COMPARATIVE STUDIES OF THE ELECTROCARDIOGRAFIC PARAMETERS, MEAN ELECTRICAL AXIS (MEA) AND CARDIAC INDEX (RV/TV) IN NORMAL AND EXPERIMENTALLY ASITES (USING COLD) GROUPS OF BROILERS

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Introduction

Ascites syndrome is noticed as a problem in commercial poultry especially for fast-growing broilers. This syndrome is characterized by elevated pulmonary arterial pressure, right ventricular dilation and hypertrophy. Oxygen requirement is the most critical trigger for ascites in these broilers. High cardiac output associated with a high oxygen requirement increases arterial pressure in lungs and causes pulmonary hypertension (1, 2).

Pulmonary hypertension results in right ventricular hypertrophy / failure and finally systemic circulatory congestion followed by liver congestion and edema which causes fluid to be exuded into lung, pericardium and abdominal cavity, which is recognized as ascites syndrome (3).

However, cardiac changes observed in ascitic birds can consider being responsible for the electrocardiographic characteristics that distinguish this syndrome even before developing of clinical signs (4, 5). Our goal in this study is to evaluate the electrocardiographic changes in the experimentally included ascites in broilers using cold model.

Materials and methods

A total of 300 one -days- old male cockerels from Ross breed were randomly divided into two equal groups (control and test). Chicks were reared for six weeks and provided ad libitum access to water and a standard corn-soybean ration. Temperature gradually was decreased in the test group to 30% of standard program from 2^{nd} week of the rearing period to the end of six weeks (6). At the end of each week (from 3^{th} week) ,5 chicks from each groups were randomly selected and electrocardiographic recordings were performed by an automatic recorder (sensitivity 10mm=1mv, 50mm/s).The limb bipolar leads I, II , III and augmented unipolar leads aVR , aVL and aVF were recorded for every chicken . Then, the amplitude of T, R, S waves and also Mean electrical axis (MEA) were measured. The heart of chickens was exposed via thoracotomy after euthanasia by cervical dislocation. After weighting total ventricles (TV) and right ventricle (RV), RV/TV ratio was determined as an index of the developing ascites in broilers (Pulmonary hypertension syndrome defined as having a RV/TV ratio greater than 0.29 during the experiments)(9).

Statistical analysis was done by student -t-test or bivriate correlation. Experimental data are presented as the mean ± SEM.

Results

There were significant elevations of the S wave amplitudes in 4th week (II, III, aVR leads) and 6th week (III lead) (Table 1). S wave had a significant correlation with RV/TV in 4th week (II lead) and 5th week (II, aVF leads) in the test groups too (Table 3). There were also significant increases of the T wave amplitudes in 4th and 5th weeks (II, aVF leads) and 6th week (aVF, aVR leads) in the test groups (Table 2). In this study, R waves hadn't any significant variation. There were an elevation of MEA in test groups but just were significant in 4th week compared with control groups and exhibited a right-cranial direction of the MEA (Table 4).

Discussion

Electrocardiography is a non-invasive technique widely used in the study of cardiac physiopatholgy. Among recorded waves from birds, R, S, T waves are specific that are suitable for comparison. In this study T, S waves have shown significant variations after 4th week in the test groups in compared to controls, which are agreed with the report of Martinez *et al.* (1997). Evidence in this study suggests that dilation and hypertrophy of ventricles is the primarily cause of the increased amplitude of S wave (long ventricle depolarization) and its correlation with RV/TV ratio. This is supported by studies of Wideman and Kirby (1995, 1996). In our study, MEA increased in associated with RV/TV ratio during rearing and electrocardiographic waves were almostly types of the short R and long S. Therefore this increased MEA exhibited a right cranial direction in the test group. This is confirmed by studies of Odom *et al.* (1992).

Conclusion

Recorded electrocardiograms can be used effectively to evaluate the development of ascites syndrome in broiler chickens. The increase in the amplitude of S and T waves could be considered as the sign of ventricular hypertrophy in ascites syndrome resulted from cold condition.

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Table 1: S wave amplitudes in different leads between two groups (control and test).

Age (days)	Lead / Group	II	III	aVR	aVL	aVF
21	Control	0.1±0.02	0.09±0.01	0.1±0.02	0.06±0.03	0.09±0.03
	Test	0.14±0.04	0.13±0.02	0.12±0.03	0.05±0.02	0.13±0.03
28	Control	0.1±0.03	0.12±0.03	0.08±0.01	0.07±0.01	0.1±0.03
	Test	0.4±0.07*	0.31±0.07*	0.19±0.05*	0.1±0.04	0.24±0.05
35	Control	0.22±0.03	0.17±0.03	0.15±0.03	0.04±0.02	0.18±0.03
	Test	0.31±0.04	0.35±0.06	0.22±0.03	0.09±0.03	0.35±0.04
42	Control	0.13±0.02	0.09±0.02	0.09±0.02	0.08±0.01	0.14±0.03
	Test	0.3±0.08	0.26±0.06*	0.19±0.03	0.07±0.01	0.28±0.08
Total	Control	0.14±0.02	0.12±0.01	0.11±0.01	0.06±0.01	0.13±0.02
	Test	0.28±0.03*	0.26±0.03*	0.18±0.02*	0.08±0.02	.025±0.03*

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alues are means ± SEM; *P < 0.05significant difference vs. control

Table 2: T wave amplitudes in different leads between two groups (control and test).

Age (days)	Lead / Group	II	III	aVR	aVL	aVF
21	Control	0.14±0.04	0.09±0.02	0.09±0.03	0.06±0.02	0.1±0.01
	Test	0.17±0.05	0.15±0.04	0.08±0.01	0.07±0.01	0.14±0.03
28	Control	0.14±0.01	0.13±0.01	0.11±0.01	0.21±0.15	0.12±0.01
	Test	0.2±0.04	0.14±0.02	0.15±0.02	0.08±0.02	0.2±0.03*
35	Control	0.14±0.01	0.14±0.01	0.11±0.01	0.08±0.02	0.13±0.01
	Test	0.35±0.07*	0.27±0.09	0.27±0.06	0.09±0.02	0.34±0.02*
42	Control	0.11±0.03	0.07±0.02	0.07±0.01	0.04±0.01	0.1±0.00
	Test	0.3±0.05*	0.26±0.09	0.16±0.02*	0.08±0.02	0.29±0.05*
Total	Control	0.13±0.01	0.11±0.01	0.1±0.01	0.1±0.04	0.11±0.01
	Test	0.25±0.03*	0.2±0.03*	0.16±0.02*	0.08±0.01	0.2±0.03*

Values are means ± SEM; *P < 0.05significant difference vs. control

Table 3: Bivariate correlation analysis of electrocardiographic waves to RV/TV ratio

		28days					35days				
	Lead	II	III	aVR	aVL	AVF	II	III	aVR	Al	AVF
R	Control	0.19	-0.14	-0.28	-0.17	0.00	0.23	0.65	0.06	0.03	0.24
	Test	-0.88	-0.47	-0.39	0.75	0.48	0.15	0.68	-0.15	0.8	0.46
S	Control	0.14	0.18	0.11	0.33	0.28	0.66	0.85	0.2	0.75	0.73
	Test	0.86	0.22*	0.36	-0.4	0.02	0.74	0.94*	0.74	0.44	0.1*
T	Control	0.65	-0.47	0.4	-0.11	0.02	0.26	0.94	0.45	0.03	0.4
	Test	0.6	0.18	0.27	0.56	0.72	0.29	0.66	0.31	-0.28	0.29

*P < 0.05 significant correlation

Table 4: Mean electrical axis (MEA) and RV/TV ratio between two groups (control and test).

Age(days)	Group	MEA	RV/TV
21	Control Test	169±48.2 302±13.3	0.2±0.00 0.24±0.01
28	Control Test	112.2±0.02 241.8±33.6*	0.21±0.00 0.39±0.04*
35	Control Test	188±50.5 247.4±0.24	0.26±0.01 0.34±0.02*
42	Control Test	182.3±38.2 249.5±32.1	0.22±0.01 0.35±0.03*
Total	Control Test	161.4±21 258.4±13.8*	0.22±0.01 0.34±0.02*

Values are means ± SEM; **P* < 0.05 significant difference vs. control

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