops at their home or home garden. Households also produce eggs and rear meat animals (sheep and goats). 27%, 30%, 27%, 7%, 5%, 6%, and 1% of the sample households produce fruits, vegetables, spices, eggs, chicken meat, mutton, and fish, respectively (see Table 2).

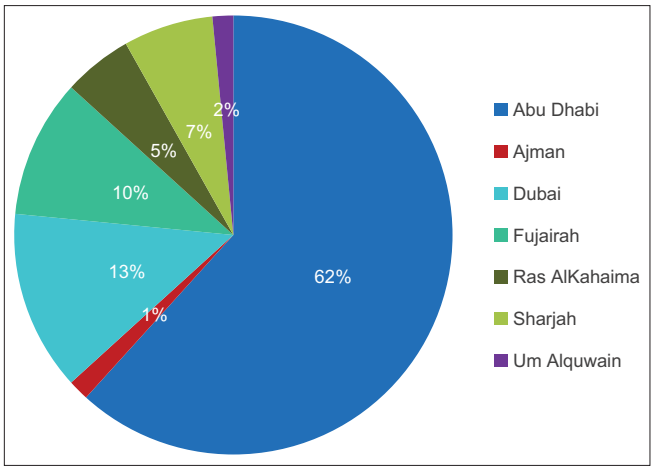

Fig 1. Distribution of a sample survey households (N = 196).

Table 1: Households who produce food products at their home or homestead

Emirate	Cases	No		Yes	
	N	Nr	%	Nr	%
Abu Dhabi	121	15	12%	106	88%
Ajman	3	0	0%	3	100%
Dubai	26	6	23%	20	77%
Fujairah	20	0	0%	20	100%
Ras Al Khaimah	10	0	0%	10	100%
Sharjah	13	3	23%	10	77%
Um Al Quwain	3	0	0%	3	100%
Total	196	24	12%	172	88%

The most common fruits that are grown by households include citrus (48%), mango (38%), pomegranate (28%), blackberry (23%), strawberry by 18% of the sample households. Similarly, common vegetable crops that are grown include tomatoes, pepper, cucumber, lettuce, carrot, and eggplant produced by 56%, 37%, 23%, 19%, 16%, and 12% of the sample households, respectively. A study by Bellows et al. (2008) noted that one-third of the 2 million farms in the United States are located within metropolitan areas, and produce 35% of U.S. vegetables, fruit, livestock, poultry, and fish.

Most of the households use a traditional open garden place to produce fruits and vegetables. The use of modern production methods like hydroponics and aquaponics is very rare. The introduction and adoption of these modern techniques will have a big impact on the ability of households to produce fresh food at home. Becraft (2017) studied the potential of improving food security in the Bahamas by implementing hydroponics for home use and

Table 2: Types of food products produced at home in the UAE (Number of sample households)

Food products	Freq.	Percent
Fruits	128	27%
Vegetables	144	30%
Species	110	23%
Eggs	32	7%
Chicken meat	26	5%
Mutton	31	6%
Fish	6	1%
Total cases	172	100%

its economic viability. This study done at the University of Illinois focused on simplified hydroponics systems revealed that a relatively low start-up cost in combination with effective implementation and education strategies could make the application of home-use of hydroponic systems to increase food security on the island.

The majority (70%) of the surveyed households reported that there has been no food safety and quality inspection made by the competent authorities. On the other hand, 77% have said they know about the food safety and quality requirements of their homegrown food products. Surveyed households reported that they spend an average of 1200 AED per month on homestead food production. This amounts to 4% of the average monthly household income reported for the sample survey. According to a study made by Csortan, et al. (2020) in Australia, smaller gardens are found to be more intensive than larger gardens, requiring higher inputs, but also returning higher outputs per unit area.

A study made on urban agriculture by McDougall (2019) in Australia related to the economic and embodied energy analyses concluded that growers were relatively inefficient in their use of material and labor resources. The study suggests balancing the sustainability of urban food production with the cost of inputs is important to determine the trade-offs required to achieve high yields.

The contribution of homegrown food products to the household food economy

The data shows that the sample households produce 21 kg of fresh fruits and vegetables from their homestead per month during the growing season, mainly in the winter months. On average, 26 kilograms of mutton and 17 kg of fish are produced per month (see Table 3).

Researchers consider urban agriculture as a way to enhance food security. A study conducted by Sanyé-Mengual (2018) in Italy revealed that a home garden could satisfy the food requirements of between 1 and 2 members of the household. A report of a study based on interviews of 360 households conducted in Malaysia (Rezai, et al., 2016)

Table 3: Production of homegrown products (quantity per month)

Type of products	N	Mean	Std. Dev.	Min	Max
Fruits, kg	110	10	11.92	0.5	70
Vegetables, kg	116	11	12.31	1	50
Eggs, Nr (per week)	54	31	48.65	2	250
Fish, kg	9	17	13.10	3.6	40
Mutton, kg	42	26	19.54	2	70

shows that there is a positive statistical association between obtaining enough quantity of food and an adequate diet through engagement in urban agriculture. The study found that food security can be derived from urban agriculture since it provides sufficient quantities of food, appropriate nutrition, cost-effective food supplies, and a reduction in food bills. In a study conducted in South Africa that evaluated the impact of homestead food programs on household food insecurity using surveys of 500 households, Bahta et al. (2018) reported that the program significantly reduced food insecurity among rural households by as much as 41.5%.

The studied sample households report that they use the home-produced food products in various ways. 40% say they use at home for their consumption while close to 50% use at home or give away some to others. Only 15% say they sell to the market (see Table 4).

A study on urban agriculture was carried out in 2015 and 2017 in the cities of Sydney and Wollongong, in Australia (McDougall, 2019). It concluded that growing food in cities for human consumption could be one means of increasing global food supply in the face of rising population and global food security concerns. The study found that yields of urban producers were nearly twice the yield of typical Australian commercial vegetable farms.

A study conducted in Japan (Tatebayashi et al., 2019) found about the role of home garden food production and food sharing. It revealed the proportions of foods acquired through self-production, sharing networks, and purchases by systematic food category, and quantified the monetary and nutritional values of the non-market foods. The study cases, the residents of Hachijo Island, shared various seasonal foods within and beyond the island, and the non-market food was beneficial to their health. More than 20% of the islanders' annual consumption of potatoes, vegetables, seafood, and fruits was obtained through the food-sharing networks.

Perception about the practice and future of homegrown food products

The main reasons for producing food products at home as reported by interviewed sample households are to be self-sufficient, to reduce food purchase expenses, and the

fact that fresh and home-produced food products are considered healthy (see Fig. 2).

Other reasons suggested by the surveyed households are considering the practice as a citizen's duty (12%) and environmental awareness (34%). Elsewhere, studies have reached a similar conclusion. In a study conducted in New Zealand, Ghosh et al. (2014) reported that local food production is an integrated pathway to achieving a sustainable food supply for the future, appropriate urban ecosystem maintenance, and meaningful environmental impact reduction. Kinsley (2020) reports that the diverse reasons why many Americans convert their home into a locus of small-scale farming growing include reorganizing their relationship with nature by cultivating an oasis of simplicity in an increasingly industrialized, commodified, and urbanized world; following a philosophy of self-sufficiency that echoes the rugged individualism of the nineteenth century; viewing food production as a way to find friends, build community, and address economic and racial inequalities. The study further noted that homesteading serves as an expression of their ability to protect themselves and others by integrating the garden and the machine and dissolving the country/city divide into a perceived sphere of safety. The surveyed households perceive different benefits of growing food products in their homestead. These are food products being free from preservatives and pesticides, nutritious, and being a source of a balanced diet. Few said they do not know the benefits of homegrown products (see Fig. 3).

The review of literature on the attitude and knowledge about backyard food production reveals its effects on resource-saving (e.g. water), reduction of environmental footprint through reduced use, and elimination of harmful chemicals are among the driving forces for increasing attention given to this system of food and non-food crops production. In Melbourne, Australia, "Very Edible Gardens"**,** a permaculture design consultancy (https://www.veryediblegardens.com.au/iveg/why-grow-food), enumerates the benefits of growing own foods under the notion '*Why grow foods?"*. Among the listed benefits are: "being organic; home-grown fruit, vegetables, and herbs are fresher, more nutritious, and more delicious than the conventionally farmed. It is also mentioned that chemical preservatives are applied but do nothing for human health; the fruit and vegetables in supermarkets have been bred for appearance, a long shelf-life, and resistance to bruising during transport while the fruit and vegetables grow in own back yard, on the other hand, have been bred for being nutritious and delicious. The benefits are also described as being the best way to ensure food security for own family and neighbors. Nogeire-McRae et al. (2018) reported that urban agriculture can link socioeconomic and health

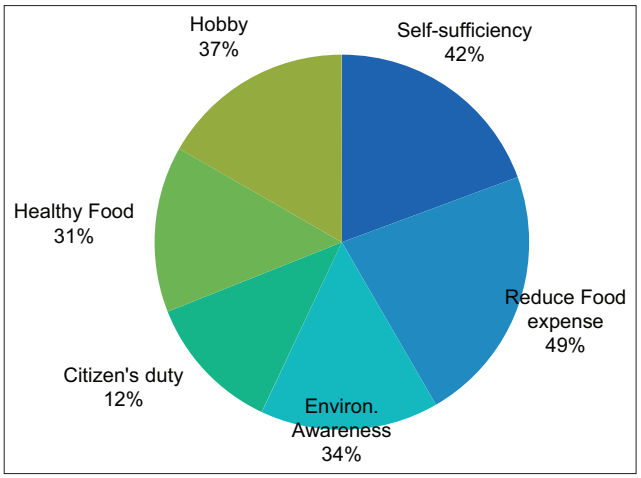

Fig 2. Reasons for producing home-grown food products (the total is >100% since households report more than one type of reasons). N = 172.

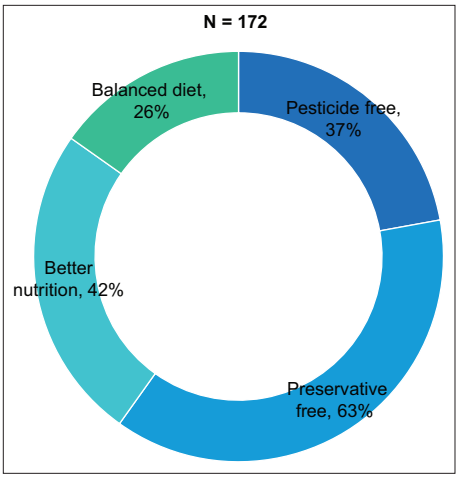

Fig 3. Perceived benefits of home-grown food products. The total is >100% since households report more than one type of benefit.

systems, support education and societal engagement, and contribute to a range of conservation goals, including nutrient recycling and biodiversity conservation.

Similarly, the "Very Edible Gardens" in Australia mentioned the health benefits where the food gardening is considered to be a gentle, relaxing, and stress-lowering form of exercise, and connects people with the seasons and the cycles of nature. It also describes the environmental benefits of urban agriculture mentioning that it reduces water and carbon footprints when it replaces lawns: growing food at home has reduced carbon footprint by reducing the food miles of what people eat. The report noted that the growing, processing, packaging, storing, and transporting of the food eaten make up 37% of the average Victorian's eco-footprint in Australia. The same report further mentions that freshly eaten home-grown food produces no greenhouse emissions; it is free from genetic modification, chemical pesticides, fertilizers,

herbicides, and pesticides; helped improving the health of soils and waterways by not creating demand for agricultural chemicals and practices that negatively affect soils, waterways, and fragile environment. Home garden food production is also praised for using significantly less water relative to the amount of food harvested.

In their study about ecosystem services in Vall Fosca (Catalan Pyrenees), Calvet-Mir et al. (2012) mention that one type of agroecosystem that remains relatively unexplored from an ecosystem service perspective is home gardens. Blechaa and Leitner (2014) reported that since the year 2000 increasing numbers of urban residents in the USA have begun keeping chickens and other small livestock in backyards. The authors noted that in the study conducted interview participants critique the industrial food system, urban economies, and social life, and "think differently" about human-animal relations and productive animals in cities. The report noted that through chicken-keeping practices, respondents establish sustainable backyard agro-ecosystems, build sociability, resist consumerism, and work simultaneously to improve the life and health of animals, humans, and the urban environment.

A study conducted in Italy (Sanyé-Mengual, 2018) reports that environmental assessment indicators of garden production related to organic fertilization, use of tap water, mineral fertilization, and pesticides were the most contributing elements of the entire life cycle. Furthermore, the relevance of garden design and crop selection was a determinant in the eco-efficiency results. Doing a detailed review of urban agriculture in European cities, Madaleno (2001) reported that as urban people in the industrialized world (Western European and North American urban populations) search for green space, cities are being transformed, spreading through the countryside, intertwining built-up and farming spaces. Dimitri et al. (2016) also reported that urban farming is becoming more common in the USA, as food-based entrepreneurs seek to make money farming in the city. Yet many urban farms are concerned with other factors in addition to food production, and thus have incorporated social goals into their missions.

90% of the households surveyed in the current study who are producing food at their home garden say they would continue growing food at home in the future. If proper technical support and access to inputs are improved, and awareness is raised on the quality and safety requirements of the home-grown food products, the practice may contribute to the future development of urban agriculture in the UAE.

Challenges faced

Only 38 percent of the valid sample households (N =196) have reported that they face some problems in home garden food production. Given that food production at home mainly use open garden plots, the high summer heat is considered to be one of the challenges faced by 64% of those who said they face problems (See Fig. 4).

Storage problems and water salinity are mentioned by 22% and 43% of the sample, respectively. Studies conducted elsewhere also confirm similar concerns regarding the challenges faced in backyard food production. Wortman and Lovell (2013) reviewed abiotic environmental factors that influence urban cropping systems, including soil contamination and remediation; atmospheric pollutants and altered climatic conditions; and water management, sources, and safety.

Only 30% of the sample households who produce food products in homestead acknowledge that there is a food safety inspection done by the Abu Dhabi Food Control Authority (ADFSA) regarding the food products they produce at home garden. On the other hand, 70% of the sample households said that they know food safety requirements for food products produced at home gardens. In terms of the drawbacks of homestead and urban farming, Brown et al. (2016) noted that concerns about soil contamination in urban areas can impede urban agriculture. Lead is the most common contaminant in urban areas. The authors have reviewed direct (soil ingestion via outdoor and indoor exposure) and indirect (consumption of food grown in lead-contaminated soils) exposure pathways. They suggest that the benefits associated with urban agriculture far outweigh any risks posed by elevated soil lead.

A study made in the United Kingdom (Hough et al., 2004) that focused a risk assessment of metal exposure to population subgroups living on, and growing food on, urban sites showed that food grown on 92% of the urban area presented minimal risk to the average person subgroup. The report, however, noted that more vulnerable population subgroups (highly exposed person

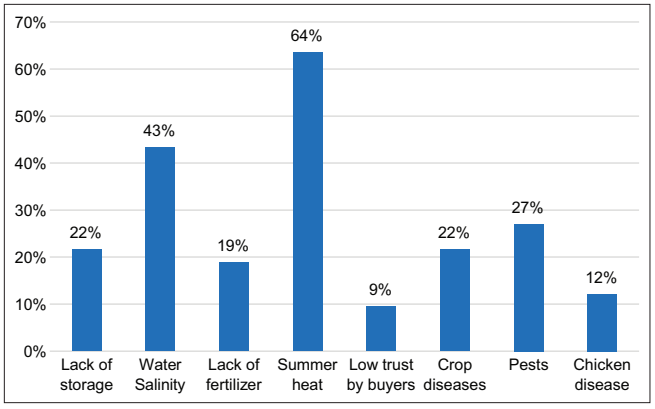

Fig 4. Problems faced in homegrown food production (N = 74).

and the highly exposed infant) were subject to hazard index values greater than unity. The study highlights the importance of site-specific risk assessment and the "suitable for use" approach to urban redevelopment. On the otherhood a study based on the assessment of water and Nnitrogen (N) budgets over a 1-year period for typical urban vegetable gardens in Lisbon, Spain, (Cameira, et al., 2014) concluded that the gardening systems are continuously cropped using high N and water application rates. The study noted that the cumulative impact of N surpluses on the environment and human health must be considered, and organic fertilizers must be selected to minimise adverse impacts.

Determinates of growing food products at home: Logit model analysis and results

A logistic regression model was built to identify and assess the drivers or factors of households' engagement in food production in the home garden. It models the logit-transformed probability as a linear relationship with the predictor variables. In this analysis, Y indicates a binary outcome variable where a sample household practices production of homegrown products or not (Y= 1/0), and *p* be the probability of *y* to be 1, p = P(Y=1). Let *x*1,……, xk be a set of predictor/explanatory variables. Then, the logistic regression of Y on x1,…, xk estimates parameter value 0, 1,…, k via maximum likelihood method of the following equation:

$$logit\ (p) = log\ (\frac{p}{1-p}) =$$

$$\alpha 0 + \alpha 1 x1 + \ldots\ldots\ldots + \alpha kxk.$$

The formula for the probability P(Y = 1),

$$p = \frac{\exp(\alpha 0 + \alpha 1X1 + \ldots\ldots\ldots \alpha kxk)}{1 + \exp(\alpha 0 + \alpha 1x1 + \ldots\ldots \alpha kxk)}$$

The result of the estimated binary logistic model is provided in Table 5. The Log-Likelihood value is a measure of goodness of fit for the model. An odds ratio of 1 indicates that the condition or event under study is equally likely to occur in both groups. An odds ratio greater than 1 indicates that the condition or event is more likely to occur in the first group. All explanatory variables in the model except household size are dummy/binary.

The result shows that the model is fit to the data. The maximum likelihood estimation worked well, and convergence is obtained within 7 iterations. From among many different methods of computing R^2 for logistic regression, the Cox and Snell (1989) and Nagelkerke R Square are employed. The SPSS software used for data analysis reports the Cox-Snell R square and Nagelkerke

Table 4: The use of home-produced food products by the sample households

Use of products	Number	%
Use at home	72	42%
Use at home and sell some	26	15%
For home and give away some	82	48%
Sell all to market	2	1%
Not provided	14	8%
N	172	114%

The total exceeds 100% since households use products in more than one way.

Table 5: Results of Estimation of the Logistic Regression Model

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	91.088a	0.243	0.464

[a]Estimation terminated at iteration number 7 because parameter estimates changed by less than .001.

	B	S.E.	Wald	df	Sig.	Exp(B)
No Space	-1.829	0.694	6.947	1	0.008	0.161
Easily Buy Food	-0.994	0.824	1.454	1	0.228	0.37
Reduce Food Expenses	1.119	0.63	3.152	1	0.076	3.061
Environ. Awareness	1.641	0.959	2.928	1	0.087	5.163
Summer Heat	0.9	1.082	0.692	1	0.406	2.46
Water Salinity	0.587	1.133	0.268	1	0.605	1.798
Household Size	0.082	0.115	0.506	1	0.477	1.085
Farmworkers	1.559	0.748	4.344	1	0.037	4.753
Have Know-how	2.323	0.706	10.823	1	0.001	10.206
Self-Sufficiency	0.763	0.704	1.176	1	0.278	2.145
Constant	-0.517	0.977	0.28	1	0.597	0.597

R Square measures in the binary logistic regression. The results on the two measures show that the proportion of unaccounted for variance is smaller i.e. 0.24 and 0.46, respectively, showing that the independent variables in the model explain the larger portion of the variation in the dependent variable.

The second column in the results table shows the logit coefficients in the log-odds units. The last Colum provides the exponentiation of the Beta coefficient and is an odds ratio. The figures are the odds of Y=1 when X increases by 1 unit. These are the exp. (logit coefficients). They are interpreted in such a way that if the OR (odds ratio) > 1 then the odds of Y=1 increases; If the OR < 1, then the odds of Y=1 decreases. A logistic regression model allows to establish a relationship between a binary outcome variable and the predictor variables. The resulting prediction equation is:

$$\log(p/1-p) = \alpha_0 + \alpha_1 * x_1 + \alpha_2 * x_2$$
$$+ \alpha_3 * x_3 + \alpha_4 * x_4 + \alpha_5 * x_5$$

Where p is the probability of practicing food production in the home garden. These estimates show the amount of increase/decrease in the predicted log odds of practicing

food production in the home garden = 1 that would be predicted by a 1 unit increase/decrease in the predictor, while keeping all other predictors constant. The odds for the non-availability of production space is 84% less than the odds for space availability. In other words, the availability of space in the homestead limits the possibility of practicing growing food products in the home garden. The study by Igwe et al. (2014) conducted in Nigeria that examined the social and economic implications of home gardening on farm households found that the readily available land and capital inputs were the basic factors that significantly influence home garden production and thus contribute to an improved household income of the gardeners. In a study made in Trinidad, Warner, et al. (2017) have identified monetary expenses associated with start-up, lack of nonmonetary resources, lack of experience, generational disconnect, and barriers beyond human control such as the weather as some barriers to the households' engagement in home food production.

On the other hand, considering reducing food purchase expenditure by a household increases the chance of their growing food at home by 200%. Similarly, having environmental awareness increase the chance of growing food at home by four-fold. This may relate to the fact that fresh food production at home may be considered as having less negative environmental impacts. Studies conducted elsewhere have reached at similar conclusions. A study by Ghosh et al. (2008) stated that local food production is an integrated pathway to achieving a sustainable food for the future, appropriate urban ecosystem maintenance, and meaningful environmental impact reduction. In a study conducted in the United States, Kinsley (2020) reported that many Americans make a remarkable decision to convert their home into a locus of small-scale farming growing their own vegetables, raise animals for slaughter, and keep chickens for eggs. The diverse reasons for this change include reorganizing a relationship with nature by cultivating an oasis of simplicity in an increasingly industrialized, commodified, and urbanized world. Availability farmworkers for production activities increases the chance of households practicing homestead food production. Although households use family members to do the activities of food production in homestead, many households do also use farmworkers. A study by Nogeire-McRae et al. (2018) reports that labor and time requirements, the potential for environmental and nutrient pollution, and scarcity of water resources are the challenges that urban agriculture must address.

Having knowledge about the safety standards requirements of home garden food production also increases the chance of adopting the practice. Other factors like household size, water salinity, and summer heat are not found to have effect on home garden food production. Although water salinity is one major problem of agricultural production in the UAE, households seems to be using the fresh water at home. A study made by Warner et al. (2017) in Trinidad revealed that monetary expenses associated with start-up, lack of nonmonetary resources, lack of experience, generational disconnect, and barriers beyond human control such as the weather are the barriers that hinder household from engagement in practicing home food production. In a study made in Sirilank, Galhena et al. (2013) identified several constraints to home garden food production including access to suitable and sufficient land, lack of ownership and usage rights access to capital, access to water, seeds and planting materials, weak extension and advisory services, and access to markets, and cultural acceptance of home gardening.

CONCLUSION

This study contributes to the knowledge of homestead food production in the UAE. The data shows that 88% of the sample households (N = 196) produce various food products in their homestead - vegetables, eggs, and some small ruminants, but mainly fruits and vegetables. The use of modern methods like hydroponics and aquaponics for home garden food production is still limited. The sample households produce on average 21 kg of fruits and vegetables, and 26 kg of meat per month, and 30 pieces of eggs per week. The food products are used for home consumption and also given away to relatives and friends. Reasons for producing food at homesteads include the need for self-sufficiency, reduce food purchase expenses, environmental awareness, the food being healthy, and a hobby. The majority of the sample households would continue producing in the future. Analysis of the logistic model reveals that many factors significantly impact the household's decision to grow food products in their homestead. Availability of space, the need for reducing food purchase expenses, household's perception about the health benefits of homegrown foods, environmental awareness, and availability of hired workers who work at home garden. Food consumers are becoming more aware of the food-consumption-heath relationship in the UAE as elsewhere in the world. Urban agriculture has an important potential in the UAE as it does in other developed countries. Hence, the following recommendations are in order: raising public awareness on the significance of homegrown food products, and the need for improved quality and safety of home-produce; popularization and demonstration of best practices, and use of modern technologies like hydroponics and aquaponic by agricultural development agencies; further large-scale study of the costs and benefits of the homegrown food production system in the UAE;

municipalities give due attention to the urban households and encourage them to expand the practice of homestead food production by a way of improving urban farming.

ACKNOWLEDGEMENT

The project was funded by the UAEU Undergraduate Research Experience (SURE Plus 2019) #G00003095 Grant. This manuscript is developed as part of the project to address the knowledge about the practices of home garden food production by urban households in the UAE.

Authors' contributions

The authors Ms. Asma Mutawa Mohammed Albedwawi and Ms. Mariam Sultan Alazeezi (BS Agriculture Resource Management students) worked under Dr. Berhanu Degefa's major supervision as part of the SURE+ grant.

The first author Dr. Berhanu Degefa has designed the study, guided data collection, analyzed the data prepared the manuscript.

The second author Ms. Asma Mutawa Mohammed Albedwawi is involved in the preparation of the survey questionnaire, data collection, and compilation of the data used in this manuscript.

The third author Ms. Mariam Sultan Alazeezi is involved in the preparation of the survey questionnaire, data collection, and compilation of the data used in this manuscript.

REFERENCES

Altieri, M. 2019. How Urban Agriculture can Improve Food Security in US Cities. University of California, USA. The Conversation. Available from: https://www.theconversation.com/how-urban-agriculture-can-improve-food-security-in-us-cities-106435. [Last accessed on 2021 Jun 18].

Andrews, F. 2012. Homegrown Food Down at The Farm: Serving up Homegrown Produce, this Tranquil Retreat Feels Miles Away from the City. Gulf News. Available from: https://www.gulfnews.com/going-out/homegrown-food-down-at-the-farm-1.1035417. [Last accessed on 2021 Jun 18].

Bahta, Y. T., E. Owusu-Sekyere, D. Emmanuel and T. B. Elizabeth. 2018. The impact of the homestead food garden program on food security in South Africa. Food Security. 10: 95-110.

Becraft, A. 2017. Potential for home-use hydroponic systems to increase food security in Cape Eleuthera, Bahamas. Inquiry ACES. 3: 12-18.

Bellows, A. C., C. Brown and J. Smit. 2008. Health Benefits of Urban Agriculture. Available from: https://www.researchgate.net/publication/238742667_health_benefits_of_urban_agriculture. [Last accessed on 2021 Jun 18].

Blechaa, J. and H. Leitner. 2014. Reimagining the food system, the economy, and urban life: new urban chicken-keepers in US cities. Urban Geogr. 35: 86-108.

Brown, S. L., R. L. Chaney and G. M. Hettiarachchi. 2016. Lead in Urban soils: A real or perceived concern for urban agriculture? J. Environ. Qual. 45: 26-36.

Calvet-Mir, L., E. Gómez-Baggethun and V. Reyes-García. 2012. Beyond food production: Ecosystem services provided by home gardens. A case study in Vall Fosca, Catalan Pyrenees, Northeastern Spain. Ecol. Econ. 74: 153-160.

Cameira, M. R., S. Tedesco and T. E. Leitao. 2014. Water and nitrogen budgets under different production systems in Lisbon urban farming. Biosyst. Eng. 125: 65-79.

Cramer, J. S. 2002. The Origins of Logistic Regression. Tinbergen Institute. Discussion Papers. Available from: https://www.papers.tinbergen.nl/02119.pdf. [Last accessed on 2021 Jun 18].

Cox, D. R. and E. J. Snell. 1989. Analysis of Secondary Data. 2nd ed. Chapman and Hall/CRC, USA.

Csortan, G., J. Ward and P. Roetman. 2020. Productivity, resource efficiency, and financial savings: An investigation of the current capabilities and potential of South Australian home food gardens. PLoS One. 15: e0230232.

Dennehy, J. 2018. The Popularity of Locally Grown Produce Surges in the UAE. The National. December 24. Available from: https://www.thenationalnews.com/uae/environment/popularity-of-locally-grown-produce-surges-in-uae-1.806111. [Last accessed on 2021 Jun 18].

Dimitri, C., L. Oberholtzer and A. Pressman. 2016. Urban agriculture: Connecting producers with consumers. Br. Food J. 118: 603-617.

Veenhuizen, R. and G. Danso. 2007. Profitability and Sustainability of Urban and Peri-urban Agriculture. Agricultural Management, Marketing, and Finance Occasional Paper Number 19. Food and Agriculture Organization, Rome.

Galhena, D. H., R. Freed and K. M. Maredia. 2013. Home gardens: A promising approach to enhance household food security and wellbeing. Agric. Food Security. 2: 1-13.

Ghosh, S., R. Vale and B. Vale. 2008. Local food production in home gardens: Measuring on-site sustainability potential of residential development. Int. J. Environ. Sustain. Dev. 7: 430-445.

Hamburgh, R. 2019. A Guide to Growing your Own Vegetables in the UAE. The National, UAE.

Igwe, K., F. Agu-Aguiyi and G. Nwazuruoke. 2014. Social and economic implications of home gardening on the livelihood of farm households in Abia State, Nigeria. Dev. Country Stud. 4: 66-72.

Kinsley, J. 2020. The Garden in the Machine: Homesteading, Local Foodways, and Agriculture in York, Pennsylvania. (Doctor of Philosophy), The Pennsylvania State University, University Park.

Madaleno, I. M. 2001. Cities of the Future: Urban Agriculture in the Third Millennium. Vol. 29. The University of Lisbon, pp. 14-20.

McDougall, R., P. Kristiansen and R. Rader. 2019. Small-scale urban agriculture results in high yields but requires judicious management of inputs to achieve sustainability. Proc. Natl. Acad. Sci. U. S. A. 116: 129-134.

Nogeire-McRae, T., E. P. Ryan, B. B. R. Jablonski, M. Carolan, H. S. Arathi, C. S. Brown, H. H. Saki, S. McKeen, E. Lapansky and M. E. Schipanski. 2018. The role of urban agriculture in a secure, healthy, and sustainable food system. BioScience. 68: 748-759.

Rezai, G., M. Nasir, N. M. Shamsudin and Z. Moahmed. 2016. Urban agriculture: A way forward to food and nutrition security in Malaysia. Proc. Soc. Behav. Sci. 216: 39-45.

Sanyé-Mengual, E., D. Gasperi, N. Michelon, F. Orsini, G. Ponchia and G. Gianquinto. 2018. Eco-efficiency assessment and food security potential of home gardening: A case study in Padua,

Italy. Sustainability. 10: 2124.

Tatebayashi, K., C. Kamiyama, T. Matsui, O. Saito and T. Machimura. 2019. Accounting shadow benefits of non-market food through food-sharing networks on Hachijo Island, Japan. Sustain. Sci. 14: 469-486.

Tusing, D. 2021. Growing your Own Food is “Like a Superpower” that Could Save you Dh5,000 a Year on Grocery Bills. Available from: https://www.thenationalnews.com/lifestyle/food/growing-your-own-food-is-like-a-superpower-that-could-save-you-dh5-000-a-year-on-grocery-bills-1.1151309. [Last accessed on 2021 Jun 19].

Hough, R. L., N. Breward, S. D. Young, N. M. J. Crout, A. Tye, A. M. Moir and I. Thornton. 2004. Assessing potential risk of heavy metal exposure from consumption of home-produced vegetables by urban populations. Environ. Health Perspect. 112: 215-221.

Warner, L. A., A. M. Harder, C. V. G. Henry, W. P. Ganpat and E. Martin. 2017. Factors that influence engagement in home food production: Perceptions of citizens of Trinidad. J. Agric. Educ. 58: 239-255.

Wortman, S. E. and S. T. Lovell. 2013. Environmental challenges threatening the growth of urban agriculture in the United States. J. Environ. Qual. 42: 1283-1294.