

Food Feasibility and Safety in Animal Protein Production in Urban and Periurban Area

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Abstract— The present study aimed to present a literature review on animal husbandry experiences in order to identify the feasibility of animal production in urban and periurban agriculture as a food security instrument, observing its limitations and potential. A systematic literature review was carried out on the topic and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses methodology was used to select the articles. From the data analysis, the understanding emerged that animal husbandry in urban and periurban areas has existed for hundreds of years and has always been present in several cities around the world. This practice can represent an inevitable challenge, with positive aspects, such as being an ally of domestic food security and enabling the generation of income and employment, as well as negative aspects, such as the presence of odors, noise and dissemination of zoonoses. Faced with this conflict, as well as the verification of the feasibility of this practice, the importance of public policies capable of organizing the activity, minimizing health risks and possible resulting conflicts is highlighted.

I. INTRODUCTION

The industrialization process, added to the expansion of cities, were responsible for changes not in the demographic profile, but also in the nutritional quality of life, consumption habits and food production, resulting in significant changes in food sovereignty and security.

According to [1] describing a study carried out by the United Nations (UN), in the year 2050 the world population will exceed 9.5 billion people, which represents an approximate growth of 20% in relation to the current number. In this process that is already underway, there is a migration of families to cities, at the same time that urban

areas and their economic systems are not able to make all these people economically active, not having adequate conditions to satisfy their economic and culture and quality of life.

However, these migrants, even in the face of a change in habits, did not undergo a complete process of erosion of their knowledge and transformation of food habits and still maintain a relationship with nature, plants and animals that continue to be produced or raised in the areas. urban and periurban, bringing up the discussion on this theme [2].

In fact, several international entities and development agencies such as International Development Research

(IDRC), Resource Centers on Urban Agriculture and Food Security (RUAF FUDATION), United Nations Development Program (UNDP) and United Nations Agriculture Organization and Food (FAO)), pointed to the practice of urban and peri-urban agriculture (AUP) as one of the public policy strategies to generate income and mitigate food and nutritional insecurity in the face of the accelerated urbanization process [3].

According to [4], the benefits of urban and peri-urban agriculture are diverse: it improves access to food for low-income families, generates jobs, contributes to the supply of fresh, nutritious products available all year round, allows families to earn income from the sale of these products and, moreover, minimizes food expenses. Therefore, this activity covers food security, with a consequent improvement in the quality of life, environmental quality, in addition to generating job opportunities that do not require a level of education, allowing the creation of employment and income for the poorest population, precisely for this reason has gained greater political recognition.

All these aspects show that the UPA is in fact a viable alternative in order to alleviate some of the many problems caused by urbanization [5].

AUP uses spaces in and around cities and in small areas (such as backyards, terraces, patios and urban gardens) to produce various vegetables (grains, roots, seeds, tubers, fruits), animals (poultry, rabbits, goats, sheep, cattle, pigs, fish, horses, etc.) and non-food products, such as aromatic and medicinal plants and ornamental plants [3; 6; 7].

In this scenario, while the practice of agriculture in urban and periurban areas enjoys greater acceptance, animal husbandry is surrounded by a series of limitations, largely due to the inconvenience that can be generated by their presence, such as noise, elimination of excrement and transmission of zoonoses [8]. Butler [9] notes that poultry, pigs, cattle, goats and horses, often raised in a precarious way, have always accompanied the inhabitants of the city's neighborhoods.

However, this same precariousness justified the creation of restrictive laws and their exclusion from the urban scenario in some cities around the world, based on a series of political, legal, sanitary and environmental limitations.

Therefore, the present study aimed to present a literature review on livestock experiences in order to identify the feasibility of animal production in urban and periurban agriculture as a food security instrument, observing its limitations and potential.

In addition to this introduction, the review has a theoretical framework that encompasses the historical course of animal husbandry in urban and periurban areas. Next, the methodological procedures used are presented, followed by the results and discussions. Finally, the conclusions are drawn and the references used are indicated.

History of animal husbandry in urban and periurban areas

The act of raising animals in and around cities, while often more restricted than urban agriculture, is as old a phenomenon as cities themselves. This is because, for centuries, municipal administrations sought to protect direct access to productive lands, as a way of safeguarding and guaranteeing an adequate supply of food for the urban population. Therefore, for a long time people had to live close to where their food was grown or raised [10; 11; 9; 12].

In fact, animal husbandry in urban and periurban areas has existed for hundreds of years, [13] reports that it dates back to ancient Egyptian, Greek, Roman and Byzantine cultures, continuing to the present day. Still, [14] states that despite the contradictions surrounding the theme, animal husbandry has never been completely extirpated from cities, it is a practice that remains even if silently.

As one of the components of urban and periurban agriculture, animal husbandry has always been present in several cities around the world: in the Middle East (including Israel), Africa (North and Sub-Saharan), Asia (Central, South, East and Southeast), Europe East, Latin America and the Caribbean, where initiatives in Havana - Cuba, Mexico City - Mexico, Antigua and Barbuda, Tegucigalpa - Honduras, Managua - Nicaragua, Quito - Ecuador, Lima - Peru, El Alto - Bolivia, Belo Horizonte - stand out. Brazil and Rosario - Argentina [3; 15; 16; 17]. An example of this practice is also noted in the immigrant populations that took their cattle breeding and slaughtering practices to cities in the United States [18; 9], despite this, urban animal husbandry in the United States is a clandestine and unevenly regulated activity in the various states [8].

In this sense, [19] highlights that, in Brazil, animals are an essential part of culture: especially in cooking and at parties. Its influence on the construction of regional identities is clear. The duck with tucupi and fish stews, in the Amazon; goat meat and buchada in the Northeast; the chicken in the Cerrado; feijoada and chicken with okra in the Southeast; beef jerky in the south are good examples of this remarkable presence of small animals in rural life and urban customs.

According to [9], despite this long history of the practice of raising animals in cities or nearby areas, technological advances in the second half of the 19th century made this proximity no longer mandatory, since they suggest not only the installation of refrigerated storage systems in transport, but also in homes. In addition, with the advent of the train, products of animal origin could be purchased in distant locations, in addition to this, cars replaced the use of horses and animal husbandry was falling into disuse. Soon, products of animal origin, such as fresh meat, milk and dairy products, could be transported over long distances and kept in homes for long periods of time [20].

This fact meant that animal husbandry and agriculture were displaced outside the cities, at the same time that there was a growth in the industrialization processes of food production and agriculture, which, among other objectives, aimed not only at large-scale production scale and price reduction, but also to enhance the population's shift to an urban diet [9].

In the second half of the 20th century, a global food system was inaugurated, characterized by abundance and convenience, establishing a new relationship with food, marked by the removal of people from production habits, by the offer of fast food and processed products. As people distanced themselves from the production of foodstuffs, a new group of consumers emerged, those who assimilate food as commodities and devalue the entire production process [21].

However, currently, as a result of criticism of the globalized food model and the search for food security and sovereignty, the practice of urban and periurban animal production has resurfaced in the global north and reaffirmed in the global south, allowing the population access to food with nutritional quality, family self-consumption and income generation.

II. MATERIALS AND METHODS

The systematic literature review was carried out based on the scientific literature available on the Scientific Electronic Library Online Platform (SciELO), the Coordination for the Improvement of Higher Education Personnel (CAPES) and Google Scholar. The survey included publications carried out from 1999 to 2020. To meet the objectives of the work, the search keyword "urban and periurban agriculture", "food and nutritional security", "animal husbandry in urban and periurban agriculture" was used. in English, Portuguese and Spanish.

The PRISMA methodology (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) was used to

select the articles. For [22], the systematic review that adopts the PRISMA protocol is based on the formulation of an objective question, as well as the use of systematic methods in order to identify, select and critically evaluate the studies considered most relevant on the subject researched.

Articles were included that had as their central research theme the creation of small animals in urban and periurban agriculture in Brazil and in the world. Scientific articles published in indexed or non-indexed journals, technical reports, legislation, technical and research bulletins were searched. The selected articles were read in full and make up the references used for the analysis of this article.

III. RESULTS AND DISCUSSION

Searches in the portal and databases returned a total of 265 productions, 26 from the SciELO database, 80 from Google Scholar and 159 from the CAPES journal portal. Of these 265 studies, 34 were excluded because they represented a duplicate record, leaving 231. Then, the titles and abstracts of the 231 publications were read, 195 were excluded. The remaining 36 productions were read in full, composing the sample according to (Fig. 1). In addition, 05 technical reports from international organizations, 01 epidemiological technical bulletin and the law n° 11.346 of 2006 were used.

From the data analysis emerged the in-depth understanding of the history of animal husbandry in urban and periurban areas, the viability of animal husbandry, the generation of income and employment through this activity, as well as the factors that negatively impact it.

Feasibility of animal husbandry in urban and periurban areas

Animal husbandry in cities can be an unavoidable challenge, with positive and negative aspects, of the former it is emphasized that this practice is allied with domestic food security, enables income and employment generation.

In a definition established at the World Food Conference (WC) in Rome in 1996, food security occurs when all people have permanent physical, social and economic access to safe, nutritious food in sufficient quantities to satisfy their nutritional needs and food preferences, thus having an active and healthy life [23].

In Brazil, Law No. 11,346, of September 15, 2006, in its article 3, defines food and nutrition security as: Food and nutrition security consists in realizing the right of everyone to regular and permanent access to quality food, in sufficient quantity, without compromising access to other essential needs, based on health-promoting food

practices that respect cultural diversity and that are environmentally, culturally, economically and socially sustainable [24].

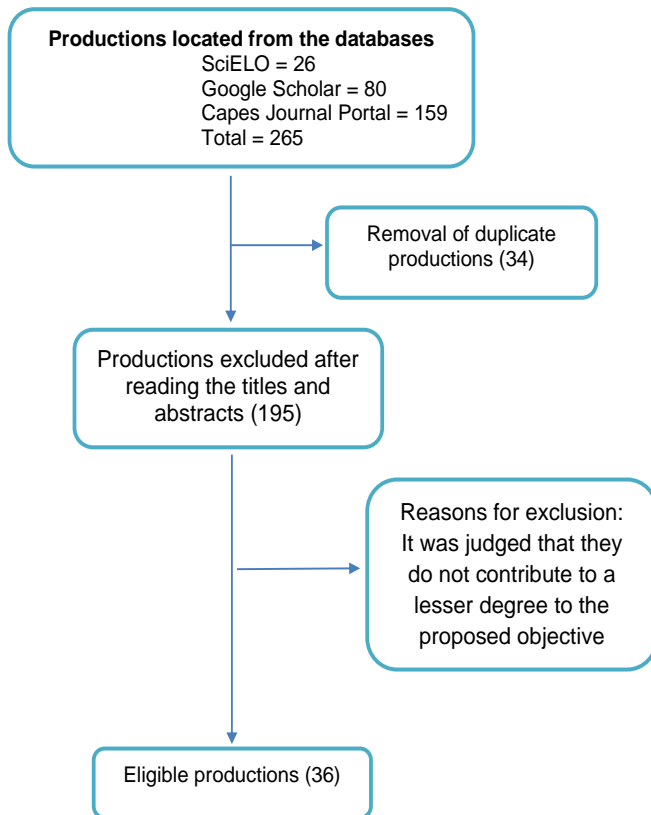


Fig. 1. Flowchart of selection of studies for review on the practice of animal husbandry in urban and peri-urban agriculture

In this way, it is evident that it is only possible to enjoy this condition if there is a constant supply of nutritious and safe food throughout the year. It is in this scenario that the production of animals in vacant lots, public areas, backyards and in the vicinity of cities, as long as they are carried out with due health care, assumes great importance, as they provide products to feed many families.

Therefore, foods of high nutritional quality, such as honey, meat, fish, shellfish, offal, fat, eggs and milk, are essential to guarantee food and nutritional security for people with low purchasing power, who have little space to drive. creations, and who also have limited financial resources to purchase products of animal origin, whose cost is relatively high [19].

In fact, with regard to nutrient intake, small animal production can make a big difference in places where access to income is restricted. In this situation, animal husbandry in urban areas is no longer a choice of lifestyle and assumes the status of a survival strategy, making it

possible to consume, for example, meat, milk and eggs that would not be possible otherwise.

Florez [11] presents the example of poultry farming practiced in urban and periurban areas of Colombia as an activity that greatly contributes to the food security of the population. SILVANA [25] reported the crisis experienced in Córdoba, Argentina, between 1994 and 1995, when the Cooperativa Agropecuária San Martín went bankrupt, as an episode that explained the importance of small animal husbandry, since at the time the municipal authorities mobilized resources to encourage more vulnerable families to practice livestock in vacant lots, in urban and periurban areas, aiming to contribute to their food security.

Another particularly exemplary case is that which occurred in Cuba after 1989. On this occasion, the Cuban model of agriculture, based on the model of green revolution, collapsed due to oil shortages and the end of external support from the Union of Soviet Socialist Republics – USSR. This crisis boosted the emergence of one of the largest urban livestock programs in the world, with the creation of cattle, poultry, sheep, goats, pigs, bees and fish [26].

Income and employment generation

Sousa and Calaça [3], analyzing a report published in 2014 by the Food And Agriculture Organization The United Nations (FAO), found that the urban and periurban agriculture network in Havana includes five municipal agricultural companies, which manage 170 livestock centers, in addition to two municipal establishments for raising pigs and other small animals. This entire structure resulted in the production of 10.5 million liters of milk and 1,700 tons of meat in 2012

Studies such as the one carried out [27], in the city of Nairobi, capital of Kenya, show that urban animal husbandry can be a significant means of generating income. Urban swine farming and poultry farming, in particular, are profitable ventures that guarantee a quick return on capital. It also highlights that despite requiring little capital investment, animal husbandry in urban and periurban areas can generate significant profits from small-scale farming. For example, in Addis Ababa, Ethiopia, rearing dairy cows in backyards has proven to be a profitable activity.

In addition, pigs represent an affordable source of protein, as they are often fed household, restaurant and hotel food scraps and vegetation, thus reducing the cost of production. On the other hand, this practice puts the health of animals at risk. In the twin cities of Hubli-Dharwad, in the state of Karnataka, India, it is common to raise pigs in the streets, however health concerns, from local and

national authorities, have questioned the viability of the future of this practice [28].

In addition to generating income and employment, small animal farms constitute a strategic saving, because in times of crisis or need, can be mobilized for rapid acquisition of financial resources [19].

According to [29; 30; 31] report that in Brazil, a study carried out in Belo Horizonte-MG, Curitiba-PR, Porto Alegre-RS, Rio de Janeiro-RJ, São Paulo-SP, Brasília-DF, Goiânia-GO, Belém-BA, Fortaleza-CE, Recife-PE and Salvador-BA registered 635 initiatives, of spontaneous or governmental origin, of urban agricultural production. Of this total, 160 of these included animal husbandry, indicating the relevance of this activity in the country. This study, entitled "Panorama of Urban and Periurban Agriculture in Brazil and political guidelines for its promotion: identification and characterization of UPA initiatives in Brazilian metropolitan regions", in 2007, was the first at the federal level with the purpose of mapping the situation of "state of the art" in all regions of the country.

Another initiative, no longer in force, but which became a landmark in Brazil was the Small Agricultural Production Verticalization Program – Prove, created in 1995, in the Federal District - DF, with the aim of also promoting animal husbandry in urban and peri-urban areas, as well as its processing and commercialization [32].

Regarding the potential of urban and periurban agriculture and one of its components, small animal husbandry, to generate income and employment, [33] states that it is a tool for reducing poverty. In this sense, data from FAO shows that 800 million people are engaged in this activity worldwide, 200 million market their production and employ 150 million people full-time [34]. In addition, there is the possibility of supplementing income earning with some type of pre-processing.

Despite constituting a reinforcement for domestic food security and the generation of employment and income, animal husbandry in urban and peri-urban agriculture faces challenges that directly impact its viability, we will address the main of these in the next topic.

Factors that negatively impact the viability of animal husbandry in urban and periurban areas

The risk posed by zoonoses, such as mad cow, foot-and-mouth disease, swine flu, swine fever, avian flu, spotted fever, glanders and others has led to restrictions on animal husbandry in cities. Added to this, there are other nuisances arising from the creations, such as the occurrence of noise, odors and waste.

As for zoonoses, it is known that birds raised in the backyard of houses can pose risks to the general public, an example of which was the outbreak of avian influenza (HPAI, H5N1) in Egypt, where most cases of clinically confirmed human infection from 2006 to 2009 were linked to direct contact of sick birds, resulting in human-to-human transmission and 36 deaths [35]. The Newcastle disease outbreak in California in 2002 can also be cited, which originated in backyard farms and resulted in the depopulation of more than 3 million birds, costing taxpayers \$161 million at the time [12].

According to [12], a survey carried out in the United States showed that contact with backyard birds is associated with hundreds of outbreaks caused by contamination with *Salmonella*. Despite this, worryingly, 25% of participants in a survey conducted in that country do not wash their hands after handling birds or eggs. In addition to this, another survey showed that most backyard owners knew little about preventing poultry diseases [36].

In Brazil, some species of flatworm worms, which need free pigs to complete their life cycle, such as *Taenia solium* (pig tapeworm), cause the diseases taeniasis and cysticercosis, constituting a public health problem, especially in regions in that basic sanitation conditions are deficient.

An episode that took place in 2020, in the municipality of Cruz das Almas, drew attention to the practice of raising horses in the urban and periurban perimeter of this city in the interior of Bahia, Brazil. On March 20 of that year, the Secretary of Health of the State of Bahia (SESAB) released an epidemiological alert nº 01/2020 reporting the occurrence of an outbreak of Glanders, an infectious disease caused by the bacterium *Burkholderia mallei* and which primarily affects equines (horses, donkeys and mules), and may occasionally be transmitted to other animals and to [37]. This situation raises the alarm for the various localities where it is common to employ horses to load loads in carts, usually these animals feed on vacant lots and on the edges of highways, they do not enjoy the correct food and sanitary management.

The fact is that any animal husbandry, if not managed correctly, will bring problems. Zoonoses, defined as diseases that affect both humans and animals, are more likely to occur when hygienic conditions are inadequate.

Considering that creations generate waste, handling them close to homes and in a limited space can also pose risks to the environment, contaminating soils and water courses, attracting insects or rodents and generating unpleasant odors, causing conflicts with the neighborhood [11]. Indeed, the act of storing food for small farms, if not properly taken care of, can become a problem, as this

favors the proliferation of rats, which in turn can spread the hanta virus, a serious disease for populations.

As an aggravating factor of this whole situation, in most cases, breeders are in a situation of illegality, given that the breeding and sale of animals is an activity prohibited or not contemplated in land use or urban planning plans [38].

In view of this, and at the same time considering the economic and social relevance of animal husbandry in urban and periurban areas, especially for the livelihood of vulnerable populations, it is necessary for municipalities to find participatory solutions, located between total repression and the lack of control, carefully examining the impact of this practice, so ancient and current, on the health of the environment, people and animals.

It was precisely in the search for solutions that Mexico City, Mexico, adopted two main measures: (1) Creation of the Secretariat for Rural Development and Equality for Communities, responsible for coordinating municipal efforts aimed at ecological production and (2) Elaboration of the Ecological Planning Program, a legal instrument that determines Land Use and Occupancy [3].

In Vancouver, Canada, the solution to the problems of raising animals in the AUP was sought through the adoption of Public Policies, such as such as the creation of a Nutrition Policy Council, urban management and planning strategies and the creation of an Agricultural Land Reserve (RTA) maintained by the Government, the latter being a way of limiting urban growth and guaranteeing the maintenance of arable land for the AUP [39]. Similarly, in Lisbon, Portugal, through the Green Plan, created in 2007, the government also plays a fundamental role in promoting the UAP [40].

In Brazil, the responsibility for developing rules for animal husbandry in urban and periurban areas is the responsibility of municipal authorities. However, as they are unable to carry out proper supervision and guidance, many creations cause odors, noise and fear of zoonoses, a great nuisance in the neighborhood, as an issue that occurred in Belo Horizonte and reported by [41], in the state Paraná, Brazil, in view of the imminent vote on a bill in the Municipal Chamber of Curitiba-PR, which allows the creation of animals in urban and periurban areas, the Animal Welfare Laboratory of the Federal University of Paraná (LABEA/UFPR), issued a statement criticizing in 10 items the permission of this activity.

It is evident that any intervention strategies in search of solutions to problems related to animal husbandry require the participation of governments through public policies of territorial planning and management, credit offer,

provision of technical assistance and the involvement of civil society.

An example of this government support occurs in some cities where there are local policies that regulate animal husbandry in urban and periurban areas [42], also in places where there are municipal laws that regulate animal husbandry, establishing, for example, the need authorization or consent of neighbors, size for the construction of shelters and limitation of the types and numbers of animals [43].

Florez [11] draws attention to the importance of local and national governments reviewing the Land Use Plan and taking effective measures to regulate urban and periurban animal husbandry, since private organizations and the government itself can only develop projects if this activity is regulated.

It is also worth mentioning the need for research, extension projects and training of small breeders to guide them in handling, methods and sanitary techniques, capable of taking this activity out of irregularity and leading it to a rational breeding system.

IV. CONCLUSION

Given its importance in generating income and employment, strengthening food and nutritional security, as well as providing protein to the public in socially vulnerable situations, the feasibility of raising animals in urban and periurban areas is evident. However, it is worth mentioning that without the proper elaboration and implementation of public policies that support this practice so old and at the same time current, there is serious health risks, in addition, the neighborhood of the breeders, which should recognize them as source of healthy food, starts to have friction and to condemn the practice.

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