



The Haematological and Biochemical Parameters Of Apparently Healthy Adult Male and Female Horses in Kaduna, Nigeria.

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Abstract

This study was conducted to determine the baseline data of haematological and biochemical parameters of adult horses in Kaduna, Nigeria. Twenty horses consisting of 10 males and 10 females aged 15 years and above were used for the study. The mean red blood cell counts, packed cell volume and haemoglobin concentration were lower than the mean reference values but fell within the normal range. The mean corpuscular volume and mean corpuscular haemoglobin were higher than those recorded in other veterinary books. The mean white blood cell counts and white blood cell differential counts fell within the range recorded in other parts of the world. Mean aspartate aminotransferase and creatine kinase enzyme values were lower than the reference values while other mean serum biochemical values evaluated did not differ from normal values reported in other clinically healthy horses in different parts of the world. In conclusion, the generated data may serve as reference values for old horses in Nigeria in order to assess their health status.

Introduction

Horses are used as beast of burden to transport riders, pull carriages, and they played significant roles in early warfare by carrying soldiers into battles (Robin, 1982). They are also used to pull agricultural implements in farms, and for recreational purposes like polo and racing as well as for research and development purposes (Zettl, 2007).

Evaluating the biochemical and hematological parameters of horses regarding age, gender and breeds (Fazio *et al.*, 2011) are crucial for the evaluation of the health and fitness levels of horses. It has been reported that age and sex influence haematological parameters (Oyewale and Durotoye, 1988). Most of the studies on

age with respect to haematology were mainly on foals from birth to 4 years of age (Jain, 1993). Demographic information suggests that older horses from 15 to 20 years of age now comprise a much larger proportion of the overall horse population and remain active into their 20s and 30s (McFarlane *et al.*, 1998), and continue to make important contributions. They are generally calmer than younger horses and they make wonderful companions (Briggs, 1998). It has been reported that horses in their late teens were still at the climax of their performance, compete in endurance rides, jumping, dressage and other athletic competitions (Robert *et al.*, 2004). Therefore it has become increasingly essential to preserve their good health and to extend their life spans.

Fitness profile in horses is used to monitor the health status of a horse. It is used to assess anaemia, electrolyte balance, muscle damage and infection challenges that can affect performance (Satue *et al.*, 2008). A healthy horse maintains a concentration of red and white blood cells, blood protein, electrolytes, muscle, liver and kidney enzymes and other blood components within an established 'normal' range relative to its age, sex, breed, degree of fitness, health and nutritional adequacy (Kohnke, 2009). Deviations from the normal range, either above or below the limits of this range, in one or more blood components, can signify an underlying disease process or a lack of response to exercise by a horse in work.

This study was aimed at establishing a baseline data of haematological and serum biochemical parameters of apparently healthy adult horses in Kaduna, Nigeria.

Materials and Methods

The animals consisted of 10 male and 10 female horses, aged 15 years and above from a private polo farm in Kaduna in the Northern Guinea Savannah zone of Nigeria. Dental eruption; wear and Galvayne's groove appearance pattern was used to estimate their ages as described by Wayne and Melvin (2000). They were housed in standard horse stables measuring 10 m by 12m. The stables are made of concrete floors, cement block walls and asbestos roof, and were well ventilated. The horses were fed with wheat bran, sorghum, hay and fresh pasture. They were pre-conditioned for two weeks before the commencement of the sampling. During this period, all the horses were screened and treated for endo-and haemoparasites. Endoparasites were treated with multiworm plusTM oral paste (Abamectin 3.7 mg and praziquantel 4.6.2 mg, Equifax Veterinary

Products, South Africa), and haemoparasites with Imidocarb, 4 mg/kg.

Blood Sampling

The blood sample was collected from each animal in the morning before feeding. 10 ml of blood was collected by jugular venipuncture using disposable syringes and 18 gauge x 1.5 inch sterile needles. 5 ml of the obtained blood was dispensed into a tube containing ethylenediaminetetra acetic acid (EDTA), and used for haematological evaluation. The remaining 5 ml collected was dispensed into a sterile bottle without anticoagulant, placed in ice, and allowed to clot for 30 minutes and then centrifuged for 15 minutes at approximately 1000 rpm. The resultant serum was removed immediately and placed in plain tubes, and stored at -20°C for serum chemistry

Haematological Analysis

The whole blood was used to determine packed cell volume (PCV), red blood cell counts, haemoglobin (Hb) concentration, and total and differential white blood cell (WBC) counts by methods described by Cole (1986).

The stored serum was used for serum chemistry and serum electrolyte determination. Creatine kinase (CK), aspartate aminotransferase (AST), urea, blood glucose and triglycerides were evaluated using the methods described by Cheesbrough (1991). Total protein was determined via the biuret method, serum albumin by Bromocresol green method as described by Cheesbrough (1991). Sodium, potassium, chloride, and calcium concentrations were evaluated using standard methods (Tietz, 1986).

Statistical Analysis

The data obtained were expressed as means \pm standard deviations. The relationship between values of male and female horses was assessed using Student's *t*-test, and values of $p < 0.05$ were considered statistically significant.

Results

Haematological parameters

The mean PCV, RBC and Hb values recorded in the horses of different sexes were significantly lower ($P < 0.05$) than the reference values (Table 1). The mean MCV and MCH evaluated were also significantly higher ($P < 0.05$) than the reference values. However, the mean erythrocyte values fell within the normal ranges. The overall mean total WBC, neutrophil, lymphocytes and monocyte counts observed were within the reference values while the mean eosinophil counts were higher than the reference values. However, no significant difference was recorded between the haematological parameters in the male and female horses.

Biochemical parameters

The mean sodium, calcium AST, CK, glucose, total protein and albumin recorded in the horses and in different sexes were lower than the reference values. The mean values observed in potassium, chloride, urea, cholesterol and triglycerol were higher than their reference values (Table 2). The values of AST and CK did not fall within the normal range. However, the values of other biochemical parameters evaluated fell within the normal ranges. There was no significant difference between the biochemical parameters in the male and female horses.

Discussion

The lower values of PCV and Hb observed compared with those recorded by Schalm *et al.* (1975) may be due to low grade helminth and protozoan parasitism, as well as poor nutrition (Anosa and Obi, 1980), common with Nigerian horses. The marked decrease in RBC counts recorded in this study compared with those recorded in American horses may be due to inaccurate manual haemocytometer used. The high range of mean MCV and MCH recorded compared with the reference values may also be due to inaccurate lower values derived from the erythrocyte counts since MCV and MCH are calculated using erythrocyte values.

The result of the present study showed that the mean overall WBC, neutrophil, lymphocytes and monocyte counts were within the reference values. However, the higher eosinophil counts recorded compared with those of American horses may be due to disease stresses common in tropical horses. Ehizibolo *et al.* (2012) observed that parasitism is a problem in horse stables in Nigeria.

The result of the present study demonstrated that the mean reference values of the electrolytes were within the range recorded in the experimental horses. Electrolytes are essential for controlling membrane potential, muscle contraction, nerve condition, and enzyme reactions, and they play a major role in the physiological process of exercise (Kohnke, 2009). The lower value of AST and CK enzyme obtained compared with reference value agrees with the work of Egbe-Nwiyi *et al.* (2012). The lower values of these serum biochemical parameters may be associated with breed, environmental and nutritional factors (Hambleton *et al.*, 1980). Zongping *et al.*, (1995) reported that some biochemical values of domestic animals may vary

according to geographic (altitude, latitude, climate) and dietary factors. AST is important in the breakdown and elimination of nitrogen while CK is important in storing energy needed for muscle contractions.

The result of glucose, urea, total protein, albumin, total cholesterol and triglycerol which fell within the reference values are in contrast with work of Gurgoze and Icen (2010) who found an increase in these parameters in older pure bred Arabian mares. Nazifi *et al.* (2000) reported that in dromedary camels the concentrations of cholesterol and triglyceride increased with increasing age. In humans, Braunwald (1995) and Kleinvelde (1996) reported that there was a statistically significant increase in the concentrations of serum cholesterol and triglyceride in advanced age.

The insignificant difference in the biochemical parameters evaluated in both sexes (Table 2) is in agreement with result of Patodkar *et al.* (2010) who reported that biochemical values did not differ in both sexes. However, the values of Na, CK, AST, total cholesterol triglyceride and HDL were slightly higher in female horses than male horses while that of chloride, glucose, total protein and albumin were higher in male horses than female horses. Previous studies in humans showed that although plasma triglyceride concentrations were lower in women than in men, triglyceride concentrations become higher with age for both sexes and can be significantly high for postmenopausal women (Schaefer *et al.* 1994).

In conclusion, the differences in haematological and biochemical values in this study as compared with results of other workers may be attributed to factors such as, low grade parasitism, environmental and nutrition factors. The findings of this study may serve as references in adult horses in Nigeria in order to evaluate their health status.

Table 1: Haematological values of apparently healthy old horses in Kaduna, Nigeria

Parameters	All horses (n = 20)	Male horses (n = 10)	Female horses (n = 10)	Mean SD values (Schalm, 1975)	Range
PCV (%)	37.6 ± 7.7 (23 – 50)	37.2 ± 6.8 (29 – 50)	37.8 ± 8.9 (23 – 49)	41 ± 4.5	32 - 53
Hb (g/dL)	12.5 ± 2.57 (7.6 – 16)	12.3 ± 2.2 (9.6 – 16.6)	12.8 ± 3.0 (9 – 16)	14.4 ± 1.7	11.0 – 19.0
RBC (× 10 ⁶ /μL)	6.23 ± 1.3 (3.8 – 8.3)	6.29 ± 1.25 (5 – 8.3)	6.17 ± 1.38 (5.3 – 8)	9.0 ± 1.2	6.8 – 12.9
MCV (fl)	60.3 ± 0.6 (58.9 – 61.5)	60.3 ± 0.85 (58.9 – 61.3)	60.24 ± 0.35 (59.7 – 60.3)	45.5 ± 4.3	37.0 – 58.5
MCH (pg)	20.0 ± 0.25 (19.6 – 20.4)	20.0 ± 0.19 (19.7 – 20.2)	20.1 ± 0.28 (19.6 – 20.4)	15.9 ± 1.5	12.3 – 19.7
MCHC (g/dL)	33.2 ± 0.1 (33.0 – 33.3)	33.2 ± 0.1 (33.0 – 33.3)	33.2 ± 0.07 (33.1 – 33.3)	35.2 ± 1.4	31.0 – 38.6
WBC (×10 ³ /μL)	8505 ± 1453 (6200 – 10, 700)	8410 ± 447 (6200 – 10, 700)	8600 ± 494 (6500 – 10200)	9050 ± 1800	5400 – 14300
Neutrophils (×10 ³ /μL)	4181 ± 1248 (2010 – 6420)	4368 ± 382 (3038 – 6420)	4010 ± 419 (2010 – 5704)	4,745 ± 1235	2260 – 8580
Lymphocyte (×10 ³ /μL)	3841 ± 899 (2460 – 5180)	3482 ± 296 (2460 – 5000)	4201 ± 232 (2700 – 5180)	3500 ± 1120	1500 - 7700
Monocyte (×10 ³ /μL)	242.7 ± 96.5 (188 – 408)	228.7 ± 35.8 (188 – 300)	256.7 ± 79 (140 – 408)	388 ± 228	0 - 1000
Eosinophil (×10 ³ /μL)	515.2 ± 141 (356 – 800)	573.3 ± 37.9 (390 – 800)	457 ± 45.0 (272- 784)	305 ± 244	0 - 1000

Values in parentheses are ranges.

Table 2: Biochemical values of apparently healthy old horses in Kaduna, Nigeria

Parameters	All horses (n = 20)	Male horses (n = 10)	Female horses (n = 10)	Mean \pm SD values (Kawumura, 2011)	Normal range
Sodium (mmo/ L)	139.2 \pm 3.47 (132-145)	132 \pm 2.76 (132-144)	138.8 \pm 4.18 (132-145)	140 \pm 3.0	132 - 146
Potassium (mmo/ L)	4.35 \pm 0.29 (3.8-5.0)	4.31 \pm 0.26 (3.8-4.6)	4.38 \pm 0.38 (3.8-5.0)	3.9 \pm 0.5	3.0 – 5.0
Chloride (mmo/L)	100.1 \pm 3.63 (95-106)	101.3 \pm 3.47 (98-105)	99.1 \pm 3.67 (95-105)	99.0 \pm 4	98 - 110
Calcium (mmo/L)	2.49 \pm 0.61 (2.31-3.01)	2.47 \pm 0.18 (2.31-2.96)	2.57 \pm 0.19 (2.33 -2.01)	2.95 \pm 0.1	2.8 – 3.1
Urea (mmo/L)	4.63 \pm 1.2 (3.1-7.2)	4.72 \pm 1.0 (3.6-6.8)	4.5 \pm 1.4 (2.8-7.2)	4.53 \pm 0.1	3.5 – 7.0
AST (Units/L)	72.8 \pm 8.29 (61- 86)	70.9 \pm 9.5 (55-87)	74.8 \pm 6.76 (66-86)	374 \pm 198	220 - 600
CK (mmol/L)	133 \pm 11.5 (107-148)	132.8 \pm 8.4 (122-142)	135.1 \pm 11.5 (107-148)	260 \pm 186	145 - 380
Glucose (mmo/L)	4.8 \pm 0.74 (3.4-6.1)	5.23 \pm 0.56 (4.6-6.1)	4.39 \pm 0.68 (3.4-4.9)	5.72 \pm 1.43	4.16 – 6.38
Total protein (g/L)	58.8 \pm 7.33 (42-71)	59.1 \pm 7.09 (52-71)	57.5 \pm 7.8 (42-68)	62 \pm 4.0	60 – 70
Albumin (g /L)	32.7 \pm 4.2 (24-41)	33.6 \pm 3.2 (30-37)	31.7 \pm 4.9 (30-41)	36 \pm 3.0	29 - 38
Cholesterol (mmo/L)	2.27 \pm 0.29 (1.8-2.8)	2.42 \pm 0.22 (2.2-2.8)	2.2 \pm 0.32 (1.8-2.6)	2.16 \pm 0.36	1.2 – 4.6
Triglycerol (mmo/ L)	0.38 \pm 0.14 (0.2-0.6)	0.35 \pm 0.15 (0.2-0.6)	0.42 \pm 0.12 (0.2-0.6)	0.26 \pm 0.36	0.1 – 0.5

Values in parentheses are ranges

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