



# Journal of Nutrition and Food Security

Shahid Sadoughi University of Medical Sciences  
School of Public Health  
Department of Nutrition  
Nutrition & Food Security Research Center

eISSN: 2476-7425

pISSN: 2476-7417

JNFS 2024; 9(1): 152-159

Website: jnfs.ssu.ac.ir

## Urban Agriculture and Food Security: A Narrative Review

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### ARTICLE INFO

#### REVIEW ARTICLE

#### Article history:

Received: 3 Jun 2022

Revised: 9 Aug 2023

Accepted: 9 Dec 2023

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### ABSTRACT

**Background** Today, the world is facing the problems of population growth, urbanization, increasing need for food, depletion of water resources, and environmental degradation. Therefore, the present study investigates the impact of urban agriculture on food security. **Methods:** Search engines including PubMed, Scopus, Embase, Science Direct, Google scholar, Magiran, and scientific information database (SID) were applied with keywords such as population growth, food security, sustainable development, urban agriculture, food system to find related articles published up to 2022. **Results:** The impact of urban agriculture on food security can be seen through several factors such as nutritional stability, food availability, affordable food supply, and revenue generation through sales. **Conclusion:** Urban agriculture refers to production of food products in urban environment, where food is produced on rooftops, backyards, gardens, or in public open spaces. This work proposes new opportunities for sustainable development and urban management to make significant changes in living environment, health and land management. Furthermore, this research provides the poor in the city a chance to achieve food security by reducing household food costs.

**Keywords:** Population growth; Food security; Sustainable development; Urban agriculture; Food system

### Introduction

In the middle of the twentieth century, only 17.8% of the population in developing countries lived in cities; but from 1950 to 2000, this rate increased to 40%, which is expected to reach about 60% in 2030 as whole (United Nations Human Settlements Programme (UN-Habitat), 2023). 21<sup>st</sup> century is the century of city and urbanization, with more than half of the world's population (54%) living in urban areas. In future, 93% of the

world's urban population growth will occur in developing countries (Armanda *et al.*, 2019, Zasada, 2011). The phenomenon of urbanization has significant economic and social consequences, but its most important effect is on consumption patterns. Currently, per capita consumption in the city is much higher than the countryside. The consumption pattern of urban dwellers is also incompatible with environment in comparison with

**This paper should be cited as:** Marzban A, Dowlati M, Sadeghi Nodoushan F. *Urban Agriculture and Food Security: A Narrative Review. Journal of Nutrition and Food Security (JNFS)*, 2024; 9 (1): 152-159.

the consumption pattern of villagers (Marzban *et al.*, 2023). In total, about four-fifths of the world's resources are consumed in cities, which occupy only one-fifth of the earth's surface (Siegener *et al.*, 2018).

Environmentalists agree that agriculture, as we know it, will be marginalized for the next 50 years because climate change is accelerating due to deforestation, and agriculture in a controlled environment is a response to reverse this situation. In this regard, some countries have introduced urban agricultural development to provide food security (Pulighe and Lupia, 2020). Urban agriculture, as part of urban activities, is an opportunity to make positive changes in the world's food system and produce quality food (Audate *et al.*, 2019).

Targeted entry of urban agriculture into urban landscape is a new solution to deal with environmental, economic, and social problems (Dowlati *et al.*, 2023). Certainly, with the expansion of cities and the growth of the urban population, the demand for food will increase. Agriculture has always been the main supplier of human food and creates food security for society. Urban agriculture, in addition to its advantages and disadvantages, is faced with several challenges (Chihambakwe *et al.*, 2018). Cities are the centers of achieving the goals of sustainable development, and therefore, the production of quality food in the nearest place and the shortest time is very important (Lal, 2020). By producing food on the roofs and yards of houses in suitable urban areas, and by applying proper management, the food needs of citizens can be met, and the quality of urban environment can be maintained. It also provides an opportunity for low-income urban groups to achieve food security by creating jobs and reducing household food costs (Azunre *et al.*, 2019, RUA Foundation, 2006).

A study of 15 countries shows that agricultural activities are closely related to food security, showing the impact of agriculture on a nutritionally adequate diet (Górna and Górný, 2020, Lee-Smith, 2010, Ramaloo *et al.*, 2018). In Cuba, there are more than 300,000 farms and city

gardens that produce more than 50% of all the fresh and healthy food for residents across the country. Livestock farming in Cuban cities also produces 39,000 tons of meat and 216 million eggs each year. Many Cuban urban farmers produce an average of 20 kilograms of food per square meter each year, which has minimized the country's need to import food from other parts of the world (Drescher *et al.*, 2021, Sulistyowati and Nurhasana, 2022).

In many developed countries today, urban agriculture and food production in or around the city is the answer to inadequate, unsafe and inaccessible food. Urban agriculture can also make it possible for more people to use food at a lower cost. In addition, engaging in urban agriculture leads to a greater variety of foods. Therefore, it is necessary to consider the appropriate strategy in order to achieve food which is available and can be prepared for everyone. Accordingly, the present study investigates the impact of urban agriculture on food security

## Materials and Methods

Regarding this review, creditable databases, including PubMed, Scopus, Embase, Science Direct, Google scholar, Magiran, and scientific information database (SID) were searched using keywords such as population growth, food security, sustainable development, urban agriculture, and food system from the published literature (English and Persian language). In this regard, a variety of studies including prospective cohort, retrospective, case-control, clinical guidelines, cross-sectional and review articles up to 2022 were studied.

## Results

### Food security

Food security is a situation where people do not live in poverty or fear of hunger and famine. The Food and Agriculture Organization of the United Nations (FAO) states that the main goal of food security is to ensure that all human beings have physical and economic access to the basic food they need. Food security is ensured when the per capita food basket of the family is properly

selected and prepared, and enough food is cooked properly so that healthy elements and nutrients reach the cells and organs of the body (Bagherzadeh Azar F *et al.*, 2017).

To maintain food security within a nation and its social structure, it is essential to work alongside the organization responsible for food security and engage in activities such as food production or import, public education, and macroeconomic policies. Food security has emerged as a pressing issue worldwide, which has attracted the attention of government officials and decision-makers (Robbiati *et al.*, 2022). The crisis of rising food prices between 2007 and 2008 and the global economic downturn have led to an increase in the number of hungry people to a historic level of more than one billion people worldwide. This is while less obvious issues, such as micronutrient deficiencies resulting from inadequate consumption of mineral-rich foods and vitamins, have increased significantly during the crisis years and less attention is paid to this problem (Adepoju and Oyegoke, 2018). At the 1996 World Food Summit, a very comprehensive definition of food security, with different dimensions, was provided as follows: Everyone, at all times, has the physical and economic ability to access sufficient amounts of healthy food and receives a nutrient that meets their nutritional needs and preferences for a healthy and active life (Food Agriculture Organization, 2009).

Today, with the increase in urban population, the population of villages and the production of agricultural products will decrease and access to food and food supply will be more difficult for the growing urban and even rural population (Lofton *et al.*, 2022). Moreover, with increase in relative population density, which means the ratio of population to area per person per square kilometer, there is a need to provide food for a larger population, which makes food access and supply difficult (Joshi *et al.*, 2019). Since agriculture is the most important part of food security, all attention will be paid to the agricultural sector, willingly or unwillingly, in order to achieve adequate food. Given the uncontrollable cost of

food and the growing malnutrition crisis, the FAO sees urban agriculture as one of the most effective ways to respond to the growing urban population (RUAF Foundation, 2006).

### *Urban agriculture*

All over the world, old agricultural traditions are strongly present in and around cities. Every tradition is deeply rooted in the local concepts of the city, and its social, cultural and local practices. But urban agriculture within cities is a new phenomenon. Urban agriculture is known for its various functions, from food production to leisure (Bopda and Awono, 2010, Kennard and Bamford, 2020).

FAO considers "urban agriculture" one of the most effective ways to respond to urban sprawl, especially in developing countries. FAO's Urban Food Program helps citizens participate in food production and nutrition for themselves and others. Most of these programs include the use of urban lands and green and apartment spaces for the production of fruits and vegetables (Lohrberg *et al.*, 2016).

"Urban agriculture" can absorb some of the municipal solid and liquid organic waste, which reduces costs and waste management problems in the city. From boxed pots to tall trees on rooftops, "urban agriculture" is rapidly changing the world's cities. The idea is simple: use all the space for agriculture and gardening (Kirby *et al.*, 2021).

Initiatives such as vertical gardens pave the way for urban self-sufficiency and food security by providing all citizens with access to nutritious food derived from "urban agriculture". This type of agriculture is not limited to developing or developed countries, but is a global phenomenon (Specht *et al.*, 2014). In some countries, such as Cuba, this change has taken place nationally and with the full support of central government. Planning and policy-making to facilitate "urban agriculture" is desirable and necessary in two respects (Deelstra and Girardet, 2000); it is desirable because, according to FAO, in order to deal with global food security crisis, countries must simultaneously pursue two parallel policies to

encourage local production and consumption of agricultural products, on the one hand, and large-scale cultivation of agricultural products for export, on the other hand (Lal, 2020). Moreover, the experience of different communities has shown that urban agriculture not only gives people more access to fresh, healthy, and nutritious food, but also has other benefits, such as encouraging waste recycling by converting it into compost (Górna and Górný, 2020). Also, the experience of different communities has shown that urban agriculture not only gives people more access to fresh, healthy and nutritious food, but also has other benefits, such as encouraging waste recycling by converting it into compost, followed by compost, Reducing the cost of garbage collection and disposal by the municipality, air conditioning and temperature adjustment, creating productive green space and as a result economic utilization of city water, increasing communication with nature for citizens (especially children and adolescents) for public vitality, and also creating Employment on a large scale (Lal, 2020). According to the United Nations, about 15 percent of the world's food is produced in urban areas, and this amount is growing (Malekinejad *et al.*, 2020).

*The importance of urban agriculture social effects:* Socially, "urban agriculture" brings families and communities together and increases food security by making individuals independent and autonomous (Hallett *et al.*, 2016, Petit-Boix and Apul, 2018).

*Environmental effects:* From an environmental point of view, this type of agriculture makes the city's environment green, cleans the air, and purifies rainwater. Due to its organic nature (no use of chemical inputs), the amount of greenhouse gases in these farms is much lower than industrial agriculture (Hallett *et al.*, 2016, Streiffeler, 1987).

*Economic effects:* Some consider urban agriculture to be at best a recreational activity with the function of beautifying urban spaces, while urban agriculture is a very important economic activity that associated with the lives of tens of millions of people around the world

(Malekinejad *et al.*, 2020). In fact, urban agriculture is a growing industry using intensive production methods, reusing natural resources and urban waste, and breeding diverse animal and plant species, while improving food security and health. In addition, such agriculture helps to improve the livelihood and environment of the individual, family, and society as a whole (Hallett *et al.*, 2016).

Reducing food distance is another effect; it is the distance that a food product travels from the place of production to the place of consumption (Kirby *et al.*, 2021). The most important environmental degradation factors in food distance are packaging and fuel consumption to keep food cool and transport it. Because locally produced food requires less transportation and refrigeration, they can provide a close market with competitive prices and fresh and nutritious products (food safety axes) (Zasada, 2011).

**Healthy effects:** From a health point of view, urban agriculture facilitates access to fresh food with high food quality- an effective option to combat hunger. Urban farmers also enjoy healthy, low-cost sports, and spending time in the green space (Hallett *et al.*, 2016, Zasada, 2011).

### **Types of urban agriculture**

*Cultivation in the backyard or balcony:* In many Asian, Middle Eastern, and North African countries, households grow fresh vegetables on the roofs and large balconies of their homes to supplement their diets, save on food costs, and earn extra income. They cultivate food and plants in the backyards and balconies of their homes. The produce from these greenhouses is used by the family, and sometimes shared with friends and neighbors (Doron, 2005). The products of these greenhouses should be used in the family, and sometimes, they should be given to friends and neighbors. In most cases, simple tools and facilities are used for production such as pottery pots, buckets, boxes, shelves, tables full of soil, soil, and compost mixture or other suitable environments for plant growth. In many countries, the government supports these projects (RUF Foundation, 2006).

*Park on the side of the street:* Some streets are designed to have dual use, which is also used in

addition to recreational use. These local gardens are usually run by local municipality (Specht *et al.*, 2014).

*Participatory garden:* It is a garden made by a group of friends and neighbors to grow vegetables and flowers and provide opportunities for constructive social interactions and recreation. The purpose of participatory gardens is not necessarily the growth of plants, but may be established with the aim of creating a pleasant space, biodiversity, or therapeutic gardening (Siegner *et al.*, 2018). The creation of these gardens pursues several goals, including regeneration of unused urban spaces, environmental sustainability, increased biodiversity in the urban environment, and increased carbon trap through tree planting, and local food production projects (McDougall *et al.*, 2019). Participatory gardens are a cheap but highly efficient tool for urban managers which can play a decisive role in enhancing urban quality by providing multiple functions; it is an obvious example of small movements to achieve major changes based on minimum facilities. This is emphasized in the theory of chaos (Doron, 2005).

*Family garden:* Family gardens are concentrated lands in an area in the city or margin of the city, which consist of several hundreds of small lands and run by individuals or families. In these family gardens, the parts of the land are separately cultivated (Siegner *et al.*, 2018). These gardens have various cultural, social, economic, and environmental functions in the physical structure of the city and its surroundings. In these gardens, families are involved in economic activity, small production of agriculture and horticulture, and the creation of a good space for leisure time for the family (Orsini *et al.*, 2013).

*Greenhouse:* Greenhouse refers to a limited space which can control environmental conditions for plant growth from different areas throughout the year. According to this definition, including the performance of the greenhouse, the necessary environmental conditions for a specified product is provided (R Shamshiri *et al.*, 2018). Greenhouses are divided into a fixed and moving type, depending on what type of building materials are

used. Fixed greenhouses are greenhouses, where the building materials used are durable. Thus, they should be used for years. Moreover, greenhouses built in residential or commercial complexes have personal or public applications (Sanyé-Mengual *et al.*, 2015).

*Green roof:* Green roofs are a special type of urban agriculture which are also part of the management and control of urban floods, and reduce surface runoff by improving infiltration to runoff ratio (Whittinghill and Rowe, 2012). Green roofs have been proposed as the most effective solution to combat urban runoff due to impermeable levels (Walters and Stoelzle Midden, 2018).

*Green wall:* A green wall is a free or standing wall, which is partially or completely covered with vegetation. Exterior and interior wall space is used for the growth of decorative plants and food. This method gives a special beauty to urban and home environment (Ackerman *et al.*, 2014). Green walls are very magnificent; their use on green roofs creates a pleasant view, and everyone can enjoy, regardless of their environmental benefits (Krishnan *et al.*, 2016).

*Vertical farms:* Vertical farming is referred to as part of urban farming by planting in the greenhouse (skyscrapers), or creating spaces in which they plants are embedded. The modern idea of vertical agriculture uses a technique similar to glass greenhouses in which natural sunlight can increase the amount of artificial light (Besthorn, 2013). Vertical farms intend to prevent natural problems in the production of food products in hundreds of kilometers of drought-prone areas and diseases (Despommier, 2013).

## Conclusion

Urban agriculture refers to the production of food products in the urban environment, where food is produced on rooftops, backyards, gardens, or in public open spaces. This study suggests new opportunities for sustainable development and urban management makes significant changes in living environment, health, and land management, and gives the poor residents of the city a chance to

achieve food security by reducing household food costs.

### Acknowledgment

for the authors would like to thank the Vice - Chancellor of Research and Technology in Iran University of Medical Sciences for providing access to scientific databases.

### Authors' contributions

Marzban A and Dowlati M designed and supervised the survey. Sadeghi-Nodoshan F and Marzban A were involved in designing the study, data collecting, and data analyzing. Dowlati M and Sadeghi-Nodoshan F wrote the manuscript. All the authors critically reviewed the manuscript and approved the final version of the manuscript.

### Conflict of interest

The authors declared no conflict of interest.

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