

Selected haematological and biochemical indices in donkeys in the Czech and Slovak Republics

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Abstract

The aim of this study was to establish normal reference values of biochemical and haematological indices of donkeys in the Czech and Slovak Republics. Blood samples were obtained from 112 clinically healthy donkeys (37 males and 75 females). The haematological indices examined were: red blood cells, white blood cells, haemoglobin concentration, haematocrit, mean cell volume, mean cell haemoglobin, mean cell haemoglobin concentration, platelets, segmented neutrophils, neutrophil bands, lymphocytes, monocytes, eosinophils and basophils. The biochemical properties examined were: total protein, albumin, creatinine, alkaline phosphatase, aspartate aminotransferase, creatine kinase, gamma-glutamyl transferase, lactate dehydrogenase, triacylglycerols, cholesterol, calcium, phosphorus, potassium, sodium, lactate. The results reported in this study could serve as reference ranges for the donkey population in the Czech and Slovak Republics.

Blood analysis, reference values, Equus asinus

The number of donkeys (*Equus asinus*) in the Czech and Slovak Republics is growing and, at the same time, there is an increasing demand for the health control of donkeys with reference to the specific climatic conditions of Central Europe. There are a few foreign publications that deal with the assessment of the health indices based on the examination of peripheral blood but, to our knowledge, no similar work has been developed locally. Due to the increased need for the existence of reference haematology and blood biochemistry values in donkeys, we have decided to monitor breeds in the Czech and Slovak Republics. Based on sample findings of drawn peripheral blood, such as reference ranges and observed values, the results are compared with those published in other countries such as Mexico, Brazil, Botswana and Serbia.

Haematology examinations provide valuable data on the metabolic profile, support objective assessment of the state of health and are often helpful in the detection of health disorders at a preclinical stage (Kral and Suchy 2000).

Inappropriate reference limits increase the risk of unnecessary investigations and diagnostic failures. The species, breed, environment, handling and physiological stage can influence serum biochemical and haematological variables (Girardi et al. 2013, 2014).

The aim of this study was to establish reference ranges for biochemistry and haematology profiles of apparently healthy donkeys in Central Europe.

Materials and Methods

This study was carried out in the Czech and Slovak Republics between the years 2009–2011. Blood samples were collected from 112 clinically healthy donkeys (37 males and 75 females) from 26 different owners. Their body condition ranged between 4–9 in the grading system of 1 to 9 (1 being very thin and 9 being very fat). The age range of all donkeys was 0.5 to 30 years.

Blood was collected by jugular venipuncture into 10 ml tubes for biochemistry and 2.5 ml EDTA tubes for

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haematology. Samples for biochemistry were allowed to clot at room temperature and serum was separated by centrifugation at 3,000 g for 15 min. Serum samples were analysed for metabolites: total protein (TP), albumin (ALB), creatinine (CREA), alkaline phosphatase (ALP), aspartate aminotransferase (AST), creatine kinase (CK), gamma-glutamyl transferase (GGT), lactate dehydrogenase (LDH), triacylglycerols (TAG), cholesterol (CHOL), calcium (Ca), phosphorus (P), potassium (K), sodium (Na), lactate (LAC).

All analyses were performed at the Central Clinical Laboratory of the University of Veterinary and Pharmaceutical Sciences Brno using the biochemical analyser DPC Konelab 20i – Thermo Scientific.

The haematological indices examined were: red blood cells (RBC), white blood cells (WBC), haemoglobin concentration (Hb), haematocrit (HCT), mean cell volume (MCV), mean cell haemoglobin (MCH), mean cell haemoglobin concentration (MCHC), platelets (PLT), segmented neutrophils (NEU), neutrophil bands, lymphocytes (LYM), monocytes (MON), eosinophils (EOS) and basophils (BAS). These indices were calculated using the haematological analyser Celltac alpha MEK 6318 – Nihon Kohden.

For each sample, a peripheral blood smear prepared from fresh blood and stained by the Diff-Quick method was examined microscopically for differential leukocyte count.

Results

The results of biochemical and haematological profiling are listed in Table 1.

Discussion

The obtained information was compared with data published in other geographical areas of the world, particularly Mexico, Brazil, Botswana, and Serbia (Table 1).

Foreign research is based on a significantly lower number of experimental animals and therefore comparisons can only be indicative, but it does provide interesting information about the dependence of certain blood indices on geographic conditions. Foreign publications provide significantly narrower ranges with respect to the reference number of samples that have been processed. The nearest values which most closely approach the results of this work were in the reference ranges produced in Brazil (Mori et al. 2004).

The reference range of WBC in the blood of donkeys in the Czech and Slovak Republics compared to the values described for most other donkey breeds was higher than those described for Mexican, Brazilian and Botswana donkeys (Mushi et al. 2000; Mori et al. 2004; De Aluja et al. 2006) but lower than that described for Serbian donkeys (Stanisic et al. 2015).

The values of RBC found in this study were similar to those described for Botswana donkeys (Mushi et al. 2000), but lower than those recorded for Mexican, Brazilian, and Serbian donkeys (Mori et al. 2004; De Aluja et al. 2006; Stanisic et al. 2015).

According to published data, the number of platelets found in this study was lower than that recorded for Mexican donkeys (De Aluja et al. 2006), but similar to that described for Botswana donkeys (Mushi et al. 2000).

In this study, the values of TP, ALB and CREA in the blood of donkeys in the Czech and Slovak Republics was higher compared to the values found for Mexican and Serbian donkeys (De Aluja et al. 2006; Stanisic et al. 2015).

The reference values were also compared with the values of individual indices in horses (Table 1). It was in this comparison where the most substantial differences in the measured quantities were found compared to the other above-mentioned groups.

In the case of haematological indices and particularly RBC, haemoglobin and haematocrit, values in the reference range of donkeys are about one third lower than in horses.

The values of biochemical properties show that the difference of creatinine in the reference range of donkeys is considerably higher than that in horses. In the case of AST, CK, GGT, LDH, TAG, Ca, P, K and lactate, reference ranges for donkeys is $\times 2$ –18 higher than in horses (Doubek et al. 2007).

Table 1. Comparison of reference ranges.

Analyte	Horse (Doubek et al. 2007)	Czech and Slovak Republics	Mexico (De Aluja et al. 2006)	Brazil (Mori et al. 2004)	Botswana (Mushi et al. 2000)	Serbia (Stanisic et al. 2015)
WBC (G/l)	5.4–14.3	5.61–15.05	10.34–12.6	4.6–11.50	10.16–12.42	11.9–17.0
RBC (T/l)	6.8–12.9	4.26–8.61	5.7–6.3	5.46–8.17	4.25–9.17	5.9–7.1
Hb (g/l)	110–190	82.73–165.04	x	107–145	59.7–154	112.0–125.0
HCT (l/l)	0.32–0.53	0.26–0.44	0.34–0.37	0.32–0.44	0.24–0.42	0.340–0.380
MCV (fl)	37–58	43.50–67.35	57.4–62.7	48.9–62.7	40.5–69.4	53–57.5
MCH (pg)	12–20	15.67–24.18	x	17.4–21.6	15.6–23.5	17.1–18.8
MCHC (G/l)	310–380	330.78–385.14	x	315–364	314–399	319.5–332.0
Platelets (G/l)	104–368	58.74–376.80	245–1195	x	63–375	171.0–283.5
Neutrophil band (%)	0–6	0–3.44	x	0–9.0	x	x
Neutrophil band (G/l)	0–0.10	0–0.47	x	0–0.88	x	x
Seg. neutrophils (%)	45–70	8.61–67.65	x	30.5–53.2	x	x
Seg. neutrophils (G/l)	2.3–8.6	0.32–7.78	1.8–9.2	1.77–5.46	x	x
Lymphocytes (%)	20–45	14.24–87.12	x	35.3–63.5	22–78	x
Lymphocytes (G/l)	1.5–7.7	0.64–10.33	4.6–6	2.14–5.88	x	4.6–7.5
Monocytes (%)	0–5	0–4.02	x	0–4.6	2–10	x
Monocytes (G/l)	0–0.10	0–0.50	0.04–1.2	0–0.48	x	x
Eosinophils (%)	0–4	0–12.24	x	1–10	4–24	x
Eosinophils (G/l)	0–0.10	0–1.32	0–1.8	0.06–0.92	x	x
Basophils (%)	0–2	0–0.79	x	0–2.9	x	x
Basophils (G/l)	0–0.30	0–0.08	x	0–0.17	x	x
TP (g/l)	55–75	58.67–91.16	71.2–74.5	x	x	59–70
ALB (g/l)	26–37	23.72–41.24	26.06–28.82	x	x	23–29.5
CREA (μmol/l)	106–168	55.95–167.88	83.17–91.92	x	x	58.5–84.5
ALP (μkat/l)	2.4–6.6	1.47–5.94	x	x	x	x
AST (μkat/l)	3.7–6	3.51–8.02	3.28–10.2	x	x	x
CK (μkat/l)	0.1–0.5	1.86–9.23	3.01–3.68	x	x	x
GGT (μkat/l)	0–0.2	0.43–2.78	0.35–2.95	x	x	x
LDH (μkat/l)	1.3–8	3.84–16.13	x	x	x	x
TAG (mmol/l)	0.10–0.5	0.01–1.91	x	x	x	0.4–1.5
CHOL (mmol/l)	1.9–3.9	0–4.6	x	x	x	0.7–1.3
Ca (mmol/l)	2.2–3.4	2.3–3.73	2.95–3.09	x	x	2.7–3.1
P (mmol/l)	1–1.8	0.88–2.66	0.61–1.67	x	x	0.8–1.2
Na (mmol/l)	132–146	117.72–150.5	123–168	x	x	x
K (mmol/l)	2.4–4.7	3.53–6.80	4.19–4.54	x	x	x
Lactate (mmol/l)	1.11–1.76	2.89–12.68	x	x	x	x

RBC = red blood cells, WBC = white blood cells, Hb = haemoglobin concentration, HTC = haematocrit, MCV = mean cell volume, MCH = mean cell haemoglobin, MCHC = mean cell haemoglobin concentration, TP = total protein, ALB = albumin, CREA = creatinine, ALP = alkaline phosphatase, AST = aspartate aminotransferase, CK = creatine kinase, GGT = gamma-glutamyl transferase, LDH = lactate dehydrogenase, TAG = triacylglycerols, CHOL = cholesterol, Ca = calcium, P = phosphorus, K = potassium, Na = sodium

In conclusion, this study established normal reference values of biochemistry and haematology indices for donkeys in Central Europe; these values can be useful for clinical routines and will allow veterinarians to establish appropriate interpretations of laboratory data.

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