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RESEARCH ON CHANGES IN ECG WAVES' AMPLITUDE IN COWS USING MORE LEADS SYSTEMS

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Abstract

Our researches are aimed to determine the amplitude of the recorded electrocardiograph waves by means of three leads systems (two systems found in the scientific literature, and a leads system imagined by us), of a dairy cow. To this end, there were recorded electrocardiograms on group of 20 dairy cows and then the electrocardiograms were interpreted by calculating the amplitudes of the waves P and T and the total amplitude (summing the positive and negative for each branch in part) of the ventricular complex QRS, from the all three leads systems used. After interpreting the obtained results, we can conclude that neither of the leads system used in our study provides a complete electrocardiographic investigation. Thus, derivations Dubois may be recommended for recording ECG in D II (bipolar derivation II), D III (bipolar derivation III) and aVF (unipolar derivation, with electrode placed on the left hindlimb), while recording electrocardiogram in D I (bipolar derivation I), we recommend using limbs leads and leads system designed by us. Regarding recording of the electrocardiogram in aVR (unipolar derivation, with electrode placed on the right forelimb) and aVL (unipolar derivation, with electrode placed on the left forelimb) we appreciate that all three systems examined in our research can be successfully used.

Key words: *amplitude, cow, electrocardiogram, leads, waves*.

INTRODUCTION

Currently, electrocardiographic technique is not globally spread in farm animals veterinary medicine especially in farm animals where cardiac investigation by this technique are virtually absent in cow farms in our country.
Studying the literature in the field (Brăslașu et al., 2004; Roth, 1980) we found little data concerning the technique and especially electrocardiographic recording parameter values in cows. Please note that in cattle there is no standardized method for recording ECG (Stavarache et al., 1997), as in human medicine or pets (dogs and cats).
Our research has aimed at obtaining the data about the amplitude of electrocardiographic waves in various leads systems (two systems finding in the literature and one leads system imagined by us) in dairy cows.
We consider our study as useful for those interested, because the system of leads imagined by us, allow a quick assessment of the heart and provide data on its operation as well as detection of various cardiac disorders (arrhythmia, abnormal frequency and especially increases the compartments heart).

MATERIALS AND METHODS

To achieve our study we used the following materials: portable electrocardiograph (ECG machine) powered by batteries, alligator catchers (electrode) and various solutions for body-contact (Sodium Chloride solution 5% or rubbing alcohol).
The biological material was represented by a group of 20 dairy cows, Holstein, which were placed on a thick layer of straw (to achieve better electrical insulation to floor house).

ECG parameters used were: ten millimeters for the mV amplitude and 25 mm/sec for the speed of paper. In our research we recorded electrocardiograms of cows using limb leads, Dubois leads and one system leads invented by us.

Limb leads suppose affixing electrodes to the body surface as so: the red electrode underarm right, the yellow electrode underarm left, the green electrode in the ingvinal fold region on the left and the black electrode in the ingvinal fold region on the right (Dojană et al. 2015).

Dubois leads involve placing the red electrode in front of the right shoulder, the yellow electrode in front on the left shoulder, the green electrode between xifoidian appendix and umbilical scar and the black electrode anywhere on the body.

Own leads involve affixing electrodes on the body surface as follows: the red electrode under the right armpit, the yellow electrode under the left armpit, the green electrode between the umbilical scar and xifoidian appendix and the black electrode anywhere on the body (not on the surface of the triangle bounded by three active electrodes).

Using these leads described above, we registered electrocardiograms of cows in three bipolar leads (D I, D II and D III) and 3 unipolar leads (aVR, aVL and aVF).

RESULTS AND DISCUSSIONS

The results are presented as an arithmetic average for 20 cows, tabulated, and for a better observation of the results, each table is followed by a suggestive figure (chart).

Average values of P-wave amplitude, are present in table 1 for each lead separately, followed by a chart and a short comments.

Table 1. Mean values of P-wave amplitude recorded in cows, using more systems leads (mV)

System leads	D I	D II	D III	aVR	aVL	aVF
Limb leads	0.087	0.082	0.052	0.085	0.080	0.025
s	0.005	0.008	0.001	0.006	0.005	0.002
Dubois leads	0.021	0.181	0.126	0.103	0.034	0.146
s	0.006	0.08	0.06	0.05	0.003	0.08
Own leads	0.094	0.086	0.047	0.086	0.084	0.025
s	0.009	0.007	0.002	0.001	0.006	0.001

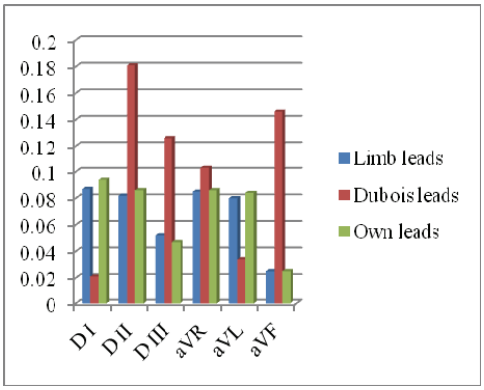

Figure 1. The average of P-wave amplitude recorded in cows, using more systems leads (mV)

By studying the data presented in Table 1 and Figure 1, we see that the average values of the amplitude of the P-wave were between 0.087 mV and 0.025 mV in the case of limb leads, between 0.021 mV and 0.181 mV in case of Dubois leads and between 0.094 mV and 0.025 mV, for the leads we imagined. These data corresponds to those found in the literature in the field (Brăslaşu et al., 2004; Mendez et al., 2001) for the limb leads and Dubois leads. Referring to the new leads system imagined by us, it provides a higher amplitude of the P- wave in D I and aVL compared to Dubois leads.

The data relating to the average amplitude of the ventricular complex are shown in Table 2 and Figure 2, for each lead separately.

Table 2. Mean values of the amplitude of ventricular complex recorded in cows, using more systems leads (mV)

System leads	D I	D II	D III	aVR	aVL	aVF
Limb leads	0.347	0.395	0.350	0.322	0.280	0.342
s	0.07	0.02	0.08	0.01	0.08	0.13
Dubois leads	0.234	0.790	0.931	0.331	0.545	0.857
s	0.13	0.04	0.08	0.01	0.01	0.02
Own leads	0.338	0.419	0.386	0.339	0.271	0.377
s	0.04	0.04	0.06	0.08	0.13	0.06

From Table 2 it can be observed that the highest average amplitude of the ventricular complex leads are recorded in Dubois leads (in descending order: D III, aVF and D II) values were 0.931 mV, 0.857 mV and 0.790 mV. This observation does not confirm the literature which gives the greatest amplitude recorded in D II (Rezakhani et al., 1993).

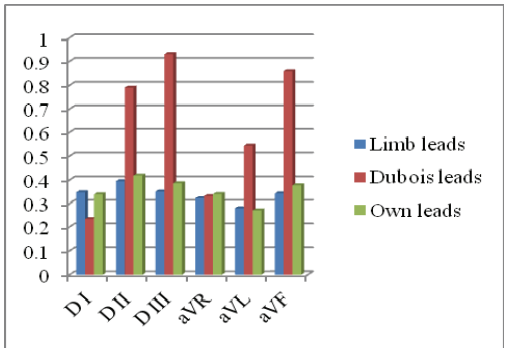

Figure 2. The average of the ventricular complex amplitude recorded in cows, using more systems leads (mV)

It is also notable that in terms of the amplitude, the Dubois leads has the lowest recorded in D I, situation that can be found in veterinary literature (Brăslașu et al. 2004; Pourjafar et al., 2012). Our recommendation is that for recording the amplitude of ventricular complex in D I, the ECG should be recorded using limb leads or our leads system.

The mean values of the T-wave amplitude recorded in our research are shown in Table 3 and Figure 3.

Table 3. Mean values of T-wave amplitude recorded in cows, using more systems leads (mV)

System leads	D I	D II	D III	aVR	aVL	aVF
Limb leads	0.167	0.220	0.155	0.177	0.127	0.157
s	0.06	0.18	0.02	0.07	0.02	0.01
Dubois leads	0.060	0.410	0.415	0.185	0.201	0.415
s	0.004	0.05	0.1	0.05	0.02	0.1
Own leads	0.177	0.233	0.157	0.205	0.150	0.183
s	0.02	0.02	0.06	0.07	0.08	0.01

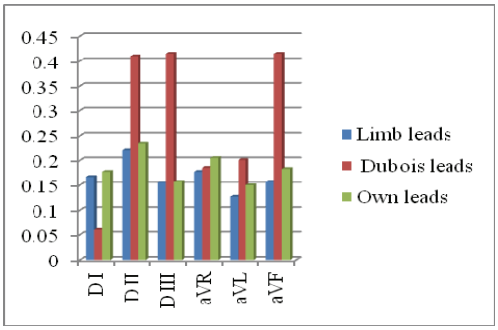

Figure 3. The average of T-wave amplitude recorded in cows, using more systems leads (mV)

Studying the data presented above, we note that the highest average amplitude of the T-wave is recorded in Dubois leads D II, D III and aVF, who have values between 0.410 and 0.415 mV. Regarding to D I recorded in Dubois leads, T-wave is observed to have the lowest amplitude (0.060 mV), which means that the wave cannot be seen on the electrocardiogram. To obtain data on T-wave amplitude value, we recommend using limb leads (average value we obtained 0.167 mV) and leads system imagined by us (average value obtained 0.177 mV).

CONCLUSIONS

P-wave average amplitude is ranged between 0.087 mV and 0.025 mV when limb leads is used, between 0.021 mV and 0.181 mV in Dubois leads and between 0.094 mV and 0.025 mV, when the ECG was recorded using the system leads imagined by us.

The average amplitude of ventricular complex had the highest value when we used Dubois leads for recording ECG, the values being obtained by us was 0.931 mV in D III, 0.857 mV in aVF and 0.790 mV in D II.

Average amplitude of the T-wave ranged from 0.127 mV (in aVL) and 0.220 mV (in D II) in limb leads, between 0.060 mV (in D I) and 0.415 mV (in D III and aVF) in Dubois leads and between 0.150 mV (in aVL) and 0.233 mV (in D II) in our system leads.

For recording P-wave amplitude we recommend limb leads and our leads.

For recording QRS and T-wave amplitudes we recommend Dubois leads.

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