

Editorial**Veterinary Pharmacy, a Dismissed Necessity**

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Veterinary pharmaceuticals play an important role in human and animal health. Although some dosage forms are specially designed for use in animals (e.g. ear tags, collars and darts), most drug delivery systems (including nano-carriers and controlled drug delivery systems) are common between animals and human (1).

A successful drug development process (for human or animal use), from initial drug discovery to market, requires skill and knowledge in different areas of science of which some disciplines (e.g. pharmaceuticals) are exclusively covered in pharmacy undergraduate or postgraduate programs. Pharmaceuticals is the art, science and technology of drug delivery system design, manufacture and control and include pre-formulation studies, dosage form design, pharmaceutical processing, quality control, quality assurance, biopharmaceutics and etc. Therefore, like human medicine, pharmacists are expected to design, manufacture and control veterinary drug delivery systems at both levels of pharmaceutical companies or compounding in a pharmacy. This is not what is happening in most veterinary pharmaceutical companies and almost all veterinary-based pharmacies in here, where the professions are performed by veterinary medical doctors (Doctor of Veterinary Medicine, DVM) (2). The educational program in veterinary medicine (DVM) is clinical-based and is focused on prevention, diagnosis and treatment of animal diseases (3), the same perspective as that designed for the physicians (MD). While, there is not such authorization for physicians to act the same in human-oriented pharmaceutical systems.

On the other hand, formulation of many drugs for human use is seldom suited for animal administration (4). Design and preparation of veterinary drug delivery systems requires different considerations and is facing more challenges than that of human formulations and cannot be implemented based on human data only. Following are some special considerations (1, 5):

- Which species is the target (ruminants, avian, mammalians, reptiles, fish, wild animals, pets, insects, bees, etc?)
- Will it be used in more than one species?
- Will it be used in food producing animals? In this case, what would be the risk to human health due to residuals in milk, meat and other products?
- What flavor do animals like?
- How can one ensure compliance?
- In what environment or weather the drug will be used?

The animal species will markedly affect the administration route, dose size and type of delivery system. Different species differ in their body size (e.g. compare parrot and horse), body fat distribution, GIT (e.g. ruminants vs. non-ruminants), skin type, drug absorption, drug distribution, biliary excretion (e.g. rats are good biliary excretors, while rabbits are poor and sheep are moderate), metabolism and excretion, receptor sensitivity to drugs, behavior, dietary habit, endocrinology and etc. (5, 6). Other factors include sleep cycle, hibernation, single or herd dosing, drug delivery to wild animals, convenience of administration and cost (1, 5). The last two factors are the foremost criteria in determining the use of dosage forms by animal owners (1).

Now let's have a look into community pharmacy. Many industrial farmers have contact with

their veterinarian, but, what about other people that might have simple questions regarding their pet, zoonosis, etc.? Pharmacists cannot simply advise animal owners or recommend OTC drugs based on their knowledge of human body or human pharmaceutical products. It has been shown that salicylates and acetaminophen are responsible for considerable morbidity and mortality in cats (6).

Considering the above mentioned expectations, pharmacy graduates need special information, i.e., we need pharmacists specialized in veterinary pharmacy to share the experience and also responsibility with veterinarians to ensure the well-being of pets and food-producing animals and indirectly human (7, 8). Pharmacists are in a key position to act as a link between veterinarian and animal owners, like what is happening in a human-oriented pharmacy (9). Such information is not currently provided in our undergraduate or postgraduate pharmacy programs in Iran, at least for those who are interested in the field, and, the question is why? The same applies to many pharmacy programs (BPharm, MPharm or PharmD) around the world.

In Iran, production, distribution and control of human drugs are regulated by the Ministry of Health and Medical Education (MOH) (10) and all aspects of veterinary drug products (from production to use) are regulated and controlled by Iran Veterinary Organization of the Ministry of Jihad-E-Agriculture (2). Based on these regulations, veterinary medical doctors (DVM) can act as a responsible manager in veterinary pharmaceutical companies (2). DVMs are equivalent to physicians (MDs) in human health system, as described above, but, there is not such an authorization for physicians to act the same in human-oriented pharmaceutical companies. In the USA, however, the Center of Veterinary Medicine of the FDA regulates the manufacture and distribution of both human and animal drugs and even food additives that would be given to animals [including food producing and companion (pet) animals]. Veterinary biologicals (e.g. vaccines) which are used to prevent or diagnose animal diseases are regulated by U.S. Department of Agriculture (11).

The practice of veterinary pharmacy is an emerging field in the USA, with the roles of dispensing, compounding and providing drug information, as studied by Ceresia et al. (8). However, it seems that this profession suffers from the lack of consensus regarding the definition and learning experiences required to practice in these roles (8). Veterinary pharmacy is also considered as a career for pharmacists in almost every branch of the profession (e.g. community pharmacy, industrial pharmacy, etc.) by the Royal Pharmaceutical Society of Great Britain (12). Accordingly, a community pharmacist will be able to offer advice to customers about health of their pets, can supply medicine and give advice to livestock farmers, and others might use their pharmacy skills in veterinary pharmaceutical companies or related regulatory organization (12). Also, the Pharmaceutical Group of the European Union, which its main function is to represent community pharmacists, has a veterinary pharmacists subgroup (13).

During my survey, I came across a number of places that provide courses in the field of veterinary pharmacy for pharmacists or pharmacy students. These include "Veterinary Therapeutic Courses for Pharmacy Students" provided by Creighton University's School of Pharmacy, Omaha, USA (14) and three veterinary pharmacy programs provided by Royal Pharmaceutical Society of Great Britain in collaboration with Harper Adams University College (UK): "Certificate in Companion Animal Health Care", "Certificate in Livestock Health Care" and "Diploma in Veterinary Pharmacy" (9).

I think we have to change our direction in the field, if we want to improve our health. In my opinion, pharmacists and veterinarians should get harmonized in practice and regulatory affairs. It is recommended to establish a joint task force, prioritizing health and safety concerns, to finally come up with an active plan to optimize current veterinary pharmaceuticals regulatory practices. Let's join these two important specialties. In this direction, and as far as the pharmacy discipline is concerned, I suggest the following changes in our pharmacy education program:

- Implementation of some modules related to veterinary pharmacy to current PharmD program.
- Establishment of MSc and/or PhD programs in veterinary drug delivery (dosage form design, biopharmaceutics and pharmacokinetics).
- Establishment of a MSc program in veterinary pharmaceuticals manufacture, quality control and quality assurance.

- Recognition of veterinary pharmacy as a specialized area within pharmacy practice.

I have personally consulted such necessities with different colleagues in academia, government and other professional organizations such as Shahid Beheshti University of Medical Sciences (SBMU), Tehran University of Medical Sciences, MOH's Deputy for Food and Drug, MOH Department of Pharmaceutical and Narcotic Control, MOH's Pharmacy Higher Education Council and School of Pharmacy of Islamic Azad University; all of which have agreed with such necessities. Consequently, and upon my suggestion, the overall program leading to a MSc degree in "Veterinary Pharmaceuticals Manufacture, Quality Control and Quality Assurance" has been approved by MOH's Pharmacy Higher Education Council and also the Department of Pharmaceutics at SBMU; with the details of individual remained units to be constructed in due course.

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