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Assessment of electrocardiographic parameters of Red Sokoto goats

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Abstract

The study was necessitated due to the economic importance of Red Sokoto goat, its resilient nature and limited literature on electrocardiographic parameter of the breed. The research was conducted using thirty goats comprising of 15 does and 15 bucks within the ages of 1-3 years and an average weight of 35kg. Electrocardiographic parameters were recorded using the three standard limb leads (I, II and III) as well as the augmented limb leads (aVR, aVL and aVF). Various forms of negative and positive wave deflections were recorded. Positive P and T waves were predominant in all the leads (standard limb leads and augmented leads). Typical QRS complex was predominant in all the leads with little qR in leads II, III and aVF. The mean electrical axis was between -178° and +170°. Cardiac rhythm was determined using P wave orientation and most of the animals had sinus rhythm. The mean heart rate was 141 ± 4.8 beats per minute and ranged from 92 to 164. The various forms of electrocardiographic waves recorded in Red Sokoto goat differ from those of other breeds of goats. The records obtained suggest that Red Sokoto goat has faster cardiac electrical conduction.

Keywords: Assessment, Electrocardigraph, Parameters, Rhythm, Red Sokoto goat

Introduction

Electrocardiogram (ECG) is a graphic depiction of the electrical forces generated by the heart (Atul, 2012). Electrocardiography is a non-invasive procedure that provides relevant information in the diagnosis of conduction abnormalities, determining the different types of arrhythmias and assessment of drug effect (Fregin, 1985). ECG has been measured in Saanen goat by Pogliani *et al.* (2013), Angora goat by Atmaca *et al.* (2014), Jamunapari goat by Mohan *et al*. (2005), and Markhoz goats by Fakour *et al*. (2013). Nigeria and especially the northern region have important role in goat production in the Africa continent and the world in general (Njidda *et al.,* 2013). The goat is a multipurpose animal. It produces milk, meat, skin and fiber (Abdalla *et al.,* 2009). Majority of Red Sokoto goats are reared in the northern part of the country and this breed plays

an important role in the life of many families as favorite animals (Abdalla *et al.,* 2009).

The Red Sokoto goat is the predominant and most important breed of goat found mainly in the Sudan and Sahel savanna zone or in the Sokoto province, North-western zone of Nigeria (Obua *et al.,* 2012).

Adaptability, quality of meat, leather produced and the ability to thrive well under extensive semi-arid climatic condition are the advantages of Red Sokoto goat that led to its popularity and demand worldwide (Nsoso *et al*., 2004). This adaptability may be as a result of circulatory buoyancy due to cardiac ability to overcome changes that could affect its electrical activities hence the need to establish the normal ECG of the Red Sokoto goat to enable clinical assessment of physiological and pathological changes in the cardiovascular system.

Materials and Methods

A total of 30 adult Red Sokoto goats with an average weight of 35kg aged between 1 and 3 years comprising of 15 bucks and 15 does was used for the study. The goats were purchased at Wamakko market in Wamakko Local Government Area of Sokoto state. The animals were conditioned for 4 weeks during which Complete blood count, protein estimation and faecal analysis were carried out. Daily auscultation was conducted and no cardiac murmurs were detected in all the animals. The goats were fed on a ration composed of Groundnut hay (*Arachis hypogea*) and bean husk (*Fabacea*) and water was provided *ad libitum*.

Electrocardiographic recordings were taken with the animals on standing position as described by Upadhyay& Sud (1997) with slight modification. The modification was shaving the site for clip attachment. A single channel electrocardiograph (EDAN VE 100)manufactured by Edan instruments China with a 25mm/s paper speed and 10mm/mV was used for the recording. The animals were kept on standing position on a rubber mat and the alligator clips electrodes were fixed to the skin above the elbow joint on the forearm and above stifle joint on the hind limb. The site of clip attachment was shaved and alcohol was sprayed to enhance contact. The standard limb leads (I, II and III) and augmented limb leads (aVR, aVL and aVF) were recorded. The amplitudes and duration of P, Q, R, S and T were measured manually from the ECG strip in millivolts and seconds respectively. PR, ST and QRS complex intervals were measured in seconds from the electrocardiagraphic record manually. Data collected was analysed using descriptive statistics with SPSS Microsoft window statistical software version 16. Means and standard deviation of parameters were calculated using 95% confidence interval.

Results and Discussion

Analysis of the waves revealed different characteristics. Various types of P, T and QRS waves are recorded in the standard and augmented limb leads. The durations and amplitudes of P and T waves recorded are presented in Table 1, while the duration of QRS as well as PR and ST intervals are presented in Table 2. Most of the goats had positive P and T wave in both the standard and augmented limb leads. The QRS complex were both monophasic and diphasic. The QRS complex was largely positive in lead III, aVR and aVF but predominantly negative in lead I and aVL while the pattern was variable in lead II.

The result obtained from the various ECG waves is as shown in Tasble 1 and 2. The P wave appeared in most of the leads but missing in some leads. P wave was missing in 10%, 3.3%, 10%, 3.3%, 13.3% and 6.6% of leads I, II, III, aVR, aVL and aVF respectively. Negative P wave was also recorded in 3.3%, 33.3%, 13.3% and 3.3% of leads I, III, aVR and aVL respectively.

Various forms of QRS complex were found, qR, 13% in lead II, 13% in lead III, 3.3% in aVL and 13% in aVF. 10% rS wave was found in aVR and 6.6% in aVL. QS wave was found in 3.3% of lead I, 3.3% of lead III, 3.3% of aVR and 13% of aVF.

Positive T wave was predominant in all leads with 16.6% negative in lead I, 10% negative in lead II, 6.6% negative in lead III, 6.6% negative in aVR, 6.6% negative in aVL and 3.3% negative in aVF. T wave was missing in 16.6% of lead II, 11.3% of lead III, 6.6% of aVR, 13.3% of aVL and 23.3% of aVF.

PR intervals were missing in 3.3% of lead I, 3.3% 0f lead III, 3.3% of aVR and 13.3% of aVL. ST intervals were missing in 16.6% of lead I, 3.3% of lead II, 26.6% of lead III, 23.3% of aVR, 33.3% of aVL and 33.3% of aVF.

The records obtained suggest that Red Sokoto goat has faster electrical conduction compared to Bengal and Markhoz breeds. Atrial depolarization is rapid and the AV nodal delay is not as prolonged when compared with Jamunapari breed. The highest duration of P value was recorded in lead I and lowest in aVR. The P duration in lead II was similar to that of Pogliani *et al.* (2013) but contradicts the findings of Ahmed & Sanyal (2008) and Fakour *et al*. (2013). This could be due to breeds used, because Bengal and Markhoz breeds of goats are taller in size than Red

Table 1: Mean and standard deviation of duration and amplitude of P and T waves in leads I, II, III, aVR, aVL and aVF in Red Sokoto goat (n=30)

	P-wave Duration	P-wave Amplitude	T-wave Duration	T-wave Amplitude
LEAD 1	0.037±0.022	0.065±0.026	0.042±0.021	0.061±0.027
LEAD 11	0.034±0.012	0.062±0.028	0.031±0.018	0.052±0.032
LEAD 111	0.035±0.011	0.077±0.033	0.033±0.014	0.073±0.032
aVR	0.032±0.012	0.062±0.035	0.037±0.015	0.070±0.029
aVL	0.034±0.016	0.072±0.038	0.030±0.014	0.046±0.036
aVF	0.034±0.009	0.065±0.03	0.022±0.018	0.042±0.052

95% confidence interval

Table 2: Means and standard Deviation of PR interval, QRS complex and ST interval in seconds in leads I, II, III, aVR, aVL and aVF in Red Sokoto goat

	PR interval	QRS duration	ST interval
LEAD 1	0.048±0.018	0.070±0.027	0.052±0.024
LEAD 11	0.062±0.03	0.062±0.021	0.042±0.024
LEAD 111	0.059±0.031	0.064±0.02	0.050±0.034
aVR	0.059±0.027	0.072±0.023	0.054±0.04
aVL	0.050±0.026	0.064±0.032	0.045±0.026
aVF	0.065±0.036	0.060±0.024	0.053±0.051

95% confidence interval

Sokoto goat used in the study. This anatomical difference could affect the size of the heart and hence could be responsible for the variation. The highest P amplitude was recorded in lead III and lowest in Lead II and aVR. This is lower when compared with the report of Mohan *et al*. (2005) in Jamunapari breed. This could be as a result of difference in body conformation because Jamunapari breed is a large breed and thickness of muscle could affect the velocity of conduction. The values of P amplitudes in leads I, II and aVR were similar to those of Atmaca *et al*. (2014).

T wave duration was highest in lead I and lowest in aVF and fall within the established range reported by Mohan *et al*. (2005) but lower than that of Atmaca *et al*. (2014). This appears to be due to the hairy nature of Angora goat which could reduce the contact between the electrodes and the skin and could delay the transmission of electrical waves. It could also be due to pericardial fat that could delay the transfer of waves, especially since Angora breed is found in temperate environment and fat deposition helps in regulating body temperature (Anne, 2018)

The significant difference in ECG parameters between Red Sokoto goat and other breeds of goats could be attributed to differences in climatic factors. The ambient temperature in Sokoto exceeds 40^{o}C, this results in anatomical changes in the skin and absence of subcutaneous fat deposit that could enhance the contact between the skin and the electrodes and result in faster cardiac transmission of impulse. The extreme environmental temperature affects the thermoregulatory mechanism thereby increasing cardiac output to eliminate excess heat from the body and could increase cardiac excitability and consequently increase in electrical activity of the heart.

Conflicts of Interest

The authors declare they have no conflict of interest.

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