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Ambit of biosafety governance in the sustainable food system

Summary

Regulations and surveillance of health risks are addressed by different socio-economic sectors. The governance of biosecurity during the agroecological transition towards sustainable food has as its scope primary food production, complementary services, post-production of food and feeding by the population. Agroecological self-regulation, self-management and education are identified as important aspects in the governance of biological security in the face of health risks.

Keywords: biosecurity, governance, agroecological transition, food system

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Introduction

The food system can be defined as the set of socioeconomic relationships that directly affect the production and distribution processes of agri-food products, to satisfactorily fulfill the social function of food-nutrition with safe or safe foods.[1]

Health is a continuum from the earth to our bodies, dictated by the interconnection and interrelationship between humans, nature's biodiversity and its systems, determined by the connecting pathways between soil health, plant health, the health of animals and, therefore, human health.[2]

Increasing the diversity and volume of international trade in animals, plants and their products contribute decisively to the spread of diseases from one region to another. Variations in human ecology and behaviour also contribute to the increased incidence and spread of major public, animal and plant health hazards.[3]

By recognizing that human, animal, and ecosystem health is inextricably linked, One Health seeks to promote and improve health by enhancing cooperation and collaboration between physicians, veterinarians, agronomists, biologists, and other professionals.[4] The many dimensions of agro-ecology need to be integrated into a holistic approach that takes into account the inter-relationship between humans, animals, and the Earth.[5]

In this regard, biosafety is a strategic and integrated approach that encompasses policy and regulatory frameworks (including instruments and activities) for the analysis and management of risks relating to the life and health of people, animals and plants. plants and the associated risks to the environment. It covers food safety, zoonoses, the introduction of animal and plant pests and diseases, the introduction and release of living modified organisms (LMOs) and their products, and the introduction and management of invasive alien species.[3]

Biosecurity is addressed in the biological processes of the different socio-economic sectors related to food, where specific management systems are established for the different entities; However, there is a need to act synergistically in the face of health risks at the territorial level, where there is a diversity of interactions between agricultural production processes, the environment and people. Precisely, this synthetic review aims to contribute to a holistic governance of biosecurity, during the agroecological transition in the construction of sustainable food systems.

Materials and methods

To elaborate this synthesis, the Integral Health and One Health approach was assumed, considering the interrelationships between plants, animals and people in the different processes related to food production and consumption. Key articles on biosecurity management in the production of bioproducts for crop nutrition and health, as well as on health management in agricultural and livestock production, were reviewed. In the documents reviewed and based on the experience of projects in agroecosystems, the comprehensiveness of biosecurity management was analyzed, considering the risks to people. The synthetic review offered is my own interpretation of the need for participatory and self-managed governance of biosafety.

Results and discussion

Ambit of biosafety governance

During the construction of sustainable food systems, health risks can occur in the following processes: primary food production, complementary services, post-production, and feeding by the population (Figure 1).

Primary production, complementary and post-production services are basic processes carried out by various production units and services in rural, peri-urban and urban areas of the territory, which during the agroecological transition are articulated through value chains to consolidate the self-management capacities of the food system; in turn, feeding by the population, which is also considered a process, is influenced by access to food and education on health determinants and is a cultural attitude of individuals and their families.

Microbiological agents that cause pathologies in plants, animals and people can be disseminated through different routes, such as:

a) Interactions with sick individuals

b) Reproductive material (plant, animal)

c) Food (animals and people)

d) Handling by people (cultivation, breeding, harvesting, slaughtering, processing, transport)

e) Vectors (insects, arachnids, nematodes, others)

f) Air currents,

g) Soil and rainwater streams

h) Water used for drinking (animals and people) and irrigation (crops)

i) Obtaining bioinputs (fertilizers, biofertilizers, microbiological biopesticides), among other routes that are specific to the different groups of harmful organisms.

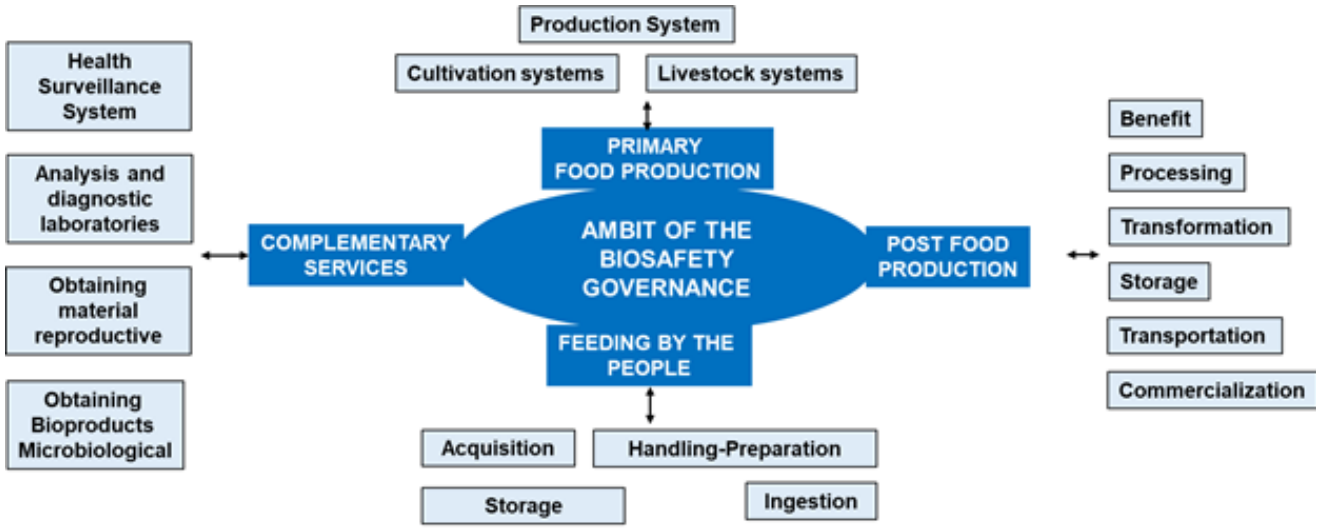

Figure 1 Socio-economic processes that determine the ambit of biosafety governance during the agroecological transition.

Plants and animals, whether productive, affective or otherwise, as well as the local population, whether in the place where they work, study or live, are exposed to possible health risks that may be common or introduced into the territory, the manifestation and magnitude of which depends on various factors related to governance in regulatory capacities (legislation, procedures, measures) and agroecological self-regulation (design and management of systems, people's attitudes)

Regarding the acquisition and consumption of fresh agricultural products, five characteristics predominate in the personal and social behavior of the majority of the population: supply, quantity, size, appearance and access; Although, there are sectors of the population and places where they also consider that they are free of chemical substances and have nutritional value, attributes that have been promoted by organic agriculture; This agricultural production model has also contributed to the perception of the safety of raw materials and additives used in processed products. Recently, based on the experience of the pandemic caused by Covid-19, the population also considers the biosafety of livestock products, whether live animals or their products.[6]

This complexity in the field of manifestation of the health risks of plants, animals and people, positions biosafety as a universal responsibility, whose measures should not be limited to the entities that manage the different processes, but should also be popularized as a social and personal attitude.

Agroecological self-regulation of health

As a result of co-evolutionary processes, mainly with respect to habitat and nutrition, whether of plants (cropping systems), animals (livestock systems) or people (community), the functions of associated biodiversity play a major role in health, a natural characteristic that has been neglected with socioeconomic development.

In agricultural production carried out in multi-crop systems (polycultures, polyfruits, polyforages, agroforestry), agroecological self-regulation of harmful organisms is promoted, mainly due to the fact that greater genetic diversity, the reduction of interventions with agrochemicals and the integration of organic and biological nutrition, facilitate functional biodiversity; while the opposite happens in specialized cropping systems with high use of agrochemicals, due to genetic simplification (monoculture) and the reduction of biodiversity functions.

In the production systems that integrate livestock farming, whether for marketing or self-sufficiency purposes, health risks are reduced when the requirements on access to the facilities (pastures for grazing, semi-stabled animals, pens, cages), distance between them and delimited by fences and auxiliary vegetation structures (hedges or living barriers) are met. the welfare of the animals (water, microclimate) is guaranteed and the diet is diverse, integrating functional foods free of chemicals, toxins and antibiotics, so as to reduce the risks of dispersion and manifestation of disease-causing agents and parasites; whereas, when these agroecological designs and management are not carried out, the systems are more vulnerable.

Agroecology emerges as a discipline that provides basic ecological principles on how to study, design and manage agroecosystems that are productive and at the same time conservative of natural resources and that, in addition, are culturally sensitive and socioeconomically viable.[7]

The interrelationships between multiple species of plants and animals, along with natural processes, provide clean air and water, rejuvenate soil fertility, create niches for multiple species, and provide a wide variety of food and genetic resources, functions that make ecosystems healthy are resilient to sudden climate changes, natural disasters or disease outbreaks; processes that have a direct and tangible link with human health, since there is an intimate connection between soil biodiversity, microorganisms, plants and their seeds, wild and crop varieties and species, animals and the biodiversity of our diet and intestine.[2]

The effects of agroecological transformation are cumulative over time. For agroecological self-regulation capacities to be expressed in systems, the implementation of a coherent and systematic process is required regarding the reduction of degrading practices

(agrochemicals, excess mechanization, single cultivation, bare soil, others) and the progressive integration of practices agroecological (designs and management), so that the selection pressure of resistant populations of the biota associated with negative functions (harmful organisms) is reduced and the biota associated with positive functions is regenerated (decomposers of organic matter, pollinators, natural enemies of harmful organisms, rhizospheric and epiphytic microbiota, plant, animal and human microbiome).[8]

In fact, human health is closely related to the environmental factors of the environment.[9] The different existing models on health determinants contemplate the environment as an important factor to take into account.[10] Several leading authoritative reviews have shown that dietary diversity is associated with better health outcomes, and that a monotonous diet, even biofortified, is associated with nutritional deficiencies and high rates of chronic disease.[11]

The intestinal ecosystem is a complex environment in which dynamic and reciprocal interactions occur between the epithelium, the immune system and the local microbiota.[12] Likewise, the concept of a nutrient as any assimilable substance contained in food, which allows the body to obtain energy, build and repair tissues and regulate metabolic processes, has passed to that of an immunonutrient, which is a substance that, unlike a nutrient conventional, is capable of enhancing the immune system.[13]

The original human populations lived in communities, where they coexisted in a feeding system integrated into the natural habitat. With social development, they were regrouped into urban (towns and cities), peri-urban and rural socio-ecosystems. These characteristics have contributed to the fact that today's society is made up of population conglomerates in anthropized habitats, where the quality of food and the state of health, which are still valued separately, have become important social problems, including in rural areas. where the influences of modernity have eroded traditional food culture and medication.[14]

The self-management of food and bio-inputs (bioproducts, reproductive material and food processing) also contributes to the capacity for agroecological self-regulation, and local marketing circuits are increased, among other characteristics in the functional redesign of the territory. Although these self-management capacities contribute to reducing the risks of introduction and establishment of harmful species to non-existent plants, animals and people, they put pressure on the capacity of health surveillance and biosafety control entities, due to a greater diversity and dispersion of service and production units, with a high prominence of the resident population.

Self-management of biosafety

Biosecurity is a complex problem that changes on the basis of multifaceted processes, such as interactions between humans, microorganisms, anthropogenic and ecological environmental factors, and, on the other hand, between political and socio-economic tensions.[15,16]

Therefore, the organization of said security through the application of basic principles (practices and procedures, security equipment and facility design) is an unavoidable task in each entity where biological agents are manipulated (whether for teaching, research or in the biotechnology industry), which may affect man, the community and the environment.[17]

Considering that the scope of biosafety governance in the food system is not limited to biotechnological productions (bioproducts, reproductive material), where rigorous regulatory measures are established, it is not enough to identify health risks and establish regulatory measures that must be complied with by primary and post-production food production units and those that offer complementary services. There is also a need to build people's capacities about the factors that facilitate the manifestation and dispersal of organisms that cause health problems in plants, animals and people. The governance of biosafety requires an understanding for action through the education of the population.

Biosafety is increasingly applied in different scenarios, which demonstrates its importance today, however, there are deficiencies in its management due to ignorance and low perception of risk, which is why work must be done on the basis of to promote a culture of biological safety as a driving force for the implementation of biosafety adjusted to each of the scenarios where it must be applied.[17]

Access to agricultural production systems (farms or farms), whether for people, vehicles, animals, agricultural and livestock reproductive material, requires special attention to biosafety systems, because in these units' plants and animals multiply massively in different types of cultivation and livestock systems, which is why they are exposed to health risks. the impact of which can have negative impacts on the food system.

The complexity in the manifestation and dissemination of the causal agents of health problems, which can become epidemics and pandemics, whether in crops, livestock or people, with possible human-animal interactions, justifies the need to move towards a biosafety self-management that is holistic, synergistic and participatory, at the scale of territories and communities.

Conclusion

The self-management of health risks in the food system implies participatory and synergistic governance in the system of surveillance and action against health risks, the transformation of systems to create capacities for agroecological self-regulation of organisms harmful to people, animals and plants, and the population's perception of biological safety.

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Conflict of interest

Authors declare that there is no conflict of interest.

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