



## Research Article

### A Study on Electrocardiographic Patterns in Turkeys (*Meleagris gallopavo*)

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#### ABSTRACT

Avian electrocardiography (ECG) was started in 1909, but reference data on the turkey ECG was not well documented. Present study was conducted to record the normal ECG patterns in adult turkeys. ECG findings aid in the diagnosis of different cardiac diseases and to know about the pathology of different systemic disorders. Six turkey birds of both sexes aged between 2 to 2.5 years were incorporated in this study. Standard bipolar (I, II, III) and augmented unipolar (avR, avL, avF) leads were recorded in standing position. Configurations of P wave, QRS complex and T wave in the different leads were studied. Duration and amplitude of P wave, QRS complex, T wave, PR and QT intervals, heart rhythm and heart rate were measured in lead II for all the turkeys. Electrocardiographic parameters reported in this study will aid clinicians, in evaluating commonly seen problems in turkeys.

**Key words:** Andhra Pradesh, ECG, Heart rate, P wave, RS, Turkey

#### INTRODUCTION

Electrocardiography (ECG) is one of the standard methods to evaluate the cardiac functions in birds (Hassanpour *et al.*, 2010). ECG was widely used to diagnose cardiac arrhythmias, conduction disturbances and it is also useful to detect chamber enlargement (Reddy *et al.*, 2014a). In the present days, utilization of the ECG in different livestock, captive and wild birds increasing, but the lack of reference values for different animals limiting the clinical value of ECG (Reddy *et al.*, 2014b). Hence, present study was taken up to obtain electrocardiographic reference data in turkeys which can be useful for the management of cardiac abnormalities in turkeys and further investigations in turkey's cardiology. The cost involved to record ECG was also comparatively low when compared with other techniques. Avian cases presented to the clinics with nonspecific signs, can be related to primary and secondary cardiac disease (Talavera *et al.*, 2008). In these cases, ECG may detect not only primary heart diseases but several subsequent abnormalities related to infectious and non infectious diseases. The production of turkeys is increasing in many countries which are good source of animal protein with low fat content (Nixey and Grey, 1985). Even though, avian electrocardiography was started in 1909 (Buchanan,

1909), but reference data on the turkey ECG was not documented. ECG information in turkeys was very little when compared with other companion and farm animals. Hence, an attempt was carried out to record the normal ECG parameters in turkey (*Meleagris gallopavo*) in Andhra Pradesh of India.

#### MATERIALS AND METHODS

Present work was carried out in healthy turkey birds (6) present in the Integrated Livestock Form Complex, College of Veterinary Science, Proddatur of Andhra Pradesh in India. The birds were reared under standard feeding and management conditions and were aged between 24 and 30 months with the live body weight ranging from 8 to 20 kilo grams. The data were recorded in the month of March between 11.00 AM to 11.50 AM where the temperature of the shed was between 37°C to 44°C.

During the ECG recording, all the birds were kept in the standing position on electrically non-conductive rubber sheet with manual restraint and ECG recordings were made as per the method described by Czarnecki and Good (1980) and Mehmet *et al.* (2013) without any anaesthesia. All ECGs were recorded on a digital portable rechargeable single channel electrocardiographic machine

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**Table 1:** Configuration of the P wave, QRS complex and T wave in turkeys

Lead	P wave			QRS complex			T wave	
	Positive %	Negative %	Iso electrical %	Positive %	Negative %	Iso electrical %	Positive %	Negative %
I	50	0	50		83.33	16.67	100	
II	100	0			100		100	
III	66.66	16.67	16.67		100		100	
avR	16.67	83.33		83.33		16.67		100
avL	50	50		16.67		83.33	50	50
avF	100	0			100		100	

**Table 2:** Amplitude in mill volts and duration in seconds of waves in Lead-II electrocardiography of turkeys

ECG parameters	(Mean $\pm$ S.D.)	Range
P amplitude (mV)	0.117 $\pm$ 0.049	0.050 - 0.200
P duration (sec)	0.037 $\pm$ 0.007	0.025 - 0.045
QRS amplitude (mV)	0.408 $\pm$ 0.041	0.350 - 0.450
QRS duration (sec)	0.033 $\pm$ 0.007	0.030 - 0.040
T amplitude (mV)	0.150 $\pm$ 0.030	0.100 - 0.200
T duration (sec)	0.040 $\pm$ 0.010	0.030 - 0.060
P-R interval duration (sec)	0.103 $\pm$ 0.028	0.060 - 0.140
Q-T interval duration (sec)	0.142 $\pm$ 0.140	0.130 - 0.160
Heart rate (bpm)	207.5 $\pm$ 23.95	168-230

**Fig. 1:** Recording of ECG to a healthy turkey.

(BPL) with 50mm/sec paper speed and calibrated 10mm/mV. Crocodile alligator clips electrodes after smoothening were attached to the skin of the wing web at the base of the right and left wings, and at the right and left thighs near the proximal attachment of the gastrocnemius muscle. Adequate contact was established using an electrode gel in standing position (Fig.1). All the ECGs were recorded in standard bipolar (Leads I, II, III) and augmented unipolar leads (Leads avR, avL and avF) were recorded. From each bird total of three ECG recordings were made and mean of the three were calculated for getting the normal values. The morphology of P waves, QRS complexes, and T waves were analyzed in all 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. Data processing was performed and expressed as mean  $\pm$  standard deviation.

## RESULTS

A representation of a normal six-lead electrocardiogram of a turkey is shown in figures (2-7). The data pertaining to the configurations of the complexes are presented in Table-1. The values for durations and amplitudes of the waves, different intervals, prominent 'rS' and 'rS' (QRS complex) were recorded and presented in Table-2.

P wave was positive deflection in lead I, II, avF but it was in positive, negative and iso electrical in lead III. In QRS complex, high amplitude complex was positive in lead avR, it was negative in leads II, III, avF. T wave was 100% positive deflection lead I, II, III, avF but, it is negative deflection in avR.

Mean heart rate was recorded as 207.5 $\pm$ 23.95 /min with range from 168 to 230 /min. Amplitude of the P wave was ranged between 0.05 to 0.20 mV with mean of 0.117 $\pm$ 0.049 mV. Duration of the P wave was ranged between 0.025 to 0.045 sec with mean of 0.037 $\pm$ 0.007 sec. Amplitude of the T wave was ranged between 0.10 to 0.20 mV with mean of 0.150 $\pm$ 0.03 mV. Duration of the T wave was ranged between 0.03 to 0.06 sec with mean 0.04 $\pm$ 0.01 sec. In QRS complex, prominent 'rS' and 'RS' were identified in lead II of ECG.

## DISCUSSION

ECG analysis among the birds contributes to the detection of some changes in health status and can be a useful aid for the diagnosis of diseases in birds. Electrocardiography has proven to be an effective technique in diagnosing the cardiovascular diseases in many mammalian and avian species (Rosenthal *et al.*, 1997; Sivajothi and Reddy, 2014). Electrocardiography of the bird is different from the humans and other animals, because the depolarization wave of the avian ventricle moves from epicardium to endocardium. Previously, abnormal ECG findings were recorded in birds affected with *Escherichia coli* and turkeys with influenza virus infections (Mckenzie and Will, 1972). ECG also useful in investigation of sudden death syndrome and ascites in broilers (Olkowski *et al.*, 1997).

In the present study all the birds showed a normal sinus rhythm. The mean heart rate was 207.5 bpm. In lead I the recorded amplitude of the all the waves and complexes were mostly iso electric and no clear demarcation in the complex configuration (Fig.2). In lead II, all the waves and complexes were clear and it is used for the standard observation in detecting the cardiac abnormalities (Fig.3). Lead III also had P wave in different types of configuration, negative deflection of the QRS complex and positive deflection of T wave (Fig.4). In two augmented unipolar leads (avR and avL) showed clear complexes but, waves, complexes deflections were vary with the individual bird (Fig.5 and 6). Last augmented unipolar lead avF was having positive P wave, T wave and negative QRS complex (Fig.7).

Previous reports on turkeys were not well documented. So, recorded wave patterns and findings were compared with the other avian species. These findings of wave pattern were comparable with the other birds like African grey parrot and Amazon parrot. Heart

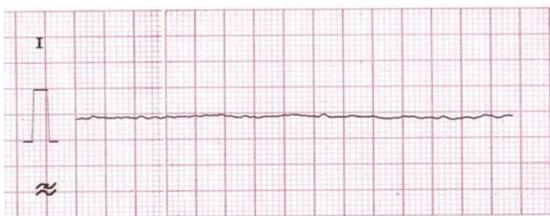


Fig. 2: ECG recording in lead I (10 mm/mV and 50 mm/sec).

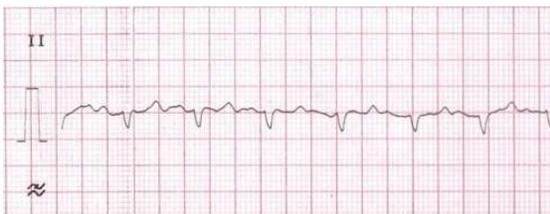


Fig. 3: ECG recording in lead II (10 mm/mV and 50 mm/sec).

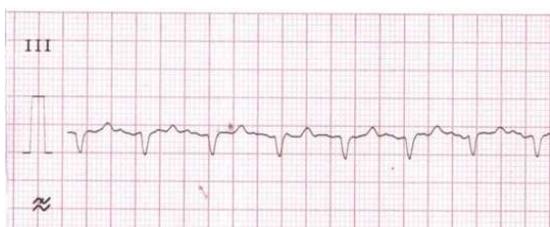


Fig. 4: ECG recording in lead III (10 mm/mV and 50 mm/sec).

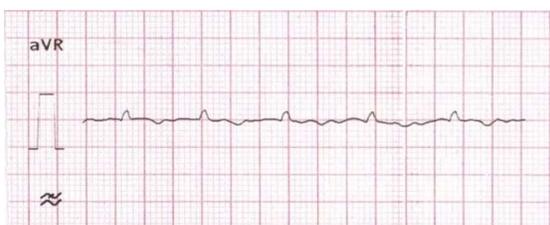


Fig. 5: ECG recording in lead aVR (10 mm/mV and 50 mm/sec).

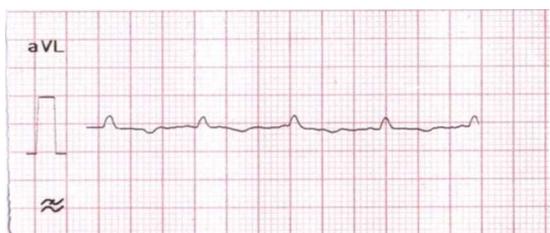


Fig. 6: ECG recording in lead aVL (10 mm/mV and 50 mm/sec).

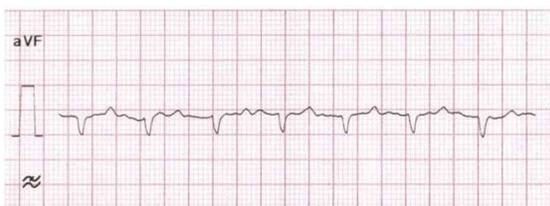


Fig. 7: ECG recording in lead avF (10 mm/mV and 50 mm/sec).

rate in this study was lower than the two types of the parrots. But, the study in parrots was carried out after anaesthesia. Differences were determined for the heart rate, duration and amplitude of the P wave, amplitude of the T wave, and amplitude of the QRS complex, especially when comparing the other avian species. Variations in the amplitudes, heart rate mainly due to the size of the body and vary with the species of the animal (Reddy *et al.*, 2014c).

Electrocardiography is a useful diagnostic tool in birds. In birds, severe cardiac histopathology is not always reflected in ECG abnormalities, and that severe ECG abnormalities have been reported in individuals with a normal cardiac histopathology (Miller, 1985). While interpretation of an ECG, one should always consider history, clinical findings and laboratory results before diagnosis.

### Conclusion

Present study, provides the basic information regarding different wave patterns and ECG parameters in healthy turkey birds in Andhra Pradesh of India. It can be useful as reference value for further research as well as to the clinicians.

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