

# Electrocardiographic studies in different age groups of Nellore cross-breed sheep

## Abstract

**Aim:** Present study was aimed to record the electrocardiography indices in different age groups of clinically healthy Nellore cross-breed sheep.

**Background:** Normal electrocardiographic studies of different species of animals help in detection of cardiac abnormalities and helpful while monitoring the vital parameters during the diseased conditions, treatment trails and operative procedures. Variations in the parameters were recorded in small ruminants based on the breed. Information pertaining to the electrocardiographic findings of Nellore cross-breed sheep was not documented.

**Methodology:** The present study was conducted at College of Veterinary Science, Proddatur, YSR Kadapa District of Andhra Pradesh, India from 2013 to 2016. Apparently, healthy local Nellore cross-breed sheep were categorized into five groups based on their age and in each group twenty sheep were included. The animals were examined prior to ECG recording and were proved to be clinically healthy. The electrocardiography was recorded on a bipolar base apex lead system. Duration and amplitude of the P, QRS complex and T wave and the PR, QT intervals and heart rate were measured and averaged from successive beats in lead I.

**Results:** Heart rate was  $73.2 \pm 1.62$  in adults and it was  $115.8 \pm 2.76$  in kids. The mean amplitude of P wave was  $0.169 \pm 0.005\text{mV}$  in lambs and  $0.177 \pm 0.005\text{mV}$  in the adult group. Mean duration of P wave, QRS complex and T wave was  $0.044 \pm 0.003\text{sec}$ ,  $0.066 \pm 0.003\text{sec}$ ,  $0.103 \pm 0.003\text{sec}$  in adult group and it was  $0.041 \pm 0.006\text{sec}$ ,  $0.063 \pm 0.003\text{sec}$  and  $0.104 \pm 0.004\text{sec}$  in kids.

**Conclusion:** No significant difference was found in P wave amplitude, duration of P wave, QRS complex and T wave. The heart rate, an amplitude of ECG waves including QRS complex, T wave and duration of P-R, Q-T and R-R intervals showed the significant difference between the age groups. Heart rate was gradually decreased while aging and the negative correlation between age of the sheep and heart rate was noticed. This study provides information on the cardiac rhythm, heart rate, duration, and amplitude of ECG deflections in one of the common sheep breed in the YSR District of Andhra Pradesh.

**Keywords:** sheep, electrocardiography, heart rate, Nellore brown

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## Introduction

Electrocardiography (ECG) is one of the non-invasive, inexpensive diagnostic techniques to detect the spread of the cardiac impulses. The electrocardiographic parameters have the greatest value in recognizing and diagnosing arrhythmias in animals. Different disease conditions lead to changes in the electrolyte balance.<sup>1</sup> The majority of arrhythmias and conduction disturbances can be detected on clinical examination.<sup>2</sup> For the physician, reference values are important to compare the results from diseased animals. Nellore cross-breed sheep is one of the common adapted breeds in the YSR District of Andhra Pradesh and it is the source for meat production which contributes significant economy to the farmers (Figure 1). There are several kinds of literatures on electrocardiographic studies in different animals including in ruminants, but there is no previous study regarding the normal ECG parameters at different age groups in the Nellore cross-breed sheep.<sup>3,4</sup> The current study was done to provide ECG values and to evaluate the effects of age on these parameters in this breed.



Figure 1 Nellore cross-breed sheep.

## Materials and methods

The present study was conducted at Department of Veterinary Clinical Complex, College of Veterinary Science, Proddatur, Andhra Pradesh from 2013 to 2016. Apparently healthy local cross-breed of sheep (Nellore) were categorized into five groups based on their age and in each group twenty sheep were included. Sheep were categorized into Group-I (below six months), Group-II (six months to one year), Group-III (one year to two years), Group-IV (two years to three years) and Group-V (above three years). The animals were examined prior to ECG recording and were proved to be clinically healthy. The electrocardiography was recorded on a bipolar base apex lead according to the standard and previous studies.<sup>5</sup> Electrocardiography recording was done in a quiet standing position by using the alligator type electrode clips. The positive electrode of lead I (left arm) was placed on the skin of the fifth intercostals space caudal to the olecranon process, and the negative electrode (right arm) was attached over the jugular furrow about the lower 1/3 of the neck on the left side. Methyl alcohol was applied before application of the electrode clips to the skin.<sup>6</sup>

All ECGs were recorded on a three-channel electrocardiographic machine (Marks electronics, Chennai) with the paper speed of 25mm/sec and calibration of 10mm equal to 1mV. A magnifying glass was used for analyzing and measuring ECG parameters. The heart rate was calculated according to the R-R interval in lead-I and expressed in beats per minute (bpm). The amplitude of P, QRS and T waves was recorded for lead I and expressed in millivolt (mV). Duration of P waves, PR interval, QRS complex, ST interval and T waves were calculated and expressed in seconds. The data were analyzed with the Statistical Package for the Social Sciences (SPSS) software and the data were expressed as mean±standard error (confidence interval 95%).

## Results

The normal electrocardiograms of different age groups of sheep are presented in the Table 1 & Table 2. Different waves recorded in the electrocardiography were shown in the Figure 2. Heart rate was ranged from 70 to 128 beats per min in different age groups of sheep. Mean value of heart rate was 73.2±1.62 in adults and it was 115.8±2.76 in kids (below six months age group). The mean amplitude of P wave was 0.169±0.005mV in lambs and 0.177±0.005mV in the adult group with a range from 0.16 to 0.18mV. There is no significant difference between the lamb and adult sheep. QRS complex amplitude was range from 0.60 to 1.12mV and it was significantly raised in adults (1.040±0.068mV) when compared with the lambs (0.785±0.068mV). Mean amplitude of T wave was 0.307±0.010mV and 0.415±0.018mV in lambs and adult sheep respectively with a range from 0.29mV to 0.45mV. There is a significant difference was noticed in between the below three years age and the above three years age group. Mean duration of P wave, QRS complex and T wave was 0.044±0.003sec, 0.066±0.003sec, 0.103±0.003sec in adult group and it was 0.041±0.006sec, 0.063±0.003sec and 0.104±0.004sec in kids. Recorded range of duration of P wave, QRS complex and T wave was from 0.028sec to 0.074sec, 0.047 to 0.072sec and 0.077 to 0.144sec respectively. These parameters were not in statistical difference between the groups which indicative of there is no statistical significance between the different age groups of sheep. PR interval was range from the 0.10 to 0.24sec with mean value of 0.118±0.008sec in kids and 0.217±0.011sec in adult group. Statistical significant was noticed between the groups and it showed difference between below two years age group and the above two years age group. QT interval was range from the 0.20 to 0.44sec with mean value of 0.235±0.016sec in kids and 0.385±0.026sec in adult group. Statistical significant was noticed between the groups and it showed difference between below two years age group, two to three years age group and the above four years age group of sheep.

**Table 1** Amplitude in mill volts of the lead-I of electrocardiography in sheep (Mean±SE)

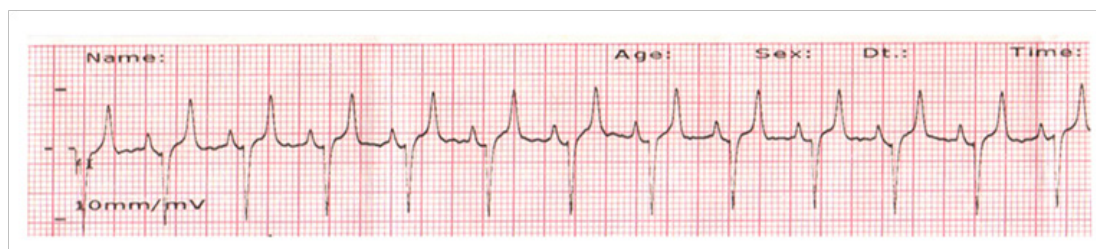
Parameters	Different age groups of sheep					'F' value
	Group-1	Group-2	Group-3	Group-4	Group-5	
P Wave	0.169±0.005	0.171±0.005	0.174±0.005	0.173±0.005	0.177±0.005	0.279 <sup>NS</sup>
QRS Complex	0.785±0.068	0.685 <sup>a</sup> ±0.037	0.982 <sup>b</sup> ±0.054	0.947 <sup>b</sup> ±0.048	1.040 <sup>b</sup> ±0.068	6.852*
T Wave	0.307±0.010	0.320 <sup>a</sup> ±0.008	0.345 <sup>a</sup> ±0.008	0.402 <sup>b</sup> ±0.021	0.415 <sup>b</sup> ±0.018	11.133*

\*Significant (P≤0.05); NSNot significant (P>0.05)

**Table 2** Duration in seconds of the lead-I of electrocardiography in sheep (Mean±SE)

Parameters	Different age groups of sheep					'F' value
	Group-1	Group-2	Group-3	Group-4	Group-5	
P wave	0.041±0.006	0.055±0.008	0.060±0.006	0.050±0.003	0.044±0.003	0.158 <sup>NS</sup>
QRS Complex	0.063±0.003	0.064±0.003	0.056±0.004	0.067±0.002	0.066±0.003	0.138 <sup>NS</sup>
T Wave	0.104±0.004	0.104±0.005	0.097±0.005	0.086±0.004	0.103±0.003	0.021 <sup>NS</sup>
P-R Interval	0.118 <sup>a</sup> ±0.008	0.139 <sup>a</sup> ±0.011	0.198 <sup>b</sup> ±0.016	0.191 <sup>b</sup> ±0.012	0.217 <sup>b</sup> ±0.011	0.000**
Q-T Interval	0.235 <sup>a</sup> ±0.016	0.232 <sup>a</sup> ±0.017	0.297 <sup>ab</sup> ±0.020	0.345 <sup>bc</sup> ±0.038	0.385 <sup>c</sup> ±0.026	0.000**
Heart Rate (bpm)	115.8 <sup>d</sup> ±2.76	106.2 <sup>e</sup> ±0.62	90.2 <sup>b</sup> ±2.25	86.8 <sup>b</sup> ±0.81	73.2 <sup>a</sup> ±1.62	0.000**

\*Significant (P≤0.05); NSNot significant (P>0.05)



**Figure 2** Electrocardiogram of adult Nellore cross-breed sheep (25mm/sec and 10mm/1mV).

## Discussion

No significant difference was found in P wave amplitude, duration of P wave, QRS complex and T wave. The heart rate, amplitude of ECG waves including QRS complex, T wave and duration of P-R, Q-T and R-R intervals showed the significant difference between the age groups. Heart rate was gradually decreased while aging and the negative correlation between age of the sheep and heart rate was noticed. While aging, significant reduction in the heart rate was noticed with a correlation. Variations in the heart rate of sheep were recorded different breeds of sheep and the difference in the size of the heart reflects the recording parameters as per the age advances in electrocardiography. The predominant negative correlation was noticed between the PR interval and the heart rate was noticed while aging. Chalmeh et al.<sup>4</sup> reported the electrocardiography parameters in Chios breed as mean amplitude of P wave, QRS complex and T wave was in  $0.052 \pm 0.016$ ,  $0.054 \pm 0.012$  and  $0.110 \pm 0.057$  mV respectively in Chios breed lambs and it was  $0.055 \pm 0.010$ ,  $0.059 \pm 0.018$  and  $0.122 \pm 0.050$  mV respectively. These findings were within range of present study. Due to the smallest cardiac size and presence of more superficial purkinje fibers in lambs in comparison with ewes can create lowest durations and intervals in younger ones. It could be suggested that as the mass of heart in larger animals became larger in the process of growth, the duration of transfer of cardiac electrical activity also increases.<sup>7</sup> Mean duration of P wave, QRS complex and T wave was within the range of other studies.<sup>8</sup>

Some of the undetectable conditions on clinical examination can be identified while electrocardiographic examination. Due to lack of normal reference values and electrocardiographic patterns in clinically healthy sheep, for a specific breed, can lead to failure in detection of different conditions which can influence the transmission of cardiac impulses.<sup>9</sup> In the present study, a variation in between the different age group of sheep has noticed it is due to the presence of variation in the conductive properties of the body mass in the ruminants.<sup>10,11</sup> Progressive increase in the body mass may cause difficulty in reaching the waves to the body surface due to relative electrical insulation by increasing body mass and the decrease of amplitude in adults.<sup>12</sup> Due to the passing of high degree of synchronized ventricular polarization in different directions, amplitude of P, R and T waves recorded in the study not followed specific pattern.

## Conclusion

This study provides information on the cardiac rhythm, heart rate, duration, and amplitude of ECG deflections in one of the common sheep breed in the YSR District of Andhra Pradesh, India. While aging, heart rate, amplitude QRS complex, T wave and duration of P-R, Q-T and R-R intervals showed the significant difference between

the age groups. It is important to compare the diseased animals or research trails in relation to the specific age group of sheep.

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## Conflict of interest

The author declares no conflict of interest.

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