Chapter 1

Introductory Chapter: Ruminants—The Husbandry, Economic, and Health Aspects

Muhammad Abubakar, Abdullah Iqbal, Abdul Kabir and Shumaila Manzoor

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1. Introduction

Ruminants have a valuable role in sustainable agricultural systems and provision of food to human beings. They play a pivotal role in converting vast renewable resources from rangeland, pasture, and crop residues and/or other by-products into food edible for humans. Grazing ruminant animals is an efficient way to produce food for humans. The need to maintain ruminants to utilize these humanly inedible foodstuffs and alter them into high-quality foods for human consumption has been a characteristic for several thousand years. In fact, dairy cattle and goats are quite exceptional in being extremely efficient in converting plant-based protein/energy sources into high-quality animal fats and proteins. It is convincing that ruminants are essential components in food production systems now and in the future.

2. Livestock value

Livestock is an important asset throughout the world, with a value of at least $1.4 trillion. This sector is subdivided in long market chains that provide employment for almost 1.3 billion people worldwide and livelihood of 600 million poor smallholder farmers in the developing world directly depends on livestock [1]. Ruminants fulfill numerous roles, ranging from providing manure, milk, meat, and draught power. Animal protein is one of the major parts of the daily food supply. Globally livestock products contribute 33% of daily protein consumption in the shape of eggs, meat, and milk. The demand of livestock products is increasing day by day due to rapid urbanization and population growth [2].

In developed countries, animal diseases adversely affect the economy of livestock farms, businesses, and animal production sectors, whereas in developing countries, there are additional menaces of food scarcity and capital reduction [3].

In developed countries, during the last few decades, there has been a decrease in livestock diseases due to the increase in vaccine's quality and quantity, more effective drug development, and advancement in diagnostic technologies. At the same time, the emergence of new diseases such as avian influenza H_5N_1 became a threat for whole world [4]. In developing countries, there have been comparatively less changes in the incidence rate and prevalence of diseases of livestock. Maladministration and husbandry practices can increase the susceptibility to parasites and pathogens. If any young animals die of disease at an early age, this decreases profit [5].

3. Ruminants health and economics

Outbreak of any disease adversely affects the livestock production starting a process that progressively leads to low production and little profit. Animal diseases in livestock are mostly multifaceted and affect all the persons involved in food chain starting from livestock owner to the livestock product consumer. These diseases affect the economy through various ways, including decreased production, increase cost of treatment, market disturbances, a ban on the transportation of livestock products, limited tourism, and prevention and control expense [6].

If we take an example of foot and mouth disease (FMD), a disease of low mortality, but the worldwide impact of FMD is massive due to a larger number of animals affected by disease [7]. The losses due to FMD can be subdivided into direct losses because of decreased production and indirect losses due to expenses of FMD control and limited access to markets [8]. It is estimated that outbreaks of FMD in FMD free countries and zones can result in loss of >US$1.5 billion per year. FMD endemic countries suffer annually between US$6.5 and 21 billion due to production losses and vaccination [9]. Foot and mouth disease outbreak in the UK in 2001 resulted in the slaughter of 6 million animals [10].

Mastitis is another major problem of dairy animals that negatively affects the production. This directly lessens the net profit due to treatment expenses, reduced milk production, and quality of milk. Indirect impacts of disease include decreased fertility, increased culling rate, and rarely mortality [11]. Globally, published data regarding the economic losses of clinical mastitis depict the loss from €61 to €97 per cow on a farm, depending upon preventive practices. For example, in The Netherlands, economic losses due to clinical and subclinical mastitis varies from €17 to €198 per cow per year [3].

Bovine respiratory disease (BRD) is the most common disease among the feedlot cattle. BRD causes an estimated $800 million to $900 million annually in economic losses from death, reduced feed efficiency, and treatment costs [12]. Peste des petits Ruminants virus causes large economic losses each year due to high mortality and morbidity rates in the infected sheep and goats and outbreaks were more severe in goats than sheep. Global estimated impact due to this disease is in between US$1.4 and 2.1 billion [13].

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4. Control and eradication of diseases

For prevention and control of infectious diseases, strict biosecurity measures, quarantine, isolation of infected and disease suspected animals, effective disease surveillance, monitoring and networking programs with suitable vaccination, and treatment strategies play a key role [14]. Routine farm practices should include measures to decrease spread of transmissible diseases, for example, by improving hygiene, keeping newly purchased animals in the quarantine, and establishing coordinated, sustained surveillance for diseases that can spread beyond borders of countries and continents [15]. Control of any disease is varying value that depends upon the country and region and needs annual expenses [16]. All most all the disease can be controlled by following simple procedures such as quarantine and vaccines. The eventual feat of control of any disease is the eradication of disease. But it is not compulsory that a disease that can be controlled can also be eradicated.

Proper cleaning and disinfection is a critical step in limiting the fecal-oral transmission cycles of pathogens that are mostly present in the feeding or treatment equipment or fomites [17]. The first step is a systematic cleaning to remove organic material before applying disinfectant. Everyday vigorous scrubbing can avoid the development of biofilms, which act as a shield for microorganisms against disinfectants.

Adequate ventilation is imperative to the health of housing animals. Sufficient ventilation in a walled housing not only removes infectious aerosol pathogens but also reduces humidity [14]. Decreased humidity decreases the survival time of airborne and surface-borne infectious agents. In case of disease outbreak bedding materials from infected animals, feed stuff, excretory and secretory products including dung and urine, and clothing of people working in infected animal houses should be destroyed properly [17]. Biosecurity refers to the management practices that decrease the contact of infectious pathogens in animals. Adoption of biosecurity measures can prevent the incidence of infectious animal diseases. Closed door policy is a pivot point of biosecurity at any farm [18].

Vaccination has been a practical approach for the control and eradication of several infectious diseases worldwide. Effective control measures along with proper vaccination can lessen the incidence rate of the different animal diseases [19]. Vaccination is used to progressively decrease the burden of infection until either eradication becomes certain or culling policy becomes an economically feasible option [18].

Many factors interrelate to lessen the immunizing efficacy of vaccination programs such as low quality vaccines, improper vaccine storage, and immune status of animals [20]. Recent molecular techniques such as development of subunit DNA vaccines, recombinant vaccines, and non-pathogenic virus-vectored vaccines lead to the production of more efficient and safer methods of immunization [16].

OIE pathway to control any disease includes preliminary surveillance for that disease, followed by mass vaccination to control the disease, and then again serological surveillance to monitor disease prevalence. These approaches push the country on the way to free from diseases that result in the declaration of provisional absence of disease [15].

Constraints in controlling the diseases should be resolved to encourage the eradication of diseases which would ultimately reduce the economic loss. Basic limitation for the eradication of any livestock disease is the cost of eradication. In developing countries of Asia and Africa, where the diseases are endemic control by vaccination of animals is a feasible option than culling of seropositive animals [21]. Due to limited funds, mass vaccination for controlling any disease is also a serious issue. Another limitation is that veterinarians are unable to collect the samples due to the lack of technical expertise, deficiency of facilities for sample collection, and preservation and transportation to the adjacent laboratory for accurate diagnosis [14].

5. One Health concept

The One World, One Health theory represents that the health of all living things present on this planet depends upon the health of other living things [22]. To survive in this world now, we should consider the planet as a dynamic system, in which the health of each component is linked and reliant on others [23]. If we want to control human diseases, we should also consider the diseases of animals. Nearly 60% of human infectious diseases is from animal origin and 75% of the emerging infectious diseases of humans reported during the last 30 years is of animal origin too [24].

Several emerging infectious zoonotic diseases have arisen as a threat to food supply and the control of these diseases needs the collective expertise [25]. As human population is growing day by day, interaction between the people and wild animals is also increasing. This exposes human to diseases [26]. Ebola and AIDS are two major examples that possibly transmitted from chimpanzees to humans [24]. One Health gives a noteworthy chance to veterinarians to cooperate with human medical experts, wildlife, and environmental health professionals for the greater good [27].

6. Conclusion and future perspective

The animal diseases should be given serious consideration and advanced research facilities should be established. For successful control of livestock diseases, epidemiological forecasting, accurate and early diagnosis, safer and quality vaccines availability along with adequate infrastructure facilities for cold storage and transport facilities are required. This will increase the livestock production, which eventually results in alleviation of poverty in the rural areas. We must adopt such husbandry practices so that we can keep livestock in such a way that it is best for individuals, communities, and the planet.

Author details

Muhammad Abubakar*, Abdullah Iqbal, Abdul Kabir and Shumaila Manzoor

*Address all correspondence to: mabnvl@gmail.com

National Veterinary Laboratory, Islamabad, Pakistan

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