Bulgarian Journal of Veterinary Medicine (2012), **15**, No 1, 37–43

AGE-RELATED CARDIAC ARRHYTHMIAS IN CLINICALLY HEALTHY IRANIAN NAJDI GOATS

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Summary

Pourjafar, M., K. Badiei, A. A. Chalmeh, A. R. Sanati, A. Shahbazi, M. Badkobeh & M. H. Bagheri, 2012. Age-related cardiac arrhythmias in clinically healthy Iranian Najdi goats.*Bulg. J. Vet. Med.*, **15**, No 1, 37–43.

The present study was performed to find out the prevalence of cardiac arrhythmias in clinically healthy Iranian Najdi goats at a different age, without any clinical signs of cardiac diseases. The animals (n=118) were assigned into 6 age groups, including 15-day-old (n=17), 2-month-old (n=23), 6-month-old (n=22), 1-year-old (n=11), 3-year-old (n=22) and 5-year-old (n=23). In 53.3% of all studied goats, at least one type of cardiac arrhythmia was seen. Four types of cardiac arrhythmias were detected in this study, including sinus tachycardia, respiratory sinus arrhythmia, sinoatrial block and ventricular premature complex. The proportion of cardiac arrhythmias differed significantly ($P<0.05$) between 15-day-old animals and all other age groups. Since none of the goats with cardiac arrhythmias showed any clinical signs of heart disease at the time of electrocardiogramme recordings, the arrhythmias observed in this study could be considered as physiological ones.

Key words: cardiac arrhythmia, electrocardiogramme, Iranian Najdi goat, physiological arrhythmia

INTRODUCTION

The electrocardiogramme (ECG) is a diagnostic criterion that measures and records heart electrical activity in exquisite details. Electrocardiographic evaluation is very useful for sheep and goats with cardiac arrhythmias. The base-apex lead is the commonest and most suitable in large animal electrocardiography (Cebra & Cebra, 2002; Suresh *et al.*, 2009) to study normal wave forms, patterns, values of duration and amplitude. Interpretation of these details allows for diagnosis of a wide range of heart conditions, varying from unimportant to life threatening signs.

The majority of arrhythmias and conduction disturbances can be revealed at clinical examination. However, some of them remain clinically undetectable and are identified only by means of electrocardiography (Radostits *et al.*, 2007). During an arrhythmia, the heart beat is faster, slower or irregular. Most arrhythmias in large animals are physiological, however some of them are serious and life threatening (Machida *et al.*, 1991; 1993). Pathological cardiac arrhythmias in goats are reported in several studies (Aslani *et al.*, 2007; Barbosaa *et al.*, 2008). Although physiological cardiac arrhythmias were established in clinically healthy sheep (Pourjafar *et al.*, 2011a) and lambs (Pourjafar *et al.*, 2011b), there are few

reports on physiological arrhythmias in goats (Smith & Sherman, 2009) but comparative studies on cardiac arrhythmias within physiologic states in different ages of goats and kids are lacking.

Therefore, the present study was undertaken to record ECGs of apparently healthy Iranian Najdi goats at different ages in order to detect and compare cardiac arrhythmias in this goat breed.

MATERIALS AND METHODS

The present study was accomplished in April 2011 on 118 clinically healthy Iranian Najdi goats in Lamerd, Fars province, southwest Iran. The study cohort consisted of both male and female goats which had been assigned into 6 age groups, including 15-day-old (n=17), 2-month-old (n=23), 6-month-old (n=22), 1-year-old (n=11), 3-year-old (n=22) and 5-year-old (n=23) animals.

All animals were grazing in a green pasture with free access to water and shade. The animals were examined prior to ECG recordings and proved to be clinically healthy. None of the goats used in this study had any clinical signs of heart disease (oedema, jugular distension or pulsation, cardiac murmurs, exercise intolerance and coughing).

The ECGs were recorded on a bipolar base apex lead, using limb lead I. Animals were kept standing without any sedation and with minimum restraint. When animals got calm (decreasing of panting behaviour and muscle tremors), the ECGs were recorded, using alligator-type electrodes attached to the skin after cleaning it with ethanol and applying electrocardiographic gel to improve the contact. The positive electrode (left arm) was placed over the cardiac apex in the fifth left intercostal space at the level of the elbow, the negative electrode (right arm) was placed in the left jugular furrow at the top of heart base, and the ground was placed on the dorsal spine or another site away from the heart (Radostits *et al.*, 2007).

All ECGs were obtained with a single channel electrocardiographic machine (Kenz-line EKG 110, Suzuken Co., Ltd., Japan) with paper speed of 25 mm/s and calibration of 10 mm equal to 1 mV. The precision of duration was 0.02 s and the amplitude was 0.05 mV. Heart rates of all animals were also recorded. In the present study, a heart rate higher than 120 and 90 beats/min was considered as tachycardia in younger and over 1-year-old animals, respectively (Radostits *et al.*, 2007).

Fisher's exact test was used to evaluate the differences between the groups using SPSS software (SPSS for Windows, version 11.5, SPSS Inc, Chicago, Illinois). $P<0.05$ was considered as statistically significant.

RESULTS

In 53.3% of all studied goats, at least one kind of cardiac arrhythmia was seen. Four types of cardiac arrhythmias have been detected in this study, namely sinus tachycardia (Fig. 1, record B), respiratory sinus arrhythmia (Fig. 1, record C), sinoatrial block (Fig. 1, record D) and ventricular premature complex (Fig. 1, record E) vs record A depicting normal sinus rhythm in a healthy goat.

The types and distributions of cardiac arrhythmias in these animals are given in Table 1. Sinus tachycardia was recorded in all 15-day-old kids and proved to be the most common type of cardiac arrhythmia in these goats (57.1%). The proportion of different cardiac arrhythmias between

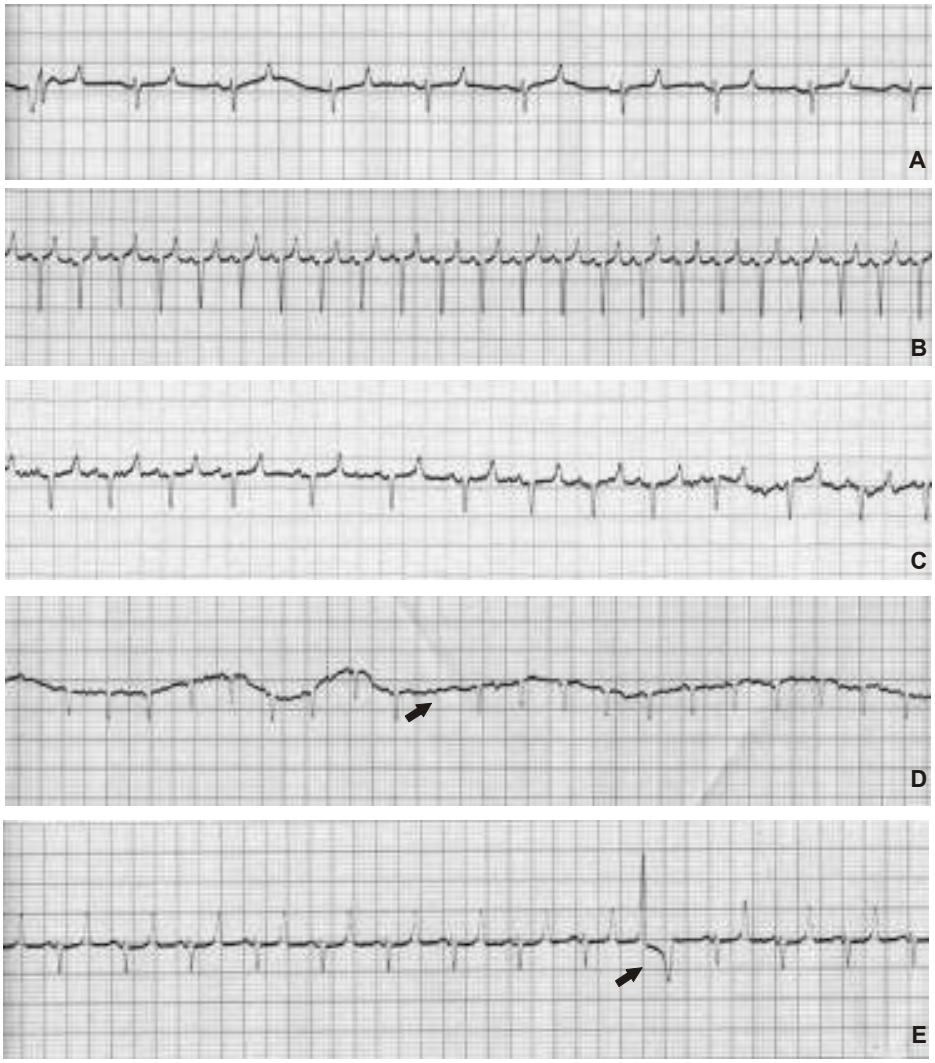

Fig. 1. ECG records in clinically healthy Iranian Najdi goats at different ages (base apex lead system; paper speed 25 mm/s, sensitivity 10 mm/mV). A: Normal sinus rhythm in 5-year-old male goat (heart rate = 70 beats/min); B: Sinus tachycardia in 2-month-old male kid (heart rate = 165 beats/min); C: Respiratory sinus arrhythmia in 3-year-old male goat: period with R-R interval = 0.56 s, connected with inspiration; and period with R-R interval = 0.72 s, connected with expiration; D: Sinoatrial block, lack of P-QRS-T complex (arrow) in 15-day-old male kid; E: Ventricular premature complex, wide and bizarre QRS-T complex (arrow) in 5-year-old female goat.

15-day-old animals and other age groups differed significantly ($P<0.05$; Table 1).

Some of the ECGs had two or three type of cardiac arrhythmias simultaneously (Fig. 2).

Table 1. Distribution of cardiac arrhythmias in 6 different age groups of clinically healthy Iranian Najdi goats in standard base-apex lead system electrocardiography. Significant differences ($P<0.05$) among proportions of cardiac arrhythmias of various groups are indicated with different letters (a, b and c)

Age groups	Normal sinus rhythm	Type of cardiac arrhythmias, number (%)			
		ST	RSA	SAB	VPC
15-day-old (n=17)	0 a	13	2	1	1
2-month-old (n=23)	6 b	12	5	0	0
6-month-old (n=22)	7 b	9	5	0	1
1-year-old (n=11)	9 c	0	2	0	0
3-year-old (n=22)	14 c	1	7	0	0
5-year-old (n=23)	18 c	2	2	0	1
Total (n=118)	54	37	23	1	3

ST: sinus tachycardia; RSA: respiratory sinus arrhythmia; SAB: sinoatrial block; VPC: ventricular premature complex.

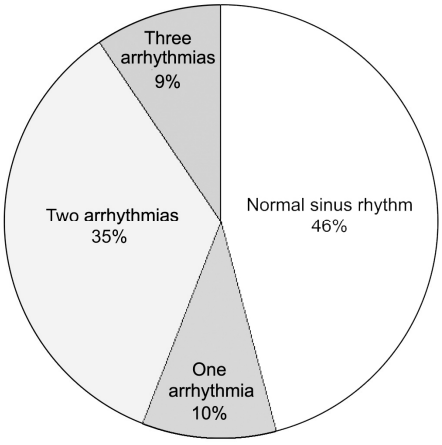

Fig. 2. Occurrence of normal sinus rhythm and one or more arrhythmias (sinus tachycardia, respiratory sinus arrhythmia, sinoatrial block, ventricular premature complex) in Iranian Najdi goats at a different age (n=118).

DISCUSSION

Electrocardiography is a clinical method to evaluate cardiac problems associated with initiation and conduction of depolarization and repolarization waves (Santamarina *et al.*, 2001). Compared with numerous data for normal physiological cardiac arrhythmias available in bovine (Rezakhani & Papahn, 2002; Rezakhani *et al.*, 2004) and ovine species (Pourjafar *et al.*, 2011a,b), caprine electrocardiography has been rarely touched and little amount of information is available about the physiological cardiac arrhythmias in these ruminants.

In the present study, sinus tachycardia was the most prevalent in the three youngest age groups (Table 1). Sinus tachycardia causes an increase in heart rate initiated by the sinoatrial node. The term sinus tachycardia has been used to describe an increase in heart rate caused by factors such as pain, excitement, exercise, hyperthermia, fall in arterial blood pressure and administration of adrenergic drugs (Radostits *et al.*, 2007). The heart rate returns to normal when factors are removed or relieved. The results of this examination proved that all 15-day-old kids had sinus tachycardia. It may be suggested that higher heart rate of kids might be due to stress and excitation caused by isolation

of kids from their dams, however, it is unlikely to be the origin for higher heart rate since the animals were kept in a quiet state. Because there were no clinical signs of cardiac problems (oedema, jugular distension or pulsation) in examined animals, this irregular cardiac rhythm could be categorized as physiological arrhythmia. Pourjafar *et al.* (2011b) reported sinus tachycardia as the most common cardiac arrhythmia in newborn Iranian fat-tailed lambs. Matsui *et al.* (1984) reported an elevation of heart rate in newborn pony foals with administration of combined blockade with atropine and propranolol. These observations indicate the possibility of high vagal activity in a newborn Thoroughbred foal at birth (Yamamoto *et al.*, 1992). Sustained tachycardia is an important clinical problem in the foetus and the newborn. The physiological properties of foetal and neonatal myocardium make it intrinsically more vulnerable to high heart rates (Rudolph, 2001). Foetal tachycardia is an important cause of foetal morbidity and mortality (Wren, 2006). The rate of foetal tachycardia is not useful in defining the mechanism, as most tachycardias occur at about 240 beats/min (Wren, 2006). The heart rate in studied kids, with sinus tachycardia, was higher than 120 beats/min and the average of this parameter was 135 beats/min at the time of ECG recordings.

Respiratory sinus arrhythmia, either transient or persistent, is the other common arrhythmia observed in all examined groups at different number and proportion (Table 1). The observation of ECGs revealed that sinus arrhythmia was associated with respiration. Sinus arrhythmia is a normal physiological arrhythmia that occurs at slow resting heartbeating rate and is connected with variation in the rate of discharge from the sinoatrial node which is related to variation in the intensity of vagal stimulations. It highly correlates with respiration so that discharge rate and heart rate increase and decrease during inspiration and expiration, respectively. Respiratory sinus arrhythmia is more clinically obvious in tamed sheep and goats (Radostits *et al.*, 2007). This arrhythmia has been reported in cattle which have been deprived of food or anorectic due to some gastrointestinal problems (Machida *et al.*, 1991; Gentile *et al.*, 1993). None of the animals with respiratory sinus arrhythmia in this study had any clinically obvious systemic problems or suffered from anorexia. The high vagal tone is supposed to be the cause of arrhythmia in these animals (Rezakhani *et al.*, 2004). It may be possible to link the genesis of sinus tachycardia and respiratory sinus arrhythmia in apparently healthy kids to the increased load imposed on the heart or the fluctuation of sympathetic or parasympathetic tone associated with excessive exertion during birth stage (Machida *et al.*, 1993).

Sinoatrial block was detected in one of the animals in the 15-day-old group (5.8%). Rezakhani *et al.* (2010) suggested that the potential importance of the vagal tone for detection of certain arrhythmias was supported by greater occurrence of sinoatrial block during periods of relative bradycardia in ponies; but the kid examined in this study had sinus tachycardia and sinoatrial block, simultaneously (Fig. 1D). This arrhythmia is common among fit racing horses at rest and can be induced in horses and cattle by procedures that increase vagal tone. Provided that it does not persist during and after exercise, it is considered as a physiological variant of normal rhythm (Radostits *et al.*, 2007).

In sinoatrial block, the sinus node fails to discharge or its impulse is not transmit-

ted over the atrial myocardium. It is associated with complete absence of heart sounds, of jugular atrial wave and of arterial pulse for one beat period. On the electrocardiogramme, there was a complete absence of P, QRS and T complex for one beat (Fig. 1D).

Ventricular premature complex was recorded from 3 age groups of animals (Table 1). Ventricular premature complexes are characterized by bizarre QRS morphology (Fig. 1E). Premature complexes of all sited origins are indicative of myocardial disease, one exception being the occurrence of atrial premature complexes accompanying cases of gastrointestinal disease in cattle (Radostits *et al.*, 2007). Ventricular premature contractions in adult horses at rest and during exercise are related to myocardial lesions. However, high incidence in newborn foals, close association with parturition, transient nature of arrhythmias and subsequent normal growth and development of foals are strong evidence that significant myocardial lesions are not the case. Physiological changes associated with the adaptive period are probably the main factors contributing to ventricular premature contraction (Yamamoto *et al.*, 1992). Since none of the studied animals had clinical signs of cardiac problems or insufficiencies, it could be suggested that ventricular premature complexes are physiological cardiac arrhythmias in Iranian Najdi goats of different ages.

The present study proved that ECG could be helpful in detection of cardiac arrhythmias in Iranian Najdi goats. It was concluded that cardiac arrhythmias observed in clinically healthy goats in this study could be regarded as physiological arrhythmias, therefore treatment was not necessary. Furthermore, results of this study may be used as a guideline for assessment of any irregular cardiac rhythm in Iranian Najdi goats suffering from cardiac problems.

ACKNOWLEDGMENTS

Thanks are extended to Dr. Amin Tamadon for statistical analyses of our data. The authors are also grateful to Mr. Mohamadreza Farangi for his valuable contribution to the English revision of this manuscript.

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Paper received 14.06.2011; accepted for publication 11.11.2011

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