

Short Paper

Electrocardiographic parameters of Markhoz goat using base apex lead and six standard limb leads

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(Received 1 Aug 2011; revised version 11 Mar 2013; accepted 16 Mar 2013)

Summary

Electrocardiographic study of 50 healthy Markhoz goats ranging from less than 1 to more than 3 years in age was carried out. The heart rate varied from 99 to 123 beats/min with a mean of 110 beats/min. There was a significant difference between the heart rate of goats in 3 age groups ($P < 0.05$). The mean duration of P and T waves and QT interval in base apex lead, QRS wave in lead I, P-R and PQ interval in aVF lead were higher and duration of QRS and T waves in aVR lead, P wave in lead III, PQ and P-R intervals in lead II and QT interval in aVR lead were lower than those in the other leads. The mean duration of QT interval had significant changes with age ($P < 0.05$).

Key words: Electrocardiography, Goat, Markhoz breed

Introduction

The importance of the cardiovascular system is the reason why many studies on identification and treatment of cardiac diseases have been carried out on different species of domestic animals.

Very few reports of using goats for studying the cardiac activity and determining different electrocardiographic parameters have been published.

Yet, there are some other reports on ECGs of normal goats of different breeds (Jha *et al.*, 1961; Ahmad *et al.*, 1965; Davis and Szabuniewicz, 1965; Szabuniewicz and Clark, 1967).

The shape and size of goat heart vary according to its breed and body size. This variation is expected to be reflected in ECG parameters (Andrassy *et al.*, 2005). Although Markhoz breed is one of the well-known Iranian native goats, there is no data on ECG parameters of this breed as far as

we are aware.

Materials and Methods

Fifty Markhoz breed goats reared at the Breed Selection Centre of Kurdistan Agriculture Organization were chosen for this study. They were divided into three age groups, 9-12 months (10 goats), 1-3 years (20 goats), and above 3-year-old (20 goats). Electrocardiogram (ECG) was recorded on standing position on a single channel portable electrocardiograph (SMART ECG, SE-1) on 7 leads (I, II, III, aVL, aVR, aVF, and base apex lead). The paper speed was adjusted to 25 mm/sec and calibration was 1 mV per centimetre.

The mean values of P, QRS, T, PQ, QT, P-R duration (in sec) and P, Q, R, S, T waves amplitude (mV) were measured. SPSS software was used for classification of results and student's t-test was used for analysis of data, a value of $P < 0.05$ was

considered to be significant.

Results

Three hundred and fifty traces of ECGs recorded from 50 Markhoz breed of goats were analysed for heart rate, cardiac rhythm, amplitude and duration. A sample of electrocardiograms recorded from the various leads are shown (Fig. 1)

The mean heart rate in Markhoz goats was 110 ± 2.38 beats/min, ranging from 85 to 150 BPM (Table 1). The highest heart rate was recorded in goats aged below 1-year-old with 123 ± 3.23 BPM and the lowest heart rate was obtained in goats aged above 3-year-old with 99.75 ± 3.83 beats/min.

The mean durations of P, QRS and T waves and also PQ, QT and P-R intervals were shown in Table 2. Table 3 shows the mean values of amplitude of different ECG waves.

Table 1: The mean and SD of the (beats/min)

Age	Mean \pm SD
Below 1 years	123.9 ± 3.23
1 to 3 years	102.6 ± 2.52
Above 3 years	99.7 ± 3.83
Total	110 ± 2.38

Discussion

The heart rate obtained in the present study for Markhoz breed was 110 ± 2.38

Table 2: The mean and standard deviation of duration (sec) of various ECG waves

Pattern	Wave				
	P	QRS	T	PQ	QT
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
BA	0.068 ± 0.009	0.065 ± 0.002	0.088 ± 0.003	0.128 ± 0.004	0.272 ± 0.009
I	0.043 ± 0.002	0.07 ± 0.002	0.082 ± 0.003	0.127 ± 0.003	0.272 ± 0.007
II	0.039 ± 0.002	0.063 ± 0.002	0.075 ± 0.002	0.105 ± 0.005	0.267 ± 0.006
III	0.03 ± 0.001	0.067 ± 0.002	0.073 ± 0.003	0.134 ± 0.007	0.254 ± 0.007
aVR	0.046 ± 0.003	0.056 ± 0.002	0.073 ± 0.002	0.12 ± 0.008	0.267 ± 0.006
aVL	0.039 ± 0.003	0.062 ± 0.002	0.720 ± 0.005	0.121 ± 0.005	0.263 ± 0.005
aVF	0.038 ± 0.003	0.063 ± 0.002	0.764 ± 0.009	0.138 ± 0.006	0.267 ± 0.009

Table 3: The mean and standard deviation of amplitude (mv) of various ECG waves

Pattern	Wave				
	P	Q	R	S	T
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
BA	0.184 ± 0.032	0.155 ± 0.033	0.15 ± 0.023	0.46 ± 0.038	0.446 ± 0.035
I	0.086 ± 0.007	0.292 ± 0.04	0.049 ± 0.011	0.346 ± 0.039	0.285 ± 0.025
II	0.064 ± 0.006	0.149 ± 0.025	0.25 ± 0.021	0.134 ± 0.039	0.264 ± 0.021
III	0.041 ± 0.005	0.071 ± 0.018	0.442 ± 0.034	0.067 ± 0.017	0.16 ± 0.021
aVR	0.084 ± 0.01	0.295 ± 0.044	0.271 ± 0.026	0.113 ± 0.014	0.24 ± 0.014
aVL	0.062 ± 0.006	0.089 ± 0.027	0.044 ± 0.012	0.393 ± 0.042	0.188 ± 0.021
aVF	0.058 ± 0.005	0.051 ± 0.018	0.348 ± 0.023	0.079 ± 0.026	0.185 ± 0.018

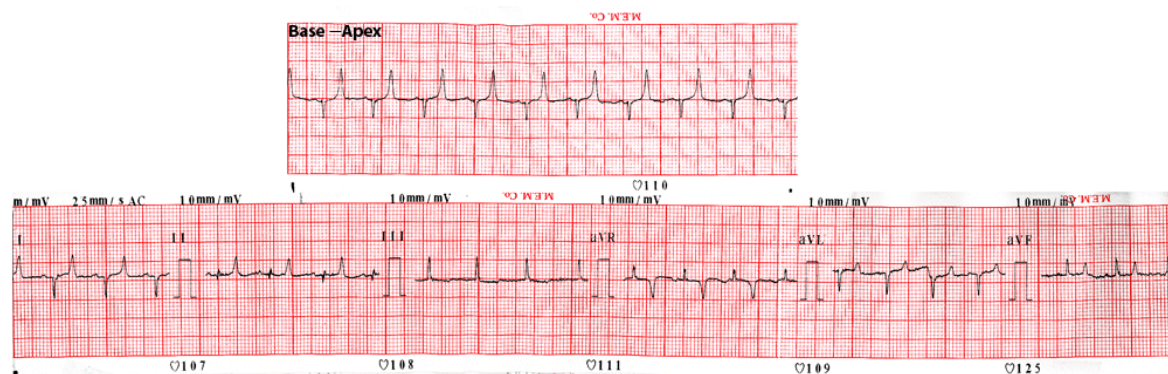


Fig. 1: ECG recorded from Markhoz goat in 7 different leads (Base-Apex and six standard leads)

beats/min which is higher than the rate reported in other studies for goats. In another study, the mean value of heart rates for normal goats was 102 ± 16 beats/min (Anitra Schultz and Pretorius, 1972).

However, in some other studies the mean value of heart rates depicted for goats is higher than the value reported in the present study. The heart of the goats is reported to vary in size and form according to the breed and this variation is expected to be reflected in the ECG (Mohan *et al.*, 2005), so this different heart rate in Markhoz goat may be due to its breed. A significant change was observed in heart rates of three age groups of Markhoz goats ($P < 0.05$).

The highest duration of P wave was found in base apex lead ($0.068 + 0.009$ sec), and the lowest was in lead III ($0.03 + 0.001$ sec).

The durations of QRS complex of 3 age groups in this breed were higher than those reported in other studies in goats. This could be due to the positive relationship between size and weight of heart and duration of QRS wave.

The duration of T wave in Markhoz goat with a maximum of $0.088 + 0.003$ sec is significantly lower than that recorded in the study conducted on an Indian breed (Mohan *et al.*, 2005, 2009).

The PQ interval in the Markhoz breed was similar to that observed by Montes *et al.* (1994) but this parameter has not been measured in other studies. The P-R interval in Markhoz goat is higher than that recorded in other studies (Davis and Szabuniewicz, 1965; Montes *et al.*, 1994; Mohan *et al.*, 2005, 2009).

The QT interval in Markhoz breed with maximum duration of ($0.272 + 0.009$ sec) was less than that observed by Mohan *et al.* (2005), but was similar to those recorded by others (Davis and Szabuniewicz, 1965; Montes *et al.*, 1994).

In this study, the QT interval had significant changes with age groups of goats ($P < 0.05$) and the same result has been reported in the study conducted by Montes *et al.* (1994). PQ and QT intervals can be a potential clinical value in evaluating heart activity (Mohan *et al.*, 2005).

The amplitude of P wave in base apex lead with $0.184 + 0.032$ mv was the highest

and in lead III with $0.041 + 0.005$ mv was the lowest in Markhoz goats. The results obtained in the other six leads were similar to those observed by others.

The mean amplitude of QRS obtained in this study was higher than the value reported in other studies in goats. The difference can be attributed to the amount of ventricular depolarization which, in turn, can be the result of breed variations (Mohan *et al.*, 2005).

The findings of this study revealed that some of the ECG parameters of Markhoz goat are similar to those of other breeds but there are differences in other parameters which could be due to breed differences.

Acknowledgements

This study is based on the research work undertaken by the first author at Islamic Azad University, Sanandaj Branch and Breed Selection Centre of Kurdistan Agriculture Organization. The technical advice and support received during the course of this research is gratefully acknowledged.

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