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## RESEARCH ARTICLE

### Comparison of Cardiac Arrhythmias between Late Pregnancy and Early Post-partum Periods in Clinically Healthy Iranian Fat-Tailed Sheep

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#### ABSTRACT

The current study was conducted to find out the prevalence of cardiac arrhythmias in clinically healthy Iranian fat-tailed sheep in two physiological states, i.e., late pregnancy and early post-partum periods. The electrocardiogram (ECG) was recorded from 32 sheep (early post-partum, n=17 and late pregnant, n=15) without any clinical signs of cardiac diseases. Assessment of ECG revealed that 84.3% of sheep had one or two kinds of cardiac arrhythmias. Two types of cardiac arrhythmias which detected in this study were sinus tachycardia and sinus arrhythmia. The proportion of different cardiac arrhythmias between early post-partum and late pregnant sheep, were significantly ( $P=0.003$ ) different. Sinus tachycardia was the most frequent arrhythmia recorded in both groups. Since none of the sheep with cardiac arrhythmias exhibited any clinical signs of heart disease at the time of ECG recording, the arrhythmias seen in this study could be regarded as physiological ones.

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#### INTRODUCTION

Electrocardiographic evaluation is most useful for sheep and goats with cardiac arrhythmias and the base-apex lead is the most common in large animal electrocardiography (Cebra and Cebra, 2002). The majority of arrhythmias and conduction disturbances can be detected on clinical examination. However, some may be undetected on clinical examination and could be found only on electrocardiographic examination (Radostits *et al.*, 2007). Variations in cardiac rate and rhythm include tachycardia, bradycardia, arrhythmia and gallop rhythms. Variation in the rate and rhythm can occur in normal animals because of strong or varying autonomic influence but can also be due to primary myocardial disease. Other factors such as acid-base and electrolyte imbalances can influence rate and rhythm (Radostits *et al.*, 2007). Veterinary literature indicates that most cardiac arrhythmias in large animals are not organic in nature and have no detrimental effects on the heart and no lesions can be found in the cardiovascular system at necropsy (Machida *et al.*, 1991; Machida *et al.*, 1993). Functional and pathologic cardiac arrhythmias in sheep due to diseases had been reported (Radostits *et al.*, 2007; Kojouri

*et al.*, 2009), but there are scanty reports on cardiac arrhythmias within physiologic states in this animal. Pregnancy, parturition and milking are common physiological changes that may elicit electrocardiographic anomalies (Murphy and Slodzinski, 2008); therefore, the present study was undertaken, for the first time to record electrocardiograms from a number of apparently healthy Iranian fat-tailed sheep in transition period to detect and compare cardiac arrhythmias in this breed.

#### MATERIALS AND METHODS

The present study was accomplished in December 2010 on 32 apparently healthy Iranian fat-tailed sheep (39 to 51 months old) at the Teaching Barn, Agricultural College, Shiraz University, Badjgah region (latitude of 29° 32' N and longitude 52° 35' E, 1810 m above sea level), southwest Iran. The animals were assigned into 2 groups, comprising late pregnant (more than 135 days in gestation, n=17) and early post-parturient (within 7 days post-lambing, n=15) sheep. Ewes were maintained in open-shed barns with free access to water and shade. The ration included mainly alfalfa, corn silage, corn and barley. The animals were examined prior to ECG

recording and were proved to be clinically healthy. The ECGs were recorded on a bipolar base apex lead, using limb lead I. Animals were kept in a standing position without sedation and minimal restraint. When the animals were calm (decreasing of panting behavior and muscle tremors), the ECGs were recorded, using alligator electrodes which were fixed to the skin after cleaning it with ethanol and applying jelly to improve skin contact. The positive electrode (left arm) was placed over the cardiac apex in the left fifth intercostals space at the level of the elbow. The negative electrode (right arm) was placed on left jugular furrow at the height of the base of the heart. The ground (right leg) electrode was placed on the dorsal spine or another site distant from the heart (Radostits *et al.*, 2007). All ECGs were recorded on a single channel electrocardiographic machine (Kenz-line EKG 110, Suzuken Co, Ltd, Japan) with the paper speed 25 mm/sec and calibration of 10 mm equal to 1 mv. By this method of measuring, the precision of duration was 0.02 sec. and amplitude was 0.05 mv. The heart rate of all animals was recorded. In the present study, the heart rate higher than 90 beats/min was considered as tachycardia. Statistical method used in this study, was Fisher's exact test using SPSS software (SPSS for Windows, version 11.5, SPSS Inc, Chicago, Illinois).  $P < 0.05$  was considered as statistically significant.

## RESULTS

Cardiac arrhythmias had been shown to be more frequent in early post-partum period. Two types of cardiac arrhythmias in this study were sinus arrhythmia (Fig. 1: c and d) and sinus tachycardia (Fig. 1: b, c, d and e). Some of the ECGs had both cardiac arrhythmias simultaneously (Fig. 1: c and d). The types and distribution of cardiac arrhythmias in these animals are given in Fig. 2. The most frequent arrhythmia was sinus tachycardia and this rhythm irregularity was most detected in early post-partum sheep (Fig. 2). The proportion of different cardiac arrhythmias between the two physiological states was significantly different ( $P = 0.003$ ). In early post-partum sheep, observation of ECGs was not revealed normal sinus rhythm (Fig. 2).

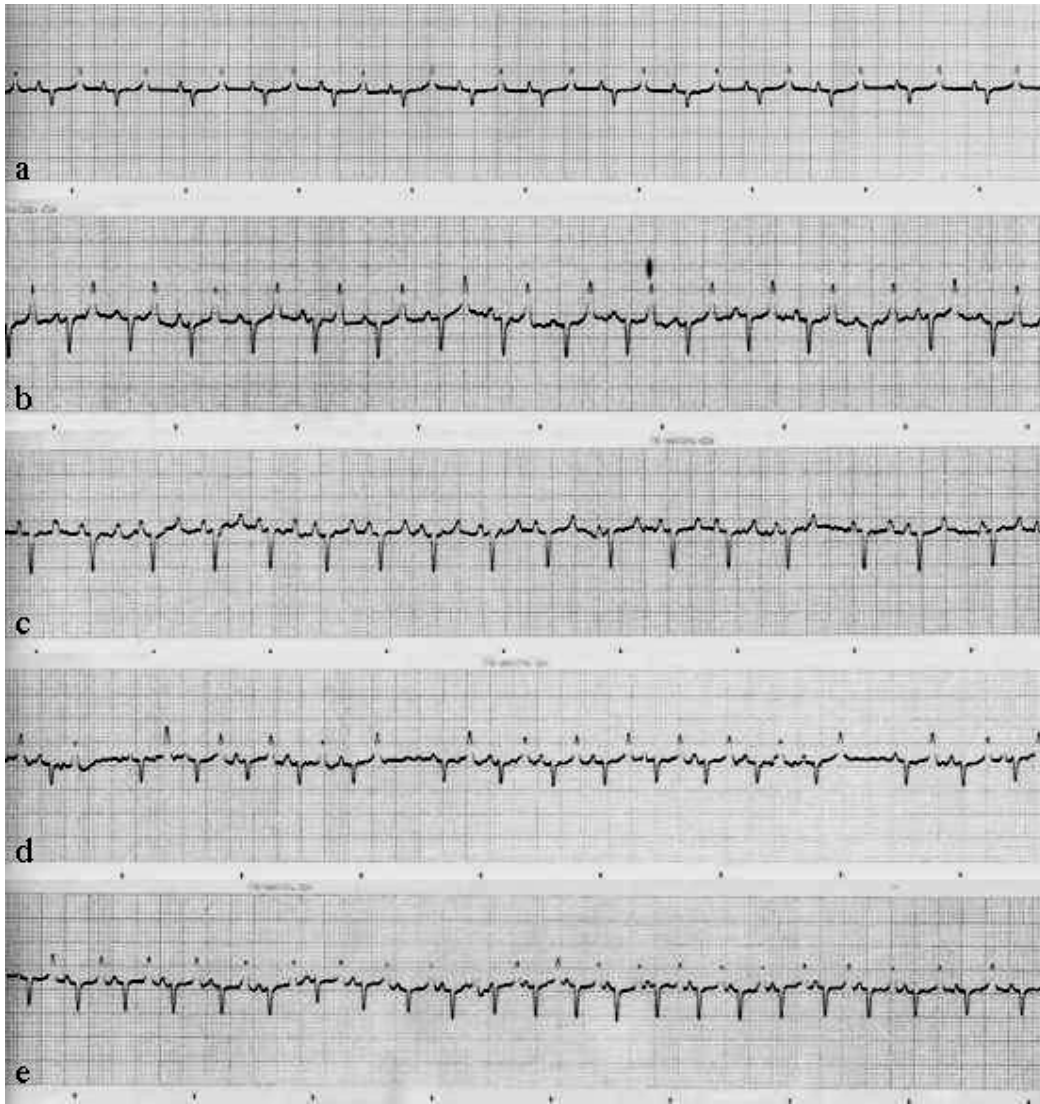
## DISCUSSION

The results of the current study showed that sinus tachycardia was the most frequent cardiac arrhythmia in the healthy Iranian fat-tailed sheep. Sinus tachycardia means an increase in heart rate that is initiated by the sinoatrial node. The term sinus tachycardia is used to describe an increase in heart rate caused by detectable influences such as pain, excitement, exercise, hyperthermia, a fall in arterial blood pressure or the administration of adrenergic drugs (Radostits *et al.*, 2007). The heart rate returns to normal when the influence is removed or relieved. Pregnancy is an important reason for tachycardia (Bernal and Concepción, 2006) but the results of the Fisher's exact test showed that proportion of the sinus tachycardia in early post-partum sheep was significantly ( $P < 0.05$ ) higher in this study. In rats, it has

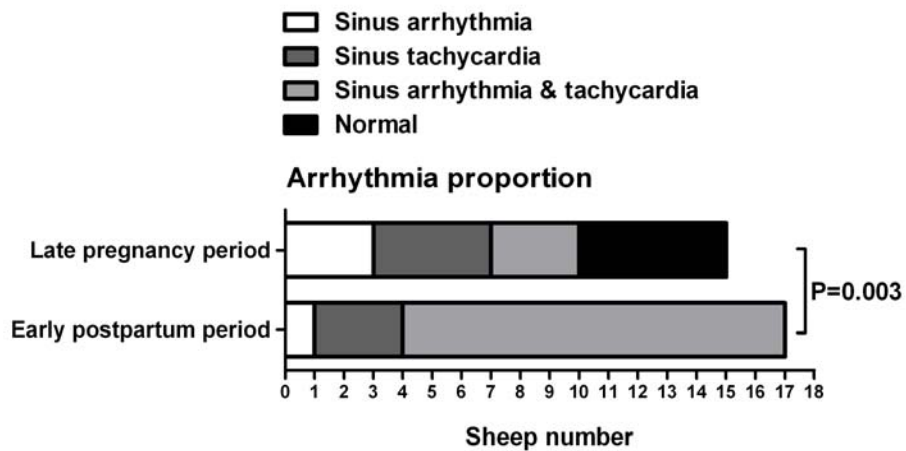
been reported that cardiac output and total volume of systemic blood flow increased significantly during lactation and these increases may well be associated with increasing milk yields (Chatwina *et al.*, 1969; Hanwell and Linzell, 1973; Machida *et al.*, 1993; Blackburn, 2007). It is well known that lactating dairy cows have increased plasma corticoid concentrations (Wagner and Oxenreider, 1972; Meinschmidt *et al.*, 2010) which are regulated by the corticotropin-releasing factor (CRF) that is secreted by the hypothalamus in response to milking stimulus (Smith and Dobson, 2002). CRF acts at additional sites in the central nervous system to stimulate sympathetic noradrenergic outflow to the heart and to inhibit cardiac parasympathetic nervous activity, resulting in increased heart rate (Fisher, 1989; Machida *et al.*, 1993; Davis *et al.*, 2002). It is suggested that the higher heart rates might be due to stress and excitation resulting by isolation of lambs from their dams, but since the animals were placed in a quiet state, it is unlikely to be the origin for this higher heart rates in studied animals. Because there were no clinical signs of cardiac problems (edema, jugular distension or pulsation) in all studied animals, this cardiac rhythm irregularity could be categorized as physiologic arrhythmias.

Sinus arrhythmia was the other common arrhythmia seen in this study. The observation of ECGs revealed that the sinus arrhythmia was associated with respiration. The animals in early post-partum period were shown this arrhythmia more frequently. Sinus arrhythmia is a normal physiological arrhythmia that occurs at slow resting heart rates and is associated with variation in the rate of discharge from the sinoatrial node associated with variation in the intensity of vagal stimulations. It is commonly correlated with respiration so that the discharge rate and heart rate increase during inspiration and decrease during expiration. Sinus arrhythmia is more clinically obvious in tame sheep and goats (Radostits *et al.*, 2007). This arrhythmia has been detected in anorectic cattle or animals which have been deprived of food (Machida *et al.*, 1991; Gentile *et al.*, 1993). None of the animals with sinus arrhythmia in this study had obvious clinical systemic disease or anorexia. High vagal tone could be suggested as the cause of this arrhythmia in these animals (Rezakhani *et al.*, 2004). It is probable to link the genesis of the sinus tachycardia and sinus arrhythmia in apparently healthy post-parturient sheep to the increased load imposed on the heart or the fluctuation of the sympathetic or parasympathetic tone associated with excessive exertion during the stage of the lactation (Machida *et al.*, 1993). Furthermore, parturition is a time of hemodynamic, hormonal, and catecholamine fluctuations, which may provoke cardiac arrhythmias (Murphy and Slodzinski, 2008).

It was concluded that the cardiac arrhythmias observed in the clinically healthy Iranian fat-tailed sheep in late pregnancy and early post-partum periods could be accepted as the physiological arrhythmias, so no treatment is necessary. Furthermore, the results of the present study may suggest that the physiological cardiac arrhythmias in sheep might be increased coincidentally with lambing.



**Fig. 1:** The electrocardiograms tracing from clinically healthy 39 to 51 months old Iranian fat-tailed sheep in base apex lead system (paper speed 25 mm/sec, sensitivity 10 mm/mv). Normal sinus rhythm in a late pregnant sheep (a), sinus tachycardia (b, c, d and e) and sinus arrhythmia (c and d) in early post-partum sheep.



**Fig. 2:** Distribution and proportion of cardiac arrhythmias in two different physiological states of clinically healthy Iranian fat-tailed sheep tracing in standard base apex lead system electrocardiography (paper speed 25 mm/sec, sensitivity 10 mm/mv).

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