

# ELECTROCARDIOGRAPHIC STUDIES IN KITTEN AND ADULT PERSIAN BREED CATS

\*K. Swetha, B. Sudhakara Reddy and G. Saritha

Department of Veterinary Medicine, College of Veterinary Science, Sri Venkateswara Veterinary University, Proddatur-516360, Andhra Pradesh, India

Received on:17.05.2023  
Accepted on:07.11.2023

## ABSTRACT

Electrocardiography is one of the primary diagnostic methods to assess cardiac abnormalities in domestic animals including cats. Persian cats are calm pets and considered the oldest breed of cats in India which can be best suitable in apartment culture also. The present study was carried out to record the electrocardiographic parameters in 16 kittens and 16 adult cats by using the three standard bipolar limb leads (I, II, III) and augmented unipolar limb leads (aVR, aVL, aVF). Duration and amplitude of the P wave, QRS complex and T wave along with P-R and Q-T intervals were measured in lead II. The mean heart rate was  $204.82 \pm 26.98$  beats/min in kittens and  $183.08 \pm 14.54$  beats/min in adult cats; the mean electrical axis was  $102.12 \pm 22.18^\circ$  in kittens and  $81.41 \pm 21.08^\circ$  in adult cats. Data from kittens and adults were compared and noticed the statistical difference between the R and T wave amplitude, PR interval, heart rate, and MEA. The present study documented the reference range for electrocardiography in Persian breed cats. These findings are helpful to compare the other conditions in cats at the present locality.

**Key words:** Persian cat, electrocardiogram, mean electrical axis

## Introduction

Electrocardiography is the reflection of heart electrical activity and considered one of the basic methods used for the evaluation of cardiac diseases in small animals (Camacho *et al.*, 2010). Electrocardiography is commonly used to diagnose and monitor arrhythmias, conduction abnormalities, myocardial hypertrophy, electrolyte disorders, pericardial and pleural effusions and heart rate in small animals (Harvey *et al.*, 2005) and advised to use as an essential tool in monitoring feline cardiac arrhythmias (Cole *et al.*, 2011). The available literature on electrocardiographic parameters were very limited in India. Hence, the study aimed to determine the heart rate, parameters of electrocardiography waves, and mean electrical axis (MEA) in Persian breed cats.

## Materials and Methods

The present study was carried out at the Department of Veterinary Medicine, College of Veterinary Science, Proddatur, YSR District, Andhra Pradesh. Doll-faced Persian breed cats were selected for the studies which were presented to the clinic for general checkups and vaccination. Initially, cats were submitted to a complete physical examination and appeared to be normal and healthy. In the study, kittens aged between 3-5 months (n=16) and adults aged between 2-5 years (n=16) were chosen. The three standard bipolar limb leads (I, II, III) and the augmented unipolar limb leads (aVR, aVL, aVF) were recorded with the cats in the right lateral recumbency position, without sedation and under minimal restraint, using alligator clip electrodes with a little cardiac gel applied just proximal to the olecranon on the caudal aspect of the appropriate forelimb and over the patellar ligament on the cranial aspect of the appropriate hindlimb, respectively (Tilley, 1992). All recordings were standardized at a voltage of 10mm/mV and chart speed of 25 mm/s. The morphology of P waves, QRS complexes, and T waves was analyzed in all the leads. Cardiac rhythm, heart rate, amplitude, and duration of P, QRS, and T waves, as well as the PR interval and QT interval, were calculated in lead

II. The mean electrical axis for each individual was determined from the net amplitude of the QRS complex in lead I and III. Data processing was performed with SPSS 18.0 and student t-test was carried out to compare the two groups. P values less than 0.05 were considered significant for all statistical calculations. The data were expressed as mean  $\pm$  standard deviation.

## Results and Discussion

The electrocardiography parameters derived from the recorded lead II are shown in Table 1. The mean heart rate was 204.82 per minute in kittens and 183.08 per minute in adults. The P wave was predominantly positive in standard bipolar leads and aVF, aVL and negative polarities in aVR of all cats (Fig.1). The obtained heart rate values were consistent with those previously reported for cats (120-240 bpm) and they were higher in kittens (204.82 bpm) compared to adult cats (183.08 bpm). The lower heart rate is an expected finding in adults as a result of the predominance of the parasympathetic system in adult ages in contrast to the newborn period when the sympathetic system predominates. The duration and amplitude of P wave is indicative of atrial depolarization. The duration and amplitude of QRS complex show ventricular depolarization. It has been reported that the amplitude of the T wave, is a marker of ventricular repolarization (Tilley, 1992; Kilicarp and Cinar, 2003). R wave amplitude was greater in adult cats than compared with kittens. It might be due to the right ventricle being more prominent in newborns but the left ventricle becomes predominant in heart development. QRS complex confirmation usually had a monophasic and diphasic configuration. T wave amplitude was greater in adult cats compared to kittens, possibly because of the heart developmental process. QT duration shows the duration of ventricular depolarization and repolarization, and PR interval measures the conduction time of the depolarization wave that originates from the sinus node. PR interval was longer in adult cats compared to kittens. It has been reported that

\*Corresponding author: swethareddy31596@gmail.com

Table 1: Amplitude in millivolts (mV) of the Lead-II of electrocardiography in Persian breed cats

Parameters	Kittens (n=16)		Adults (n=16)		P-value
	(Mean ± SD)	Range	(Mean ± SD)	Range	
P wave	0.11±0.01	0.10 to 0.15	0.13±0.013	0.05 to 0.20	0.08 <sup>NS</sup>
R wave	0.36±0.16 <sup>a</sup>	0.10 to 0.50	0.60±0.24 <sup>b</sup>	0.15 to 0.90	0.01 <sup>*</sup>
T wave	0.09±0.05 <sup>a</sup>	0.05 to 0.20	0.16±0.08 <sup>b</sup>	0.05 to 0.30	0.01 <sup>*</sup>

a,b: Data having different superscript letters within the same row were statistically different (P<0.05)

Table 2: Duration in seconds (sec) of the Lead-II of electrocardiography in Persian breed cats

Parameters	Kittens (n=16)		Adults (n=16)		P-value
	(Mean ± SD)	Range	(Mean ±SD)	Range	
P wave	0.032±0.001 <sup>a</sup>	0.02 to 0.04	0.031±0.003 <sup>a</sup>	0.03 to 0.04	0.50 <sup>NS</sup>
QRS complex	0.032±0.0026 <sup>a</sup>	0.02 to 0.04	0.031±0.004 <sup>a</sup>	0.03 to 0.04	0.62 <sup>NS</sup>
T wave	0.037±0.012 <sup>a</sup>	0.02 to 0.06	0.043±0.001 <sup>a</sup>	0.02 to 0.06	0.06 <sup>NS</sup>
PR interval	0.064±0.00 <sup>a</sup>	0.05 to 0.10	0.081±0.001 <sup>b</sup>	0.06 to 0.10	0.04 <sup>*</sup>
QT interval	0.141±0.014 <sup>a</sup>	0.12 to 0.18	0.132±0.019 <sup>a</sup>	0.10 to 0.16	0.45 <sup>NS</sup>

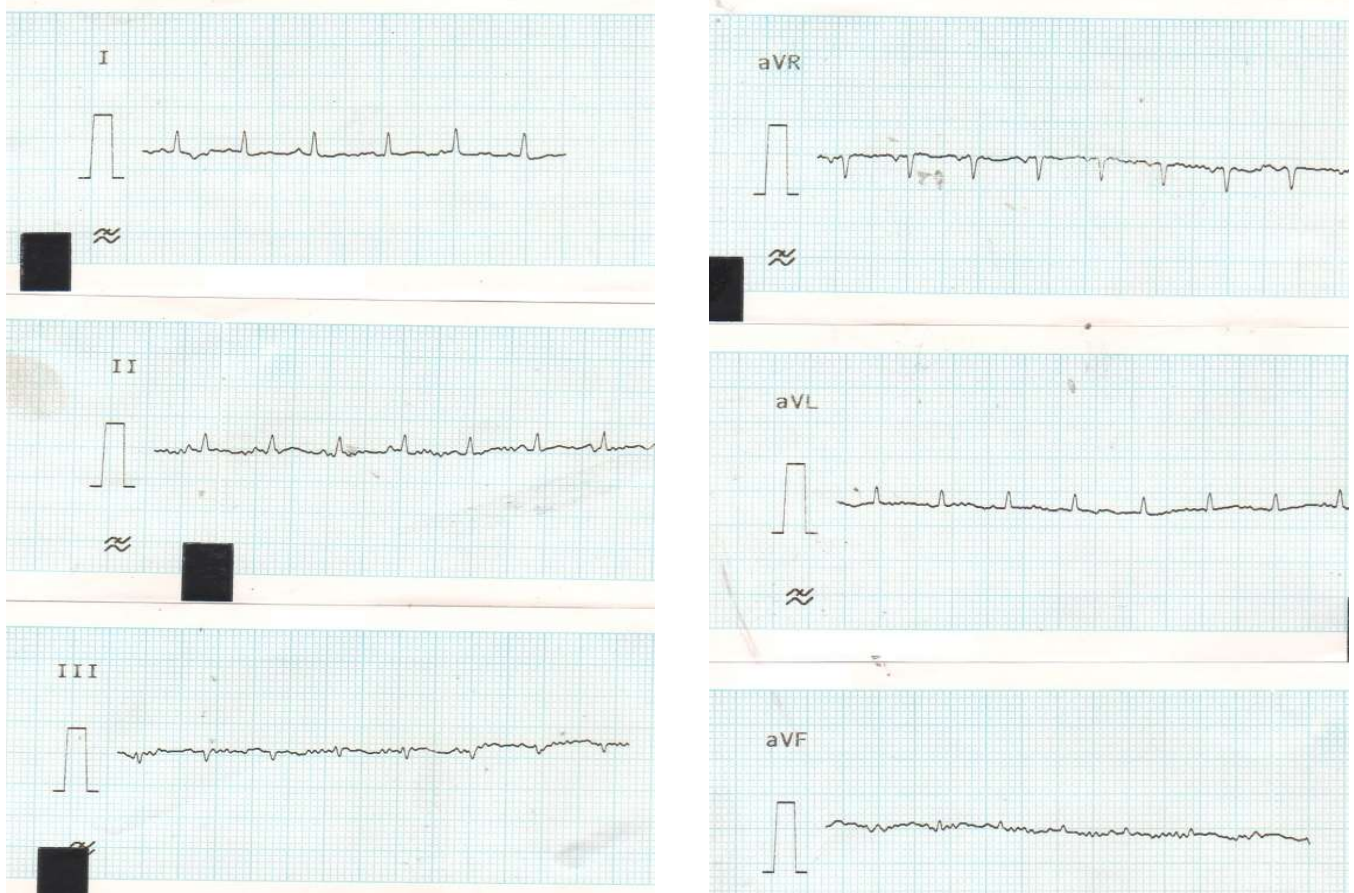
a,b: Data having different superscript letters within the same row were statistically different (P<0.05)

Table-3: Heart rate and Mean electrical axis (MEA) in Persian breed cats

Parameters	Kittens (n=16)		Adults (n=16)		P-value
	(Mean ± SD)	Range	(Mean ±SD)	Range	
Heart rate (bpm)	204.82±26.98 <sup>a</sup>	167-250	183.08±14.54 <sup>b</sup>	150-200	0.01 <sup>*</sup>
MEA (°)	102.12±22.18 <sup>a</sup>	90-160	81.41±21.08 <sup>b</sup>	45-120	0.01 <sup>*</sup>

a,b: Data having different superscript letters within the same row were statistically different (P<0.05)

Figure 1: The electrocardiogram of an apparently healthy Persian breed cat (paper speed 25 mm/sec, calibrated 10 mm/mV)



the mean electrical axis ranged between 0° and +160° in cats (Tilley, 1992).

In the present study, the mean electrical axis ranged between 90° to 160° in kittens and 45° to 120° in adult cats. It was noted that kittens and adult cats had different MEA values. Lourenco and Ferreira (2003) reported a right to left shift in the electrical axis during the neonatal period in kittens. The difference between the MEA values in kittens and adult cats determined in this study was thought to be related to the age factor. Electrocardiographic confirmation and alterations depend on the structural and functional alterations of the cardiovascular system and vary with the type of species and breed in livestock (Abbott, 2005). Studies are carried out on electrocardiography on different species of animals in the current research locality (Reddy *et al.*, 2014, 2015, 2016). In felines, hypertrophic cardiomyopathy is common disorder in the old age group and it is initially screened by electrocardiography (Abbott, 2010) and it is useful for prognostic factors in monitoring arrhythmias (Adabag *et al.*, 2005). There is no effect of gender on electrocardiographic parameters in livestock (Lourenco and Ferreira, 2003). Hence, in the present study, gender-wise separation was not carried out during group formation. Anesthesia will effect electrocardiography parameters hence none of the present study cats received any type of sedation while recording the electrocardiography.

In conclusion, the present study provides the different electrocardiographic parameters in kittens and adult Persian breed cats. These values will be considered as reference ranges while comparing the other disease conditions in Persian breed cats.

#### Acknowledgements

The authors are thankful to the authorities of Sri Venkateswara Veterinary University, Tirupati for providing the facilities to carry out the research work.

#### Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

#### References

- Abbott JA (2010) Feline hypertrophic cardiomyopathy: an update. *Vet. Clin. North Am. Small Anim. Pract.* **40**: 685–700.
- Adabag AS, Casey SA and Kuskowski MA (2005) Spectrum and prognostic significance of arrhythmias on ambulatory Holter electrocardiogram in hypertrophic cardiomyopathy. *J. Am. Coll. Cardiol.* **45**: 697–704.
- Camacho AA, Paulino D, Pascon JPE and Teixeira AA (2010) Comparison between conventional and computerized electrocardiography in cats. *Arq. Bras. Med. Vet. Zootec.* **62(3)**: 765–769.
- Cote E, MacDonald KA, Meurs KM and Sleeper MM (2011) Section F: Arrhythmias and Other Electrocardiographic Abnormalities. In: *Feline Cardiology*, 1st ed., Wiley-Blackwell, West Sussex. pp. 227–266.
- Gomes Lourenco ML and Ferreira H (2003) Electrocardiographic evolution in cats from birth to 30 days of age. *Can. Vet. J.* **44**: 914-917.
- Harvey AM, Faena M, Darke PGG and Ferasin L (2005) Effect of body position on feline electrocardiographic recordings. *J. Vet. Intern. Med.* **19**: 533-536.
- Kilicalp D and Cinar A (2003) Investigation of the effects of age, sex and season on electrocardiographs (ECG values) and heart radiographs of healthy Van cats. *Turk. J. Vet. Anim. Sci.* **27**: 101-107.
- Lourenco MLG and Ferreira H (2003) Electrocardiographic evolution in cats from birth to 30 days of age. *Can. Vet. J.* **44(11)**: 914-917.
- Reddy BS, Reddy LSSV, Raju KGS and Sivajothi S (2014) Electrocardiographic studies in adult Osmanabadi goats. *J. Vet. Sci. Photon.* **115**: 333-337.
- Reddy BS, Reddy PA, Venkatasivakumar R, Reddy BS and Reddy ET (2016) A study on electrocardiographic patterns in turkeys (*Meleagris gallopavo*). *Int. J. Vet. Sci.* **5(2)**: 79-82.
- Reddy BS, Venkatasivakumar R, Reddy LS, Vani S and Sivajothi S (2015) Analysis of base apex lead electrocardiograms of adult buffaloes. *J. Dairy Vet. Anim. Res.* **2**: 00058.
- Tilley LP (1992) *Essentials of canine and feline electrocardiography*. 3<sup>rd</sup> edn., Philadelphia, Lea and Febiger, 1-252.