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Research Article

Preliminary Studies on Some Haematological and Serum Biochemical Parameters of Apparently Healthy Adult Horses in Maiduguri, Nigeria

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ABSTRACT: Some haematological and serum biochemical parameters in twenty one apparently healthy adult horses in Maiduguri were examined to establish their reference values. The mean red blood cell (RBC) counts, packed cell volume (PCV), haemoglobin(Hb) concentration, white blood cell (WBC) counts, mean corpuscular volume (MCV), mean corpuscular haemoglobin(MCH) and mean corpuscular haemoglobin concentration (MCHC) were found to be comparable with the normal values. The mean absolute values of neutrophil, eosinophil, lymphocyte, monocyte and basophil were also within the normal range. The mean serum values of sodium, potassium, chloride and bicarbonate, as well as urea, creatinine and alanine aminotransferase(ALT) enzyme did not differ from the normal values, while the mean aspartate aminotransferase (AST) enzyme value appeared to be lower than the normal range. In conclusion, the RBC, PCV, Hb, WBC, MCV, MCH, MCHC, neutrophils, eosinophils, lymphocytes monocytes, basophils, sodium, potassium, chloride, bicarbonate, urea, creatinine and ALT values recorded in horses in Maiduguri were comparable with those values reported in other clinically healthy horses in different parts of the world.

Keyword: Haematological, biochemical, healthy, parameters, horses, Maiduguri.

INTRODUCTION

The horse (*Equus caballus*) is a hoofed herbivorous mammal of the family Equidae. It is identified with the ruling class (Kings and noble men). The horses are useful in Agriculture, transport, policing, games, sports and a host of others (Radostits *et al.*, 1994). The common breeds of horses in the world are; Belgium, Arabian, Argentina, Ciollo, bard, Dangola and others. The animals suffer from a lot of bacterial, viral, fungal and parasitic diseases (Losos, 1986; Radostits *et al.*, 1994). Blood is a good medium for diagnosis of various diseases of animals including horses (Schalm *et al.*, 1975; Radostits *et al.*, 1994). Biochemical analysis of serum enzymes has been useful in the evaluation of

specific diseases of horses and other animals (Kaneko, 1989; Radostits *et al.*, 1994). The levels of these enzymes and blood parameters give an indication of the health status of the horses evaluated. In view of this, the present study was designed to establish the reference values or baseline data of some haematological and serum biochemical parameters of apparently healthy adult horses in Maiduguri metropolitan council of Borno State, Nigeria.

MATERIALS AND METHODS

Animals: Twenty one (21) apparently healthy adult horses of both sexes were examined at the polo ground, Government house and police mounted troops, all in Maiduguri Metropolitan area of Borno State. Some of the animals were housed in stables while others were in open areas but well cared for. They were examined for various diseases, wounds or any abnormalities and those with abnormalities were excluded from the study.

Blood Collection and Analysis: Ten millilitres (10ml) of blood was collected aseptically from the jugular vein of each animal in the mornings or evenings with the assistance of the horse attendants. Five (5ml) out of the

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ten mililires (10ml) of blood collected from each animal was allowed into a bottle with ethylene diamine tetracetate (EDTA) for haematology while the remaining 5ml was transferred into another bottle without EDTA for serology. The blood without EDTA was allowed to clot, then serum was separated immediately by centrifugation at 1000 rev/min. The sera samples obtained were stored at -20°C until used.

The red blood cell (RBC) counts, white blood cell (WBC) counts, packed cell volume (PCV), haemoglobin (Hb) concentration and absolute differential leucocyte counts (DLC) namely; the neutrophil, eosinophil, lymphocyte, monocyte and basophil values were determined using the standard methods (Coles, 1980; Jain, 1986). The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) values were calculated using standard formulae (Schalm *et al.*, 1975).

Biochemical analysis

The serum samples obtained were used to determine sodium, potassium, chloride, bicarbonate, urea and creatinine levels using standard methods (Tietz, 1986). The alanine aminotransferase (ALT) and

aspartate aminotransferase (AST) enzymes were estimated colorimetrically using commercial reagent kits (Randox Lab Ltd, Co. Antrim, UK).

Statistical Analysis

The data obtained were summarised as means \pm standard deviations.

RESULTS

The mean (\pm SD) and range of values of haematological and serum biochemical parameters obtained in the present study are presented in tables 1 and 2. The mean RBC, WBC, PCV and Hb values fell within the normal ranges but the lower limit values of PCV and Hb which were 26% and 10.0gm/dl respectively were lower than the 37% and 11.0gm/dL values respectively for the normal values (Table 1). The lower limit value ($5.12 \times 10^6/\mu\text{L}$) of RBC was lower than the lower limit value ($6.80 \times 10^6/\mu\text{L}$) of normal value. The lower and upper limit values of total WBC in the present study ($6.05 - 14.6 \times 10^3/\mu\text{L}$) were higher than the lower and upper limit values of their corresponding normal values ($5.4 - 14.3 \times 10^3/\mu\text{L}$) (Table 1).

Table 1:

Haematological values of apparently healthy adult horses examined in Maiduguri Metropolitan council of Borno State, Nigeria

Parameters (Units)	Values		
	Mean \pm SD (n = 21)	Range	Normal Range of values (Schalm <i>et al.</i> ,1975)
Packed cell Volume(PCV)%	34.98 \pm 4.96	26 - 48	32-53
Haemoglobin (Hb) Concentration(g/dl)	13.24 \pm 1.92	10 -17.5	11.0-19.0
White Blood Cell Count (WBC ($\times 10^3/\mu\text{L}$))	9.38 \pm 2.19	6.05-14.6	5.4 -14.3
Red blood cell (RBC) count ($\times 10^6/\mu\text{L}$)	7.58 \pm 1.17	5.12-10.22	6.8 -12.9
Mean corpuscular Volume (MCV) (fL)	46.28 \pm 3.11	41.1-55.2	37.0-58.5
Mean Corpuscular haemoglobin (MCH)(Pg)	17.71 \pm 3.29	12.9-25.0	12.3-19.7
Mean Corpusc. haemoglobin conc (MCHC) (g/dl)	38.26 \pm 6.54	28.8-54.8	31.0-38.6
Absolute DLC ($\times 10^3/\mu\text{L}$)			
Neutrophil counts	4862.27 \pm 1940.49	1573-8856	2,260-8,580
Lymphocyte counts	3617.9 \pm 1410.42	1111-7154	1500-7,700
Eosinophil counts	542.47 \pm 254.80	74 - 1560	0-1,000
Monocyte counts	326.83 \pm 206.48	76-1296	0-1,000
Basophil counts	0	0	0-290

DLC = Differential Leucocyte counts; n = number of horses examined

Table 2: Mean (\pm SD) Serum biochemical parameters of apparently healthy adult horses examined in Maiduguri Metropolitan Council of Borno State, Nigeria

Parameters (Units)	Values		
	Mean \pm SD (n = 21)	Range	Normal Range of values (Mercks Manual 2010)
Sodium (mmol/L)	138.9 \pm 5.0	110.0 – 134.0	128 - 142
Potassium (mmol/L)	3.9 \pm 1.2	1.7 – 7.7	2.9 – 4.6
Chloride (mmol/L)	88.5 \pm 3.4	80.0 – 94.0	98 – 109
Bicarbonate (mmol/L)	20.5 \pm 1.7	17.0 – 23.0	24 – 30
Urea (mmol/L)	6.2 \pm 1.9	2.0 – 10.1	3.9 – 9.6
Creatinine (Mmol/L)	133.4 \pm 5.0	103.0 – 166.0	35 – 194
Aspartate aminotransferase (AST) (U/L)	55.4 \pm 25.0	23.0 – 108.0	160 – 412
Alanine aminotransferase (ALT)(U/L)	6.0 \pm 3.1	3.0 – 15.0	2.7 - 21

n = number of horses examined

The mean absolute DLC values were also within the normal range of values. The lower limit value (1, 578/ μ l) of absolute neutrophil counts was lower than the lower limit value (2, 260/ μ l) while the upper limit value (8, 856/ μ l) was higher than the corresponding upper limit value (8, 580/ μ l) of the normal value (Table 1). Similarly, the upper limit values of absolute eosinophil and monocyte counts which were 1, 560/ μ l and 1, 296/ μ l respectively were higher than their corresponding upper limit values of the normal values (0 – 1, 000/ μ l) (Table 1).

The mean MCV, MCH and MCH values did not differ from the normal values. The lower limit value (41.0fL) for MCV was higher than the lower limit value (37.0fL) of the normal value while the upper limit values 25.0pg and 54.8gm/dL for MCH and MCHC respectively were higher than those of the normal values (Table 1).

The mean serum sodium potassium, chloride, bicarbonate, urea, creatinine, and alanine aminotransferase (ALT)enzyme levels fell within the normal range of values. The mean aspartate aminotransferase (AST) enzyme level and upper limit value however were lower than the lower limit value of normal value (Table 2). The lower limit value of ALT enzyme was slightly higher than the lower limit value of normal value.

Moreso, the lower limit value of creatinine was higher than the lower limit value of the normal value (Table 2). On the other hand, the lower limit value of urea was lower than the lower limit value of the normal value (Table 2). The lower limit values of serum sodium, potassium, chloride and bicarbonate

were lower than the lower limit values of their corresponding normal values (Table 2).

DISCUSSION

The results of the present study demonstrated that the mean RBC, PCV and Hb values did not differ from the normal values reported by Schalm *et al*(1975) in other horses from different parts of the world. The packed cell volume (PCV) helps to determine anaemia in man and animals while Hb is the oxygen carrying capacity of the blood. The RBC serves as a carrier of Hb (Jain, 1986). The mean MCV, MCH and MCHC values observed in the present study were also in agreement with the findings of previous workers (Schalm *et al.*, 1975). The MCV, MCH and MCHC values assist in determining whether there is anaemia or not; and the type of anaemia (Coles, 1980; Radostits *et al.*, 1994).

The white blood cells (WBC) or leucocytes and the absolute differential leucocyte counts (DLC) namely; neutrophils, eosinophils, lymphocytes, monocyte and basophil values were in consonance with earlier reports (Schalm *et al.*, 1975). Leucocytes generally participate in body defense against invading bacteria, viral and parasitic organisms but each is kinetically and functionally independent (Duncan and Prasse, 1977; Coles, 1980). The slight differences in terms of lower or upper limits of values recorded in this study when compared with the normal values may among other things be attributed to environmental, breed, age, sex and nutritional factors.

It is pertinent to note that this study was carried out in a tropical region (semi –arid zone), while Schalm *et al.*, (1975) made their observations from animals in the temperate region. Environment influences haematological values of animals remarkably (Coles, 1980, Miller and Campbell, 1983; Egbe-Nwiyi, 1995; Egbe-Nwiyi *et al*; 2007), while nutrition helps to boost the immunity of animals to withstand the effect of various diseases especially haemoparasitic types that usually attack or destroy white and red blood cells (Manston, *et al* ; 1975; Radostits *et al.*, 1994; Egbe-Nwiyi *et l*; 2010). It has also been reported that age (Allen and Archer, 1973), Sex (Archer, 1959) and breed (Jain, 1986) differences affect haematological values of horses. Furthermore, Archer (1974) reported positive influence of training on red blood cell values of horses while Jones (1976) observed that cold-blood horses have lower RBC, Hb and PCV values than hot-blooded horses. Pregnancy and lactation have been reported to have strong influence on blood values of horses (Trum, 1952).

The mean serum values of sodium, potassium, chloride and bicarbonate observed in this study agreed with the normal values recorded in other horses elsewhere (Schalm *et al.*, 1975). Electrolytes help to maintain the acid-base balance of the body as an increase or decrease in any of them can alter the pH of the body leading to acidosis or alkalosis (Kaneko, 1989; Radostits *et al.*, 1994).

The ALT is an important organ specific leakage enzyme as it helps to assess hepatocellular damage and the mean ALT value recorded here did not differ from observations of previous workers in other horses in other parts of the world (Schalm *et al.*, 1975, Coles, 1980, Kaneko, 1989). On the other hand, the mean AST value was not in consonance with the value reported previously as it appeared to be lower than that of the normal value although AST is not an organ specific enzyme but it assists other organ specific enzymes to determine the level of organ damage (Kaneko, 1989).

The mean serum urea and creatinine levels recorded in the present study were comparable with those values reported earlier in other horses in different parts of the world (Schalm *et al.*, 1975). The urea and creatinine generally help in assessing renal damage in animals and humans (Kaneko, 1989, Radostits *et al.*, 1994). The lower or higher values of some of the serum biochemical parameters witnessed in this study may be associated with age, sex, breed, environmental and nutritional factors, as these were not seriously taken into account during the study. Zongping *et al.*, (1995) reported that some biochemical values of domestic animals may vary according to geographic (altitude, latitude, climate) and dietary factors.

In conclusion, the mean PCV, Hb, RBC, MCV, MCH, MCHC, WBC, neutrophils, eosinophils, lymphocytes, monocytes, basophils, sodium, potassium, Chloride, bicarbonate, ALT, urea and creatinine values in horses in Maiduguri were comparable with those values reported in other clinically healthy horses in different parts of the world. The AST value was lower than the value reported in other horses elsewhere.

The few horses examined in this study were apparently normal. There is the need to study in details the influence of age, sex, racing, pregnancy, lactation, nutrition, breed and weather on the haematological and biochemical parameters of horses in Maiduguri in semi arid zone of Nigeria.

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