Research Article

Changes in Haematobiochemical Indicators as Prognosis Criteria for Cows Affected by the "Downer" Syndrome

Healthcare

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Abstract

Studies are focused in monitoring 12 farms during the years 2015-2017 and aim to prove prognostic value of changes in haemato-biochemical indicators in cows affected by the "downer" syndrome. For the study period "downer" syndrome was found in 47 cows (4.89%) of average age 7±0.6 years and in the pre-calving period (82.97%). Most affected were Speckled cows (53.19%), Simental (29.78%) and interbreeding (10.02%). In 36.17 % of cases cows ended in slaughter. "Downer" syndrome in cows dictates changes in haemato-biochemical indicators that might be used for prognostic purposes. Raising indicators are the amount of albumin (4.1 ± 0.7g/dl from 2.1-3.6 g/dl), the total of white cells (16.0 ± 0.8 x 103/µl from 4-12 x 103/µl) and number of neutrophils (65.2 ± 5.1 x 103/µl out of 15-47 x 103/µl). Indicators that decrease are the overall calcium (1.58 ± 0.2 mmol/l from 2.43 - 3.10 mmol/l), inorganic phosphorus (0.98 ± 0.2mmol/l from 1.08 - 2.76 mmol/l), magnesium (1.32 ± 0.1 mmol/l from 0.74 - 1.10 mmol/l) and number of lymphocytes (23.9 ± 2.1 x 103/µl from 45.0 - 75.0 x 103/µl). Changes in haemato-biochemical indicators are recorded since days 3-5 and can be used to control the clinical status and prognosis in cases of cows affected by the "downer" syndrome.

1. Introduction

"Downer cow" syndrome is increasingly clinically diagnosed in dairy farm cows. Cows manifesting the "downer" syndrome are part of clinical practice activities for all veterinarians and represent not only veterinary medical emergency but as well a therapeutically challenge. Continuous recumbent condition and inability to stand on foot are basic criteria for majority of veterinarians when facing such cows. Cattle manifesting "downer" syndrome are serious clinical cases because the results often remain negative despite treatments and prolonged medical care. In a considerable number of cases the end by sacrifice remains the only way for cows that continue to remain recumbent even after 5-6 days of treatment. The purpose of the study is mainly to find ways and possibilities for early diagnosis, prognosis and reduction of economic damages through evaluation of haemato-biochemical indicators dictated by the "downer" syndrome. In previous publications we have identified changes in haematological and biochemical indicators in the serum of cows' blood affected by the "downer" syndrome. In this study we'll try to identify correlation of indicators and their prognostics value in clinical practice.

2. Materials and Methods

The study was focused in dairy cows of 12 farms in Prizren region, with a total of 960 of cattle heads. For the period 2015-2017 were taken into consideration all cases of cows clinically diagnosed with "downer" syndrome. Cows in this study underwent medical treatment using standard schemes for 4-6 days. Twenty cows were prepared every two days, for 10 consecutive days from which 3 swabs and blood samples were taken from jugular vein in tubes with anticoagulant (EDTA) and without anticoagulant in the amounts of 5 ml.

The prepared swabs, after drying were dyed with giemsa and manually checked in the laboratory of the clinical diagnosis in the Faculty of Veterinary Medicine in Tirana for figurative elements of blood. Blood samples and separated serum were checked with biochemical analyser EMP-168 Vet. using respective kits for indicators: Total proteins, albumins, overall calcium, inorganic phosphorous, magnesium, overall bilirubin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), total of white cells (WBC), erythrocytes (RBC), haemoglobin (HB), haematocrit (HCT), medium corpuscular volume (MCV), corpuscular haemoglobin (MCH), platelets (PLT) and indicators of leucocyte formula (neutrophils, granulocytes, monocytes, eosinophils and basophils). Obtained data were statistically processed with ANOVA method (homogeneity of variances and normality). Average values of indicators in the study were compared based on the groups of cattle according to breed, ages, period of occurrence (months of the year) and clinical conclusion (group of cattle that were sacrificed and group of cattle that were clinically cured). For each group were defined also deviations from average values and connections between indicators. From all obtained data charts of the regress and correlation coefficients between pairs of indicators in the study were compiled, too.

3. Results and Discussions

Data of the study showed that for the period from January 2015 until October 2017 with "downer" syndrome were affected 47 cattle heads, or 4.89%. In table 1 are shown cases encountered by years and breeds. Obtained results showed lower incidence compared with the data from other researchers. According to Bicalho, R. C. et al.(2007, b), 3.8 – 28 % of cases with hypocalcaemia in the period around calving get affected by "downer" syndrome and 20 – 67 % end with death or slaughter, Amory J.R. et al. (2006).

Table 1. Cases of cows with "downer" syndrome for year2015-2017

Years	Affected		By breed		
	Cattle head	%	Breed	Cattle head	%
2015	16	34.04	Speckled	9	56.2
			Simental	5	31.2
			interbreed	2	12.5
2016	11	2.34	Speckled	7	63.7
			Simental	2	18.1
			interbreed	2	18.1
2017	20	42.55	Speckled	9	45.0
			Simental	7	35.0
			interbreed	4	20.0
Total	47	100.0	Speckled	25	53.19
			Simental	14	29.78
			interbreed	8	10.02

From cases studied (tab. 1) was noticed that most affected by the "downer" syndrome were cows of Speckled breed with 25 cattle heads (53.19 %), Simental with 14 cattle heads (29.78 %) and less of interbreed breeds (8 cattle heads, 10.02 %). Average age of cows with "downer" syndrome was 7±0.6 years.

Our data coincide with those of other researchers Bicalho, R. C. et al. (2007b); Goff J. P. et al. (1995, 1997) who emphasise that the highest incidence of "downer" syndrome is noticed in cows above 6 years old (39 %). Mostly "downer" syndrome in cows was found after calving (39 cases or 82.97 %). Before the calving syndrome was found in 8 cows or 17.02 % (tab. 2). According to Sielman E.S. et al. (1997) and Sattler N. et al. (1998), cases before calving are rare (approx. 6 %).

Table 2. Cases with "downer" syndrome in relation with the period of calving and prognosis.

Years	Total cases presented							
	Before calving		After calving		Cured		Sacrificed	
	Cattle	%	Cattle	%	Cattle	%	Cattle	%
2015	3	6.3	13	27.6	10	21.2	6	12.7
2016	2	4.2	9	19.1	9	19.1	2	4.2
2017	3	6.3	17	36.1	11	23.4	9	19.1
Total	8	17.02	39	82.97	30	63.82	17	36.17

From obtained data, 62 % of cases occur within first 24 hours after calving and nearly 20 % were diagnosed within first 100 days after calving. In 30 cattle (63.82 %) results after medical treatment were positive and cows were clinically cured. In 17 cases (36.17 %) results even after medical treatment remained negative. Obtained biochemical and haematological indicators from checks in 20 cows with "downer" syndrome (regardless of clinical diagnosis) are presented in Table 3.

Indicators are given in average values, based on the days of the check-up. In the table are given normative value limits according to Radostits, (2005). Obtained data showed that changes in haemato-biochemical indicators were noted in cows affected by the "downer" syndrome. Such changes are reported also by other authors in their studies, Ceroni V. et al. (2012, 2014), Lumsden, J.H. et al. (1980), Doornenbal, H. et al. (1988), Duraj J. Ceroni V. (2016). Changes in haemato-biochemical indicator values are part of body's answer against responsible of clinical pathology manifested with "downer" syndrome, Ceroni V. et al. (2014), Doornenbal, H. et al. (1988), Peinado, V.I. et al. (1999), Radostits O. M., et al. (2005). From the obtained data for indicators in the study it was concluded that most affected by the "downer" syndrome in cows was the amount of albumins, level of calcium, of inorganic phosphorous, of magnesium, ALT, total of white cells (WBR), number of neutrophils and lymphocytes. The total amount of proteins, level of total bilirubin, of creatinine, AST, number of erythrocytes, haemoglobin, monocytes, eosinophils and basophils kept their values in the normative limits. Changes in indicators of the albumins amount, of total calcium, of magnesium, total of white cells and neutrophils are statistically verified (p < 0.05). The data for changes in values of ALT, of inorganic phosphorus and number of lymphocytes aren't statistically verified. Especially changes in ALT values were non-uniform with very wide variations and can be random in different individuals.

Changed indicators (with green background in the table) were grouped according to cattle' clinical outcome, by indicators of the group that was clinically cured and the group that was sacrificed. For the evaluation were singled out data with statistically proven changes (the grey background row) and not statistically unproven changes (the row with pink background).

Table 3. Average values of haemato-biochemical parameters in cows by check-up, compared with normative values.

| Indicators		Normative values	Haemato-biochemical indicators by the check-up days				
			First 24 hours	Third day	Fifth day	Seventh day	Ninth day
Total of Proteins g/dl		6.7 – 7.5	7.82 ± 2.1	7.22 ± 1.31	6.88 ± 2.2	7.27 ± 1.37	7.33 ± 1.6
Albumin g/dl	A	2.1 - 3.6	2.6 ± 0.4	2.4 ± 0.4	2.7 ± 0.4	2.6 ± 0.6	2.7 ± 0.21
	B	2.1 - 3.6	2.6 ± 0.2	†3.6 ± 0.32	*4.1 ± 0.7	*3.9 ± 0.6	-
Total of Ca (mmol/l)	A	2.43 - 3.10	2.33 ± 0.1	2.2 ± 0.3	2.16 ± 0.21	2.63 ± 0.1	2.61 ± 0.2
	B	2.43 - 3.10	2.12 ± 0.3	*1.58 ± 0.2	*1.69 ± 0.6	*1.72 ± 0.2	-
Inorganic P (mmol/l)	A	1.08 - 2.76	1.82 ± 0.3	1.85 ± 0.12	2.32 ± 0.2	2.14 ± 0.2	1.98 ± 0.13
	B	1.08 - 2.76	1.86 ± 0.3	*0.98 ± 0.2	*1.04 ± 0.3	*1.02 ± 0.2	-
Mg (mmol/l)	A	0.74 - 1.10	1.09 ± 0.1	0.91 ± 0.2	0.89 ± 0.2	0.93 ± 0.2	0.89 ± 0.1
	B	0.74 - 1.10	0.82 ± 0.1	*1.27 ± 0.2	*1.23 ± 0.3	*1.32 ± 0.1	-
Total Bilirub. (µmol/l)		0.17 - 8.03	4.68 ± 1.2	5.12 ± 3.1	4.34 ± 1.3	4.52 ± 2.22	4.77 ± 1.4
Creatinine (µmol/l)		0.35 – 2.80	1.62 ± 0.4	2.03 ± 0.2	1.83 ± 0.12	1.04 ± 0.54	2.2 ± 0.1
AST IU/L		60 - 150	116.4 ± 16.0	132.2 ± 21.1	145.1 ± 12.4	92.2 ± 27.3	107.7 ± 31.0
ALT IU/L	A	35 - 350	236.4 ± 13.2	207.2 ± 12.7	335.4 ± 11.6	309.2 ± 16.6	246.3 ± 14
	B	35 - 350	261.7 ± 31.3	†287.2 ± 16.1	*387. 8 ± 33.	*399.4 ± 11.6	-
RBC (10^6/µl)		5 - 10	6.29 ± 0.64	6.00 ± 0.78	7.0 ± 0.26	6.44 ± 0.14	5.91 ± 0.6
HGB (g/dl)		8 - 15	9.90 ± 0.86	10.07 ± 0.83	9.71 ± 0.92	9.0 ± 2.1	9.2 ± 0.8
WBC (10^3/µl)	A	4 - 12	6.61 ± 2.2	6.84 ± 1.1	7.32 ± 1.4	7.46 ± 1.1	7.75 ± 1.2
	B	4 - 12	5.58 ± 1.67	†11.5 ± 2.6	*12.2 ± 2.1	*16.0 ± 0.8	-
HCT (%)	A	24 - 46	29.57 ± 2.80	29.37 ± 2.64	29.7 ± 2.7	28.8 ± 2.4	29.1 ± 1.6
	B	24 - 46	29.12 ± 2.2	†41.3 ± 3.2	†39.6 ± 3.5	†39.8 ± 4.7	-
Neutrophils (10^3/µl)	A	15.0 - 47.0	27.60 ± 2.29	28.23 ± 4.5	27.6 ± 3.3	28.6 ± 2.5	25.4 ± 5.1
	B	15.0 - 47.0	26.10 ± 4.29	*65.2 ± 5.1	*59.3 ± 4.2	*62.3 ± 2.7	-
Lymphocyte (10^3/µl)	A	45.0 - 75.0	61.23 ± 3.2	60.5 ± 5.9	61.4 ± 4.4	61.0 ± 3.7	64.5 ± 3.1
	B	45.0 - 75.0	63.46 ± 4.52	*23.9 ± 2.1	*28.1 ± 5.1	*29.1 ± 3.6	-
Monocytes (10^3/µl)		2.0 - 7.0	6.84 ± 2.37	7.26 ± 3.39	7.61 ± 3.55	6.12 ± 1.88	5.72 ± 1.1
Eosinophils (10^3/µl)		0 - 20.0	3.07 ± 3.75	3.26 ± 2.93	2.67 ± 2.11	2.34 ± 0.34	3.41 ± 2.1
Basophiles (10^3/µl)		0 - 2.0	0.51 ± 0.86	0.26 ± 0.62	1.11 ± 0.21	0.56 ± 0.37	0.8 ± 3.2

Note: **A** = Group of cows that were clinically cured; **B** = Group of cows that were sacrificed.

    * : Significant changes against reference values ($p < 0.05$); † against Group A ($p < 0.05$).

   Reference values according to *Radostits O.M., 2005*.

In cows of the group that were sacrificed, the average level of albumins was growing, especially around the fifth day (respectively **4.1 ± 0.7**g/dl, from the norm 2.1 - 3.6g/dl). Indicator of the average of total calcium faces significant decrease since the third day, (Ca, **1.58 ± 0.2**mmol/l from 2.43 – 3.1 mmol/l). Otherwise, average magnesium values are significantly grown (**1.27 ± 0.2**mmol/l, from 0.74 - 1.10 mmol/l that are normative values). In particular, for these indicators we are giving charts with the result of average values from the daily check-ups, where trends of changes are clearly visible.

Chart 1: The curve of average level of albumins in cows with "downer" syndrome by days. (r = 0.633).
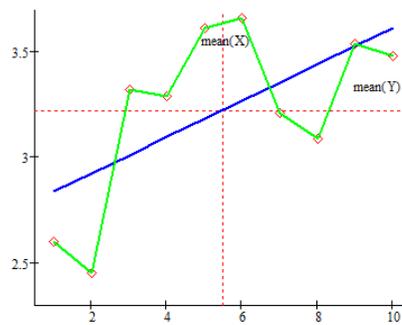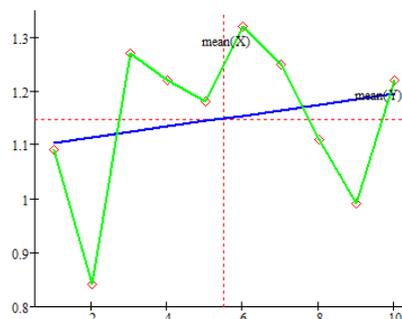

Note: *The green curve shows changes in average daily values, whilst blue curve shows the progressive tendency, depending on the days of recumbency.*

Chart 2: Curve of average level of total calcium in cows with "downer" syndrome, by days of check-up (r = -0.457)
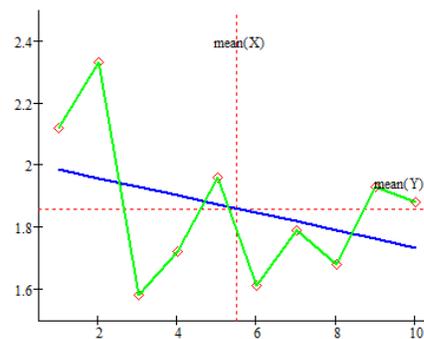
Chart 3: The curve of average level of magnesium in cows with "downer" syndrome. (r = 0.305).


From charts 1, 2 and 3 is recorded the increasing tendency in values of albumins and magnesium and decrease of average values of total calcium according to days of recumbency.

Tendency for decrease of increase in haemato-biochemical indicators are also reported by other authors, Peinado, V.I. et al. (1999). The total of white cells was found with the highest increase (up to 16.0 x 10^3/µl against the norm 4 - 12 x 10^3/µl) on the fifth and sixth day. The number of neutrophils also increases in cows that were sacrificed (up to 65.2 ± 5.16 x10^3/µl against 15.0 ± 47.0).

The number of lymphocytes changes with significant decrease (23.9 ± 2.1 x10^3/µl), but it isn't statistically proven. Changes in the number of white cells and neutrophils are seen from the third day of the check-up. Our data are pertinent also with changes of hematologic indicators in cows with "downer" syndrome that are reported by other authors, Ceroni V. (2012, 2014). In charts 4 and 5 is recorded the increasing tendency of average values of the number of white cells and neutrophils by the days of recumbency.

Chart 4: The curve of the number of white cells in cows with "downer" syndrome. (r = 0.758).
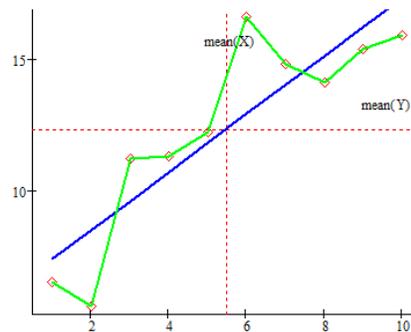
Chart 5: The curve of the average number of neutrophils in cows with "downer" syndrome. (r = 0.624).
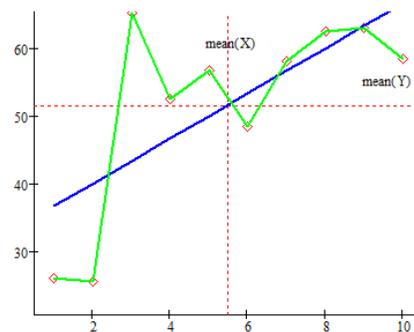
Results of the study suggest that in cows that suffer from "downer" syndrome changes in haemato-biochemical indicators occur from the third day. Changes in the number of total white cells, of neutrophils, level of albumins and especially of the level of total calcium and magnesium that are found from the third day of clinical manifestation of "downer" syndrome in cows, not only can be used but are beneficial as well to evaluate prognosis. Cows with such changes is advisable to be sacrificed immediately in reduce expenses.

4. Conclusions

In cows of our farms "downer" syndrome is present in 4.89 % of cattle that are breed. Most affected by this syndrome are cows of Speckled breed (53.19 %), Simental (29.78 %) and less of interbreed ones (10.02 %). In 82.97 % of cases "downer" syndrome is found in cows after calving. In cows suffering from "downer" syndrome present are changes in few haemato-biochemical parameters. Most visible and statistically proven changes faces the total of white cells, neutrophils, amount of albumins, level of total calcium and magnesium. The level of inorganic

phosphorous, ALT and number of lymphocytes face statistically unproven changes. Changes in haemato-biochemical indicators become evident and with tendency to turn severe in cattle with suspicious prognosis, starting from the third day of the start of "downer" syndrome. The progress of changes in haemato-biochemical indicators should be used for early evaluation of prognosis in dairy cows.

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