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Short Communication

Electroencephalography Associated with Immunogenetics Studies in Animal Diseases

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DESCRIPTION

The Electroencephalic dysfunctions are permeated among several etiologies, such as neoplasms, endocrine and metabolic alterations, intoxications, morphological alterations, among others. To fully understand them, it is necessary to access not only the structural alterations of the brain, but also its functional disorders. To this end, only the electroencephalogram can provide information about the neuroelectrical activity [1].

The Electro Encephalo Gram (EEG) records spontaneous cortical electrical function and can identify waves with frequencies between 0.5 and 90 Hz and amplitude between 1 and 500 microvolts. The electrical signal originates mainly from three sources: the synaptic activity of cortical neurons, changes of action potentials at the surface of glial cells, and generalized electrical activity generated by large populations of neurons, mainly from deeper neuronal layers [2].

Although electroencephalography is a diagnostic method available for many years in veterinary medicine, having been employed in cattle since the work of Golikov in 1966; dogs [3], horses [4] and cats [5], its routine use in veterinary clinical neurology has received little attention [6]. Still, recent years have shown much promise for the experimental use of this technique, as it is being recognized as essential for the verification of brain function in association with imaging examinations, which only illustrate the structural portion [7]. The International Veterinary Epilepsy Task Force (IVETF) itself strongly recommends that EEG be used as a diagnostic method for idiopathic level III epilepsies [8]. In addition, EEG has evolved greatly due to the development of new technologies for data acquisition [9] and signal processing [10].

Research has shown that electroencephalography can be used beyond the diagnosis of idiopathic or structural epilepsy. EEG has been used to monitor the sleep quality of dogs and correlate with ease of learning [11], indicate which foals are best managed as a function of sleep depth during the day and night [12]. In the behavioral field, it has been used to monitor the degree of stress (animal welfare) in horses [13], check neurological responses associated with behavioral changes in dogs [14] and horses [15]. In humans it has been used as a method for classifying depression [16] and monitoring neuronal degeneration states [17].

Another extremely promising area of EEG use in animals is the quantitative aid in pain diagnosis. From verifying the pain associated with the quality of the slaughter blade in cattle [18], to proving the presence of pain in castrated calves without anesthetic procedures [19], the electroencephalogram has been very useful in proving and understanding pain mechanisms in animals. It is important to emphasize that pain is different from nociception because it requires brain processing of nociceptive impulses for it to occur. Thus, the EEG, as a method for evaluating brain activity, becomes an interesting quantitative tool for direct assessment of pain and not only nociception [20].

Immunogenetic studies have been associated with electroencephalography exams in order to gather information about brain function and gene expression in certain cerebral areas. Thus, relevant information has been obtained for understanding mechanisms such as narcolepsy [21], epilepsy [22], hereditary neurodegenerations [23], senile neurodegenerations [24], and adverse reactions to medications [25].

The most recent method for real-time EEG analysis is computer analysis of EEG signals in the form of power spectrum analysis [26]. Today it is a standard practice in human medicine and already starting in veterinary medicine, used in the assessment of brain activity. Based on the mathematical analysis of FFT (Fast-Fourier Transformation), the waves generated in the time domain are transformed into a graph the frequency domain, reflecting the intensity of the colors in relation to the intensity of the waves at a given frequency, using generally accepted limits of: delta (0-4 Hz), theta (4-8 Hz), alpha (8-13 Hz) and beta (13-30 Hz). The spectrogram (graph) changes dynamically and allows instant visual interpretation, providing data for various applications such as anesthetic monitoring, sleep disorders, epileptic disorders, level of consciousness, pain, brain injuries, cognition disorders, behavioral assessment, degenerative injuries, emotion recognition, machine learning, and others [27]. It is created during measurements (in real time) and does not require

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further analysis. To date, some veterinary colleges in Europe are conducting research using this system.

CONCLUSION

EEG is a brain electrical evaluation technique that allows checking intracranial neuronal function in animals and humans. It has methods studied for the main domestic species and its applicability goes beyond the diagnosis of epileptic patients. Signal post-processing methods associated with immunogenetics studies allow the evaluation of sleep, neurodegenerations syndromes and drugs toxicity, expanding the universe of evaluation and verification of neurological scenarios in domestic animals.

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