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The Role of One Health Approach to Feed the World and Sustain the Planet

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Mini Review

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ABSTRACT

The current situation of the Earth, which has now become the Anthropocene, requires man to act on food system with two equally important objectives: feed the population and protect the planet. A useful concept for this purpose is One Health: a collaborative, multisectoral, and transdisciplinary approach with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment. All this, in fact, means that it is necessary to act in a coordinated way to achieve the same objective for the three aspects of the issue: 1) how animals, as source of foods and other functions, can affect human health; 2) how animals, according to species, production type, number etc. can affect planet health; 3) how animal health allows to achieve the previous two objectives. However, not only specific technical-scientific knowledge are important, since the planet presents completely different situations in terms of socio-economic development and this must be taken into account in the attempt to achieve One Health objectives to the maximum level possible and everywhere.

INTRODUCTION

According to Foley [1], "To feed the world without ruining the planet, agriculture will have to produce much more food and find better ways to distribute it, while significantly cutting the damage it does to the atmosphere, habitat and water." He did suggest 5 solutions, to be used together: 1) Stop expanding agriculture's footprint. 2) Close the world's yield gaps. 3) Use resources much more efficiently. 4) Shift diets away from meat. 5) Reduce food waste. To simplify, the first 3 mean an increase of productivity and last two a reduction of losses (again better efficiency).

To better understand the Foley's suggestions, we must remember the externalities of the agri-food system, associated with the production of food; according to Willet, et al. [2]: "agriculture occupies about 40% of global land, and food production is responsible for up to 30% of global greenhouse-gas emissions and 70% of freshwater use." And animals contribute considerably to this impact, at least for occupied land (28-30 *vs*. 10%-12%) and GHG emissions (20 *vs*. 10%); for water, 70% represent the withdrawn proportion utilized for irrigation (but it would be only 20% for animals). Therefore, to reduce the environmental impact, they suggest an almost vegetarian diet, defined healthy diet because the same authors recall the negative effects on human health of food of animal origin (obesity and non-communicable diseases). Many of the problems mentioned so far have a motivation and deserve attention, but are they such as to exclude animal farming? Still Willet et al. suggest that many regions, such as sub-Saharan Africa, still face severe burdens of undernutrition and malnutrition, and growing children often do not obtain adequate quantities of nutrients from plant source foods alone [2]. This means that proper quantities of foods of animal origin are essential. On the other hand Shefali Sharma, director of the Institute for Agriculture and Trade Policy (IATP) tells Food Tank (January, 16, 2022) that there needs to be a transition out of the industrial model of livestock production to a low density stocking well managed pasture, which will sequester carbon, increase soil health, and ultimately lead to a better climate. This means that a correct way of raising animals (even if not just grazing) can improve - and not necessarily worsen - the health of the planet.

LITERATURE REVIEW

With reference to what is highlighted in the introduction, there are three aspects to clarify on this issue: i) how animals, as source of foods and other functions, can affect human health; 2) how animals, according to species, production type, number etc. can affect planet health; 3) how good animal health can allow to achieve the previous two objectives.

Animals and human health

It is well known that animals can bring some diseases to humans (zoonoses and food borne diseases), but there is no room to talk about them here. Quite often, particularly in the developed countries, farm animals are considered only as a source of "nutritionally rich" foods; but it is a big mistake, because animals:

- allow the enhancement of otherwise unusable plant resources, starting from those supplied by 3.3 billion ha, equal to 2/3 of the world agricultural area (about 4.8 billion hectares), and which cannot be cultivated. To these almost natural resources, we must add various by-products and waste that enter the diet of animals; in fact, according to Mottet et al. [3], 86% of animal feed would not be edible for humans;

- supply power with different purposes, but namely essential to increase the productivity of cultivated land; animals provide energy in Low-Income Countries (LIC) to plow, draw water and transport people and goods [4];

- produce textile fibers and hides-leathers for the most diverse uses; as well as manure that can be used as organic fertilizers to increase the productive response of cultivated plants. Furthermore, 35-50% of the live weight, is not used for human nutrition, but after slaughterhouse enters industrial processes to make cosmetics, pharmaceuticals, pet food, fertilizers, biogas etc [4];

- Finally have a considerable role in guaranteeing socio-cultural functions, with not negligible economic implications, also in low-income countries: psychosocial well-being, traditional foods, cultural, ritual, and religious events, dowry for weddings, physical exercise, sport and recreation (hunting) [5].

All these functions of animals have a more or less important role in ensuring human health, both directly (greater food availability) and indirectly (clothes and footwear, less tiring work, better psycho-social conditions of life, etc.). Nevertheless, no doubt that nutrition–particularly supplying 40%-50% of very high quality proteins, but also some essential fatty acids, besides micronutrients (minerals and vitamins)–remains one of major functions. This particularly in some life conditions: child, pregnant and lactating women, and ageing persons; however, a proper amount is always important. This role is strategic in the low-income countries, because: "Even small amounts of animal source foods can improve the nutritional status of low-income households" [6]. In fact, according to Adesogan, et al. [7]: "Livestock and ASF are vital to sustainability as they play a critical role in improving nutrition, reducing poverty, improving gender equity, improving livelihoods, increasing food security, and improving health"; particularly because animal-source foods can ensure normal physical and cognitive development of children [8].

Animals and planet health

Animals are part of the living nature of planet Earth and therefore farmed animals are not a potential cause of harm for it. It is in fact the increase of number that could have an unbearable effect in terms of occupation of natural areas (deforestation with biodiversity loss), atmosphere warming due to greenhouse gasses, and several kinds of pollution (soil, water, and atmosphere). Nevertheless, has been previously mentioned that animals allow a restraint of intensely cultivated areas by producing food from almost natural areas, which would still be inhabited by wild animals with similar negative effects. Furthermore, there is confirmation that well-managed farm animals can contribute to increasing the C accumulated in the soil [9]. This means that our objective must be the reduction of animal number and their proper farming. The number of livestock has certainly increased in recent decades, at least after 1960, for two main reasons: i) individual consumption of eggs and meat has more than doubled, but milk has also risen significantly; ii) the world population has grown from 3 to 8 billion. This required a greater number of animals and therefore an increase in the occupied land (for grazing or to cultivate cereals / protein components of feeds). In reality, albeit with some approximation, the increase in the agricultural use of land (today 4.8-5.0 billion ha out of the total 13.3) was rapid until the immediate post-war period, while it increased little or nothing after 1960 (the period previously considered for the increase in the consumption of animal-source foods). This apparent contradiction is due to the well-known improvement of productivity of crops and animals; this at least in developed countries or those on the way to development. Unfortunately, the situation in a continent like Africa is different because livestock accounts for one-third of the global livestock population and it will be increasing, but food production is very low. Therefore, the increase of livestock production obtained with a larger number, causes extensive land degradation, overgrazing, and associated loss of biodiversity. Furthermore, because it is associated to the human population increase, more and more pastureland is used for food crop cultivation, thus increasing stocking rate (and degradation risk) on remaining grazing lands.

This type of situation occurs to a certain extent also in other continents and can force animal breeders to find new pasture areas (i.e. forest clearing in Brazil), but the occupation of new land is not the only problem; in fact,

converting forest in pasture or pasture into cultivated crops, produces the phenomenon known as change of use of the soil which still today represents about 1/3 of the world CO_2 emissions from the agri-food system [10]. Therefore, the increase of animal number not only causes an increase of land occupation, but also contributes indirectly to the warming effect (GHG rise for soil emissions increase). This, of course, adds to the direct effect on the increase in GHG (methane) emissions by low-productivity animals; in fact, the emissions per unit of livestock product are, in east Africa, four times greater than the global average, but particularly respect to the developed countries. According to the average milk carbon footprint in developed countries is 1.3 kg of CO_2-eq./kg of milk (9000 kg/lactation), much lower than the corresponding Sub-Saharan Africa estimates of 7.6 kg of CO_2-eq./kg of milk (250 kg/cow). Similar differences can be showed for meat.

This means that, especially in LIC, it is essential to achieve a substantial increase in animal productivity and the necessary knowledge is already widely available (science and technology). This improvement, as already mentioned, ensures a reduction in the number of animals and at the same time-especially in low-income countries, where many farmed animals are ruminants and managed on pastures-can also contribute to the fundamental objective of promoting the so-called carbon farming, namely the accumulation of Soil Organic Carbon (SOC). There are several grazing and land management options that can increase SOC: practices that optimize the floristic composition of pastures, the shifted and not excessive consumption of forage (stocking rate reduction) to maintain soil cover, therefore a greater accumulation of nutrients, organic matter and water in the soils; a further improvement can be achieved by planting trees (silvo-pastoral systems) or perennials plants with deep roots [5].

Farmed animals are also held responsible for the exploitation of water, as well as its pollution (nitrates and phosphates), but also of the atmosphere (PM 2.5 and 10) and soils. In general, these are less serious problems (albeit to be addressed), and we only remember that-at least for the green water (rain)-animals do not steal anything since rain would have no other useful use for humans.

Animal health for that of humans and planet

It has been shown so far that on the one hand animals, with their products and services are indispensable for mankind, but on the other hand they can have a negative impact on the planet system. However, the magnitude of these negative effects is influenced by many factors, among which the number of animals dominates; therefore, if we want to contribute to planet preservation-in addition to minimize our needs for animals-a second fundamental step is maximizing their productivity, to cover even reduced needs with fewer animals. Well highlighted in the conclusions of WRI (2019) report: “Productivity gains also provide the most important potential synergy between income, food security, and environmental goals.”, has been well documented by Balmford et al., suggesting that the additional externalities resulting to generate the same quantity of agricultural product are higher in case of low-yield systems, because they require more land (with a reduction of natural habitat) and increase GHG emissions, soil losses etc [11].

We all know that, for maximum productivity, an optimal level of health is first of all necessary; of course together high genetic merit, optimal feeding, comfortable environmental conditions (dry-soft bedding, protection from heat-cold excesses, absence of stressful situations, etc.) and good general management (hygienic-sanitary conditions, reproduction, animal/animal as well as human/animal interactions, etc.). All these conditions are also necessary to

guarantee optimal conditions of welfare to the animals which man asks to contribute to its well-being, as well as lower risks of zoonosis and food borne diseases. However, health issue is a too vast subject to be treated here, therefore I limit myself to underline the enormous differences between little or no developed countries compared to developed ones:

1) in case on underdeveloped countries, there are numerous negative factors, including: shortages of veterinary services, lack of technical assistance for animal owners, absence of commercial structures both to supply medicines and supplements, but also to enhance animal products (animals, milk, eggs). Other important negative factors for these countries are the low cultural level and a mentality tending towards passivity. For these reasons, several efforts made to introduce advanced technologies in these countries, failed. In fact, aid to LIC cannot be solely of a financial-technical nature but must be based on the involvement of local people, who must be engaged directly, in a kind of partnership;

2) in case of developed countries, it is important remember that infectious-parasitic diseases are less spread; on the other hand, production diseases, that are linked to high production, management errors and stressful factors, take on greater relevance. Intensive systems are usually characterized by high feed intake and well-balanced diets, deficiencies are rare, while the excesses are infrequent if the diets are calculated to cover the corresponding requirements of high-yielding animals. However, of major interest could be the case of high-yielding dairy cows which in the transition period are strongly conditioned by inflammatory processes, including subclinical ones, which can have many different causes, often occurring at calving time: infections, energy excesses, stressful conditions that can alter digestive function, etc [12]. This can impair for several weeks the Negative Energy Balance (NEB) and increase the risk of secondary metabolic (ketosis) or infectious (i.e. mastitis) diseases, at the end affecting milk yield, fertility and therefore longevity (thus confirming that health must have a holistic approach) [13].

DISCUSSION AND CONCLUSION

In the Anthropocene era, man's choices significantly affect the status of the planet, especially for strategic resources: minerals, energy, water, and atmosphere and, in general, for the life conditions for nature organisms (biodiversity). This is also true for agri-food system because the challenge is whether we can feed the world and sustain the planet. The One Health model and its holistic approach can be of great interest, namely for the production of animal origin foods; in fact, their good health allows a proper availability of foods which are essential for human health, but at the same time it occurs with a reduction of possible dangerous consequences (i.e. occupied land, GHG emissions, and any kind of pollution). To conclude, it would guarantee an improvement of the ecological system, which means better health of the planet and therefore better life conditions for humans and animals.

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