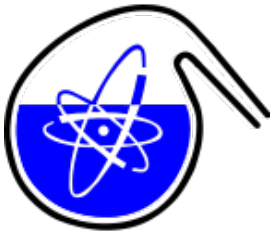

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Discrimination of cat and dog foods using neutron activation analysis and machine learning

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Domestication of dogs and cats took place thousands of years ago, altering the behavior and physiology of animals. Since then, the number of pets has increased year after year, reaching nowadays 471 million dogs and 373 million cats in the world. On average, half of a pet's cost of living is related to food, mainly dry kibble. The existence of exclusive pet foods is relatively recent. The first dog food dates back to the late 19th century, until then pets were fed what was available to the owners, such as bread, bones and pieces of meat. Foods for cats and dogs are similar in visual aspects but different in composition. Despite being mammals living in the same environment, dogs and cats have physiological differences that require specific nutritional needs. Dog and cat food follows distinct formulations, manufacturing processes and legal requirements. Cats that have access to dog food, or vice versa, can suffer from various diseases and malnutrition. Given the multitude of commercial brands available in the Brazilian market, we sought to evaluate their chemical profiles, as well as compliance with the recommendations of the Association of American Feed Control Officials (AAFCO). The study was carried out with representative samples of food for dogs (n=96) and for cats (n=103). Samples categorized by dogs, puppies, cats and kitten were submitted to neutron activation analysis to determine the chemical elements Br, Ca, Co, Cr, Cs, Fe, K, La, Na, Rb, Sb, Sc, Se, U and Zn. Data analysis were performed by univariate and multivariate non-parametric statistics and supervised machine learning algorithms (Random Forest, Multilayer Perceptron, Adaboost, Kneighbors and Support Vector Machine) to discriminate the categories. Significant differences were found for the elements Fe, K, Na, Se that are nutritionally important in diets, according to AAFCO recommendations. Non-parametric multivariate tests showed significant differences for all the food categories. The results indicated that dog food has a greater number of non-conformities with nutritional recommendations, presenting more samples with higher levels of toxic elements (U and Sb). The differences between the dog and cat foods were substantial enough to allow discrimination with supervised machine learning algorithms, achieving a maximum accuracy of 81.3 % by the Multilayer Perceptron.

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