

Global market for veterinary herbal products during the 2018-2019 period

Mercado mundial de produtos fitoterápicos veterinários durante o período 2018-2019

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ABSTRACT

The industrial manufacturing of natural products for veterinary use represents a major weakness in the veterinary sector despite increased interest and the traditional ancestral knowledge that supports them. A cross-sectional, descriptive observational study was conducted to characterize the veterinary herbal products marketed worldwide during 2018 and 2019. A comprehensive thematic search limited to the 2018-2019 period was performed in the ScienceDirect, Scopus, PubMed, Web of Science, ResearchGate, and Academic Search Complete databases. The investigation identified 487 products registered in the global market manufactured by 54 companies, led by India, The Netherlands, and the United Kingdom. The market segments of animal production and phytomedicines were dominant with 73.7% and 53.0% of products, respectively. Cattle (22.2%), sheep-goats (16.2%), and canines (16.2%) were the most favored species. The most represented therapeutic indications were those intended to treat gastrointestinal disorders (30.47%), antimicrobials (16.66%), and antiparasitic agents (10.47%). The families Fabaceae, Lamiaceae, Asteraceae, Apiaceae, Malvaceae, and Rutaceae stood out because of their frequent use, encompassing 35.0% of the 137 declared species. *Andrographis paniculata* (Burm.f.) Nees and *Withania somnifera* (Lin) Dunal were the most important species. Oral formulations for internal use (72%) and liquids (51%) in 100 mL, 500 mL, and 1 L presentations showed the highest prevalence on the market. The global market for veterinary herbal products during the 2018-2019 period was relevant in the productive and medical animal sector. No differences were found between medicinal plant species used to formulate herbal products for human and animal use.

Keywords: Herbal product. Veterinary health. Pharmaceutical industry. Marketing. Phytotherapy.

RESUMO

A fabricação industrial de produtos naturais para uso animal é uma das grandes fragilidades do setor veterinário, apesar de um crescente interesse e do suporte dado pelos conhecimentos tradicionais ancestrais. Foi realizado um estudo observacional descritivo transversal para caracterizar os fitoterápicos veterinários comercializados mundialmente no período de 2018-2019 através de uma busca temática exaustiva nas bases de dados ScienceDirect, Scopus, PubMed, Web of Science, ResearchGate e Academic Search Complete. O estudo mostrou a existência de 487 produtos registrados no mercado mundial, fabricados por 54 empresas, lideradas pela Índia, Holanda e Reino Unido. Os segmentos Danimal produtivo e fitomedicamentos dominam o mercado com 73,7% e 53,0% dos produtos, respectivamente. Bovinos (22,2%), ovinos-cabras (16,2%) e caninos (16,2%) foram as espécies mais favorecidas. As indicações terapêuticas mais representadas foram aquelas destinadas à correção de distúrbios gastrointestinais (30,47%), antimicrobianos (16,66%) e antiparasitários (10,47%). Devido à alta frequência de uso, destacam-se as famílias Fabaceae, Lamiaceae, Asteraceae, Apiaceae, Malvaceae e Rutaceae, que compreendem 35,0% das 137 espécies declaradas a saber, *Andrographis paniculata* (Burm.f.) Nees e *Withania somnifera* (Lin) Dunal, são as mais importantes. Constatou-se que as formulações para uso interno via oral (72%) e líquida (51%) em embalagens de 100, 500 e 1000 mL são as que prevalecem no mercado. O mercado global de produtos fitoterápicos durante o período de 2018-2019 foi relevante para animais produtivos e o setor médico. Não foram encontradas diferenças entre as espécies de plantas medicinais utilizadas em formulações de produtos fitoterápicos para uso humano e animal.

Palavras-chave: Produto fitoterápico. Saúde veterinária. Indústria farmacêutica. Marketing. Fitoterapia.

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Introduction

The worldwide social, scientific, and economic changes during the last decades have led to important changes in relationships between humans and medicinal plants and animals. Considerable traditional veterinary knowledge has taken second place in modern medicine in many cases. Besides, its practitioners have been considered primitive, old-fashioned, superstitious, and promoters of witchcraft. After overcoming this negative reputation held by the scientific community, ethnoveterinary knowledge has been recognized as a complex set of elements, including concepts, beliefs, practices, skills, and experiences transmitted vertically or horizontally along with generations. It has been demonstrated that these practices and knowledge are essential in many areas of the world to guarantee the health of livestock and therefore the survival of pastoral or agropastoral communities (Abdul et al., 2020; Wanzala et al., 2005).

Currently, there is considerable interest in herbal products despite the availability of multiple synthetic chemicals intended for veterinary use (Martínez & Jiménez, 2017). Several factors explain this, including the search for alternative, effective, and economical solutions to unresolved global health problems such as microbial resistance; the promotion of rural development along with its biocultural heritage (Aziz et al., 2018a; Mutua et al., 2020; Suroowan et al., 2017); and the similarities between veterinary and human ethnomedicine (Miara et al., 2019). Regardless of the reasons, the use of plant-based veterinary products as a therapeutic complement, or even as the only available option, has recently acquired tremendous importance in terms of animal welfare (Feyera et al., 2017; Lans, 2019; Sharma & Manhas, 2015; Yigezu et al., 2014).

The enthusiasm for herbal products occurs in difficult times, from the social, environmental, livestock, and health perspectives. The recent socio-economic changes, which have brought about rural displacement, deforestation, and the extinction of botanical knowledge, medicinal species, and practitioners, worsen this situation.

Moreover, there is an imminent increase in livestock production by 2050, associated with a demographic explosion, especially in urban areas, and the expected 70% increase in the global demand for animal protein. This unfavorable scenario includes microbiological threats, the emergence of zoonotic diseases, chemical residues in food, and increasingly demanding markets. Therefore, rescuing, preserving, and transmitting traditional values will be key for developing new and improved natural products, which could become a viable option for successfully addressing these challenges (Calixto, 2019; Cruz, 2011; Friedrich, 2014; Sen & Samanta, 2015).

In the face of this complex perspective, neither the ethnoveterinary literature nor the animal health industry is prepared to meet future requirements and opportunities. Traditional knowledge continues to be a useful resource that has not been fully exploited, and its implementation in the veterinary pharmaceutical industry is one of this industry's major weaknesses. Therefore, pharmaceutical manufacturers worldwide need to monitor the behavior of the global market for veterinary herbal products as a step leading to implementing national development strategies. In this sense, this study was aimed at characterizing the veterinary herbal products marketed worldwide in 2018 and 2019.

Materials and Methods

Search strategy

A cross-sectional, descriptive observational study was performed from January to March 2020 to obtain an overview of the herbal veterinary products on the market. The starting point was a comprehensive thematic search in databases and online platforms (ScienceDirect, Scopus, PubMed, Web of Science, ResearchGate, and Academic Search Complete) limited to the 2018-2019 period.

Thematic strategy

The title, abstract, and keywords fields were used, along with specific search terms related to ethnoveterinary science (medicinal plants, traditional medicine, and veterinary herbal products) and animal health problems (infectious diseases, microbial resistance, and reproduction, among

others). It was aimed at excluding homeopathic products and stratifying the different species of domestic animals into productive and pets. Besides, we used combinations of terms often used to refer to the bovine (cattle, calf, bovine, cow, and calves), equine (horse, equine), porcine (pig, hog, swine, porcine, and piglets), sheep-goat (ovine, sheep, caprine, goat, and goatish), bird (bird, avian, pigeon, and poultry), canine (pets, dog, and canine), and feline (pets, cats, and feline) species.

Variables studied

The generated database considered the following parameters: companies in the sector (name and country of origin); type of herbal product (phytomedicines, phytogetic additives, or natural nutraceuticals); animal species category, productive (bovine, equine, pig, sheep-goat, or poultry), or pet (dog or cat); plant species (scientific name, family, formulations, and frequency of use); route of administration (oral or external application); pharmaceutical form (liquid, solid, or semisolid), and presentation.

Inclusion criteria

- Having declared the natural active ingredient (medical plant) used in the formulation.
- Having shown indications of use in productive terrestrial animals and pets.

Data analysis

Microsoft® Excel® was used to organize and analyze the downloaded data. Descriptive statistics (percentage, frequency, and the 25th and 75th percentiles) were performed using the SPSS software, version 12.0.

Results and Discussion

A detailed analysis of the veterinary herbal product market demonstrated the wide variety of products included in it. The presence of 487 products legally authorized for commercialization during the 2018-2019 period was identified. The productive-commercial universe was composed of 54 companies, of which Ayurved Ltd, Himalaya Drug Company, Amovet, Kamal Ayurvedic Herbs (India), the ECOstyle Group (Holland), and Dorwest Herbs Ltd. (UK) were the best positioned. These results suggest that this sector of the veterinary market is large, attractive, and beyond the scope of the large international biopharmaceutical companies based in the United States, Germany, and France (Domínguez et al., 2014).

Globally, the market for veterinary herbal products is segmented by animal species (productive or pet) and type of product (phytomedicines, phytogetic additives, or natural nutraceuticals). Figure 1 shows the market share for both segments with productive animals being prevalent (73.7%), followed by pets (26.3%). Phytomedicines represented the largest market share with 53.0% of the products sold, and the remaining 47.0% belonging to the food line. Within the latter category, phytogetic additives were the best positioned (55.8%), followed by natural nutraceuticals (44.2%).

These results show that this market is somewhat more complex than initially thought. Bovine cattle (22.2%) were identified as the leading animal species, followed by sheep-goats (16.2%) and canines (16.2%). An analysis by the type of product and species showed that the phytomedicines maintained the same previous order, unlike the additive products (canines: 23.3%, bovines: 20.9%, and cats: 16.3%) and nutraceuticals (bovines: 22.0%, poultry: 20.0%, and sheep-goats: 19.0%).

The disproportion observed in the veterinary herbal product market in favor of productive animals and the medical sector was expected. The reasons are based on the ancestral requirement for using medicinal plants to ensure the health of the herd, the production of animal protein, and thus, the subsistence of agropastoral communities. Besides, the chemicals generated by modern veterinary medicine are often expensive and veterinary services are not always available to farmers (Feyera et al., 2017; Suroowan et al., 2017). Also, resistance is generated by microorganisms and the quality of animal protein is reduced. The popularity of phytomedicines intended for use in bovines and sheep-goats is proportional to the weight that these species have in the production of meat, milk, cheese, and leather. The husbandry of these three polygastric animals is essential both for household survival and for increasing economic capital and social prestige in pastoralist and peasant societies (McGaw et al., 2020; Tilahun et al., 2019).

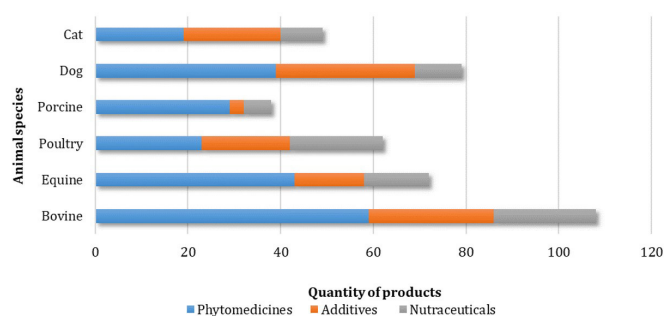


Figure 1 – Global share of veterinary herbal products on the market based on animal species and type of product during the 2018-2019 period.

Despite the overwhelming dominance of the productive species, it is important to point out the presence of pets in the medical and food sectors, with dominance in phytochemical additives. It can be inferred, therefore, that there is awareness regarding the health and well-being of pets. This is associated with the progressive change observed concerning the public perception of raising companion animals, thus provoking a greater demand for general care, food, and hygiene services. Pets today have lost their function as working animals (protecting homes and livestock, and hunting for mice) and have acquired the social function of providing company. The growing body of scientific data shows certain factors that lead to these changes are primarily related to the evident positive physical, social, and emotional impact (promoter of mental health) that possessing a pet provokes in interpersonal relationships and in families with members who are traumatized, stressed, or have chronic health problems (Bibbo et al., 2019; Lass-Hennemann et al., 2020). However, there is a false belief that herbal products have fewer undesirable side effects compared to those of synthetic origin because they are natural (Mengual-Moreno et al., 2015).

An asymmetric behavior among the 210 phytomedicines was seen when grouping them in ascending order, which is an aspect that cannot be separated from the previous characteristics. Figure 2 summarizes the representativeness of each phytomedicine and shows that the products to treat gastrointestinal disorders, antimicrobials, and antiparasitic agents are represented the most. They individually represent 30.47%, 16.66%, and 10.47% of the products positioned in the market, and as a whole reach 57.6% of all herbal products manufactured for medical purposes.

The dominant medical indications show remarkable consistency with health requirements and ethnoveterinary practices in livestock communities in Africa, Asia, Europe, and America (Abdul et al., 2020; Calzetta et al., 2020; Lans, 2019; Martínez & Jiménez, 2017; Miara et al., 2019;

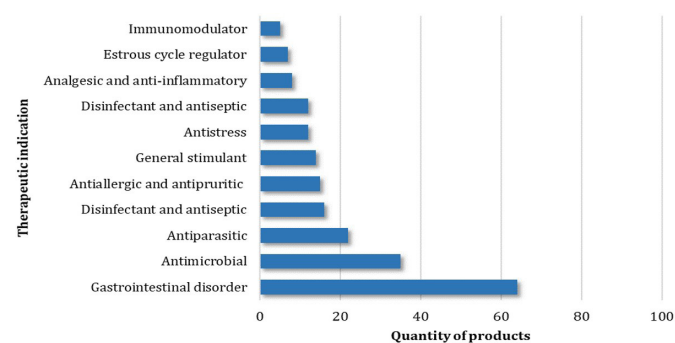


Figure 2 – Veterinary phytomedicines present on the market based on therapeutic indication during the 2018-2019 period.

Stucki et al., 2019; Suroowan et al., 2017). Additionally, there is correspondence to the diseases with the greatest effect on productive and reproductive performance of productive animals in general, and especially polygastric animals at early ages, such as diarrhea and bloating (tympanites) (Ayrle et al., 2016; Charlier et al., 2020; Figueroa et al., 2018; Swartz et al., 2020).

The considerable use of herbal products with antimicrobial and antiparasitic properties reaffirmed their relevance to current veterinary practice. From the “one health, one medicine” perspective they deserve special attention for their contributions to the control and treatment of infectious-contagious diseases, the increase in organic livestock production, and for their potential to lower the use of synthetic products in animals and humans (Hernández et al., 2018; McEwen & Collignon 2018; Mertenat et al., 2020). Another remarkable aspect is their ability to decrease microbial virulence, growth, and development of resistance. This is attributed to their numerous secondary metabolites that attack microorganisms at the same time and through different pathways when strengthening or in synergy with each other (Hernández et al., 2018; Peng et al., 2017).

The special position of these two types of drugs in the market is not coincidental. However, it occurs at a time when the human and veterinary pharmaceutical industry, farmers, and researchers seek solutions to the serious issue of antimicrobial resistance (Collignon & McEwen, 2019; Iannino et al., 2019). The reasons for this cooperation are the rapid expansion of resistance associated with the globalization of trade, a decrease in therapeutic options to combat it, an increase in productive-reproductive losses because of high morbidity and mortality, and the possibility of transferring resistant microorganisms of animal origin to humans (Astorga et al., 2019; Feiyang et al., 2019; Mutua et al., 2020; Van Boeckel et al., 2019).

The analysis of the formulations made it possible to acknowledge the wide and valuable ethnobotanical knowledge that underlies each herbal product. The inventory yielded 68 botanical families, which include a wide variety and quantity of plant species. Figure 3 shows the main botanical families that form the catalog. The families Fabaceae, Lamiaceae, Asteraceae, Apiaceae, Malvaceae, and Rutaceae were the most frequent and together constitute 35.0% (48/137) of the species used. These results are largely consistent with the results from other international ethnobotanical and ethnopharmacological studies, which not only highlight these families but also provide extensive documentation and a scientific assessment on the chemical composition and biological activity of the species grouped within them

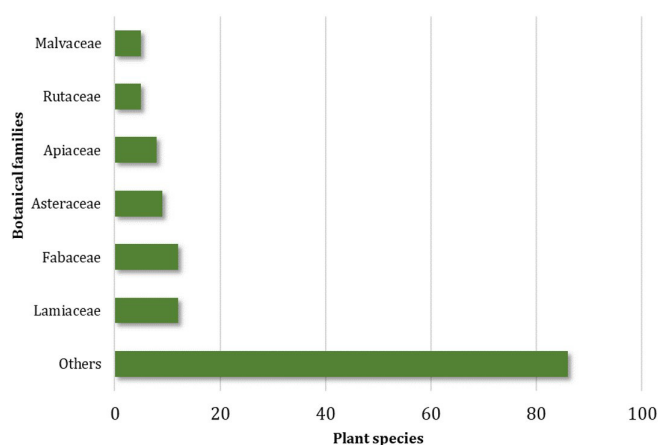


Figure 3 – Botanical families most represented in the catalog of medicinal plants of the leading companies during the 2018-2019 period.

(Abdelhafez et al., 2020; Abdul et al., 2020; Bhadane et al., 2018; Coimbra et al., 2020; Miara et al., 2019; Nisar et al., 2018; Sharifi-Rad et al., 2020; Suroowan et al., 2017).

Two interesting aspects were identified: The 137 plant species used generally have an extensive distribution and habitat, and 50% of the commercialized products are composed of one to three plants. The combined use of medicinal plants in a formulation is not surprising, since it is done to increase the product's therapeutic efficacy by the strengthening or synergy mentioned above (Hernández et al., 2018; Pietruszewska et al., 2018). This strategy, in general terms, is not exclusive to herbal products but is performed by large biopharmaceutical companies. Polyvalent vaccines formulated with several antigens are the best example (Domínguez et al., 2014). By protecting against multiple diseases simultaneously, they are the best way to reduce the manipulation of animals, lower costs, and shorten vaccination programs (McVey & Shi, 2010).

Considering a large number of medicinal plant species identified that would be very extensive to analyze, reference will be made only to species with a high and medium level of use in formulations (Table 1). The results suggested that 100% of the reported plant species, far from being of exclusive veterinary use, were extensively used in humans (Bijak, 2017; Dewangan et al., 2020; Fourati et al., 2020; Gucwa et al., 2018; Hossain & Mizanur Rahman, 2019; Javir & Joshi, 2019; Lu et al., 2019; Ma et al., 2020; Murugan et al., 2020; Nigam et al., 2020; Rose et al., 2019; Singh et al., 2019; Sabir et al., 2020; Saggam et al., 2020; Santhan, 2020; Saha et al., 2020; Singh & Geetanjali, 2016; Yadav et al., 2020; Yu et al., 2020; Zhang et al., 2020). The pronounced convergence found evinces the similarities between ethnomedical and ethnoveterinary knowledge

Table 1 – Catalog of medicinal plants with high and medium levels of use of the leading companies during the 2018-2019 period

Levels of use	Scientific name	Formulations	
High	<i>Andrographis paniculata</i> (Burm.f.) Nees	16	
	<i>Withania somnifera</i> (L.) Dunal	16	
	<i>Asparagus racemosus</i> , Willd	14	
	<i>Embllica officinalis</i> , Gaertn	14	
	<i>Zingiber officinale</i> , Rosc	14	
	<i>Ocimum basilicum</i> , Lin	13	
	<i>Azadirachta indica</i> , A. Juss	13	
	<i>Tinospora cordifolia</i> , (Thunb.) Miers	12	
	<i>Ocimum sanctum</i> , Lin	11	
	Medium	<i>Silybium marianum</i> , (L.) Gaertn	9
		<i>Terminalia chebula</i> , Retz	8
<i>Phyllanthus niruri</i> , Lin		8	
<i>Allium sativum</i> , Lin		8	
<i>Acacia catechu</i> , (Willd.) Wight & Arn		7	
<i>Bacopa monnieri</i> , (L.) Wettst		7	
<i>Boerhaavia diffusa</i> , Lin		7	
<i>Cyperus rotundus</i> , Lin		7	
<i>Eclipta prostrata</i> , (L.) Lin		7	
<i>Picrorhiza kurroa</i> , Royle ex Benth		7	
<i>Piper longum</i> , Lin	7		
<i>Punica granatum</i> , Lin	7		

(Miara et al., 2019) and reinforces the “one health, one medicine” concept.

Andrographis paniculata and *Withania somnifera* stand out from the 21 plant species identified with high and medium levels of use in formulations, thus reflecting their wide therapeutic potential and commercial value (Santhan, 2020). Both share similar pharmacological activities in humans with antimicrobial, antitumor, hypoglycemic, and anti-inflammatory activities associated with the action of andrographolide and withaferin, respectively (Dai et al., 2019; Dutta et al., 2019; Saggam et al., 2020; Zhang et al., 2020). Several authors have demonstrated the usefulness of *A. paniculata* as both an antiparasitic and antiviral agent in veterinary medicine (Elango & Rahuman, 2011; Sornpet et al., 2017), whereas *W. somnifera* excels against urinary disorders and as an antipyretic agent (Aziz et al., 2018b; Feyera et al., 2017).

In terms of the route of administration, the formulations present on the market for internal use by oral route prevail over those for external application (72% vs. 28%). Similarly, liquid presentations predominate (51%) in 100 mL, 500 mL, and 1 L presentations; followed by solids (46%) in the form of powders packed in bags of 1, 20, 25, and 50 kg; and finally, the semisolids (3%). The predominance of the oral route and liquid presentations is not very surprising, and this behavior is consistent with studies conducted in

agropastoral communities (Feyera et al., 2017; Martínez & Jiménez, 2017; Mertenat et al., 2020; Suroowan et al., 2017). Another feature that supports the use of liquid forms is their advantage of higher absorption rate of the active principles compared to other forms of presentation, and the number of active ingredients they contain, which is generally higher than that found naturally in the plant (Tiwari et al., 2011).

Conclusions

1. The global market for veterinary herbal products during the 2018-2019 period was relevant in the productive and medical animal sector;

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2. No differences were found between medicinal plant species used to formulate herbal products for human and animal use.

Conflict of Interest

The authors declare that there are no conflicts of interest.

Ethics Statement

None.

Acknowledgments

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