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# Patrolling Police Horses (*Sawari*) Welfare, Khartoum State, Sudan: Some Nutritionally Related Blood Metabolites and Blood Parameters

**Suhair Sayed Mohammed A/Alrahman [(1)*] and Gusai Hussein Abdelsamad [(2)]**

[1]University of Bahri, College of Veterinary Medicine, Teaching Veterinary Hospital, Khartoum North, Sudan
[2]University of Bahri, College of Veterinary Medicine, Department of Microbiology, Khartoum North, Sudan
*Corresponding Author: E-Mail: musu421@gmail.com

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**ABSTRACT**

In this study, a surveillance was conducted during 2013(February-April) to investigate some police horses (Sawari) welfare conditions. A total number of 90 (83 males and 7 females) horses were randomly selected, in different Khartoum State stables Khartoum (KH), Khartoum North (Almazad, ALZ) and Ummdurman (Almulazmin, ALN Ummbada Janob, UMJ, Ummbada Shamal, UMSH and Almuhandesin, ALH) cities. Blood samples were collected from the jugular vein; samples with anticoagulant (EDTA) were prepared for the total leukocytes count (TLC), Packed cell volume (PCV) and haemoglobin concentration (HB). Blood smears were prepared for the differential leucocytes count (DLC). Sera were obtained for the determination of total protein (TPR), albumin (ALB) and urea (UR) concentrations**.** The obtained values of parameters examined were mostly within the normal range. Compared to other stables**,** TPR, ALB and UR concentrations were significantly lower in UMJ and ALH stable respectively. However, the percent of lymphocytes (L) and neutrophil (NEU.) were significantly lower in UMSH and KH stables respectively and that of eosinophils (EOS) was significantly higher in KH stable. The TLC was significantly lower in KH stable compared to the other ones. The PCV percent was significantly lower in UMSH stable. This study revealed that Sawari horses receive appropriate food; however bacterial infection and parasitic infestation adversely affected their metabolic profile and immunity.



## INTRODUCTION

Patrolling police horses (*Sawari*) are used routinely in the security programs adopted by the Police authorities throughout Khartoum State to furnish peace. According to their load they need

the minimum requirements of animal welfare (Dey *et al.*, 2010, Holcomb *et al.*, 2010). Previous work covered some aspects of *Sawari* horses welfare in Khartoum State which included exposure to heat stress (Mohammed, 2015) and general health and environmental mal-management (Mohammed and Mahammed, 2015).
Assessment of the metabolic profile of riding horses could be useful for monitoring nutritional status and required supplementation. The knowledge of the metabolic profile also helps in earlier prediction and avoidance of serious or irreversible metabolic diseases (Marc *et al.*, 2000, and Kida et *al.*, 2007). Also the analysis of the biochemical properties of animals coupled with the study of packed cell volume(PCV) and haemoglobin (Hb) is essential in diagnosing nutritional and pathological problems (Daramola *et al.*, 2005) .

Sawari horses have to walk for long distances during nights and to stand for long times during festivals and occasions all these exert stress and subject them to cortisol hormone effects (Foreman and Ferlazzo, 1996; Marc *et al.*, 2000). Stress of exercise induces significant effects on horses′ immune responses; strenuous exercise is immunosuppressive (Huston *et al.*, 1987). However, moderate and less exhaustive exercise is said to be immunostimulatory (Hines and Schott, 1995).
This study was conducted to study some nutritionally related blood metabolites and blood parameters in Sawari horses which indicate their welfare and energy status.

## MATERIAL AND METHODS

***Study Area*:** The study was conducted at Khartoum state, it is the capital of Sudan**,** and it lies between 15° 33' N, 32° 31' E. The stables in the three cities of Khartoum state (Khartoum, Khartoum North and Umdurman) were covered.

**Animals:** A total number of 90, apparently with normal physical and health conditions, horses, (83 male and 7 non-pregnant females) of night patrolling police (Sawari) horses with age ranged between 3-6 years old were randomly selected. They represented different police horse stables at Khartoum (KH), Khartoum North (Almazad, ALZ) and Umdurman (Almulazmin, ALN Ummbada Janob, UMJ, Ummbada Shamal, UMSH and Almuhandesin, ALH) cities.

***Housing and Management*:** During the experimental period, a routine program of deworming and grooming was applied .They were fed sorghum (*Ferterita)* and barseem (*Lucerne hay*), which are rich in protein (Sulieman and Mabruk, 1999), and allowed free access to water. Some horses were kept in stables and others outside in the yard or under the trees.

***Sampling*:** Blood samples were collected weekly from the jugular vein of each horse. 3ml of each sample were transferred to a plain test tube and 2ml were transferred to a test tube with an anticoagulant (EDTA) for hematological indices determination.

***Laboratory work:*** Samples in plain test tubes were centrifuged and obtained sera were kept at -20°Ċ for the determination of the concentrations of TPR, ALB and UR. Kits from Biomed diagnostics, Biosystems and Crescent Diagnostics were used for the determination of the concentrations TPR, ALB and UR respectively. Samples with anticoagulant were used for total leukocytes count, PCV and Hb determination and blood

smears were prepared for DLC according to (Jain, 1986).

***Statistical analysis:*** The obtained data were statistically analyzed using the SPSS (SAS, 1997). Results obtained are presented as means ±SD.

**RESULTS AND DISCUSSION**

Values obtained for blood metabolites, PCV and hemoglobin were within reference (The Merck Veterinary Manual, 2015) normal range which indicated that the nutritional status was appropriate in all stables and energy expenditure is moderate .Also this could be related to aerobic adaptation to exercise (Mole *et al.*, 1973).

Figure (1) shows the concentration of some blood metabolites in different Sawari horses stables. Generally, the values of TPR concentrations obtained were within the normal range (5.6-7.6 gm/dl) of reference (The Merck Veterinary Manual, 2015). This could be related to the high protein content of their feed and the small amount lost during exercise. Calles-Escandon *et al.,* (1984) indicated that protein is only a minor source of energy during light and moderate exercise. Similar findings were reported by Yang *et a*l., (1998) who indicated an increase in plasma volume in response to aerobic exercise and eventually retention of water in the vascular compartment via the colloidal osmotic pressure of proteins. Compared to the other group examined, TPR concentration was significantly ($p<0.05$) lower at UMJ (5.16 /gm/dl) and KH (6.49/ gm/dl) stables. This finding could be related to the possibility of insufficient amounts of food allowed to the horses and/or parasitic infestation accompanied with patrolling stress. Previous studies on Sawari horses of these stables (Mohammed and Mahammed, 2015) indicated different parasitic infestations which can justify for this finding.

Generally, ALB concentration in all groups was within the reference range (2.6-4.1/gm/dl (The Merck Veterinary Manual, 2015). This response could be associated with the increase in hepatic albumin synthesis due to increase in albumin gene expression in response to aerobic exercise (Nagashima *et al.*, 1999). Compared to other stables ALB concentration was significantly ($p<0.01$) higher in ALH (5.09 /gm/dl) stable. This could be associated with the lowest incidence of parasitism in these stables (Mohammed and Mahammed, 2015). Matanovic *et al*. (2007) indicated a strong relationship between nutrition and internal parasites. Parasitic infestation results in low amount of amino acids supposed to be used in the formation of ALB. However, compared to the investigated stables, ALB concentration was significantly lower ($p<0.01$) in UMJ (2.38) and UMSH (2.82) stables. This could be attributed to the high incidence of parasitism reported by (Mohammed and Mahammed, 2015) in these stable. Rumosa *et al*. (2010) reported poor body condition and low level of ALB in parasitic animals .The obtained values of UR concentration in all examined stables were higher (35.7-55.4/gm/dl) than that reported by The Merck Veterinary Manual, (2015) (11-27/gm/dl). These high values could be related to the high protein content of horses' diets and catabolism during exercise (Calles-Escandon *et al.*, 1984). However, Yoo *et al*., (2007) indicated that ammonia level was high in horses 40-60 minutes post-exercise due to deamination of Adenosine –Monophosphate (AMP). Similar findings were reported by Harris *et al.*, (1987).

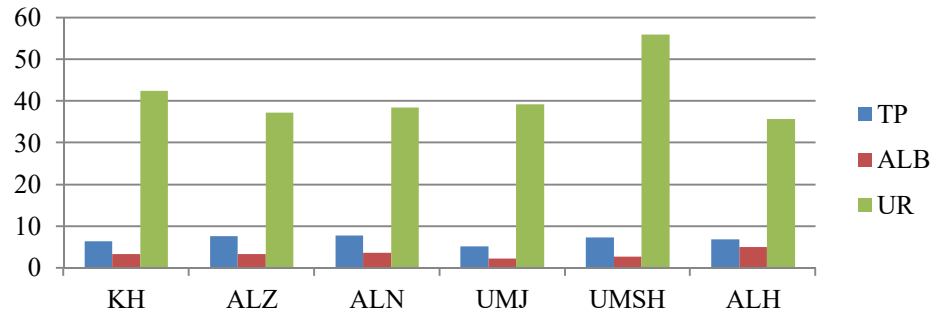


**Figure 1:** Blood metabolites of Patrolling Police horses(Sawari) in Different stables.

Figure (2) shows the values of the TLC of horses in different stables. The normal range of TLC reported by The Merck Veterinary Manual, (2015) is 5.6-12 ($X10^3$µl) and all values obtained were within the normal range. This could be related to adaptation to exercise stress. Compared to other stables, the TLC reported from ALZ stable was significantly ($p<0.01$) higher 10.48 (X103µl) and that of KH was significantly ($p<0.05$) lower, 4780 ($X10^3$µl). According to what was reported previously in these stables (Mohammed and Mahammed, 2015), the high value of TLC reported at ALZ could be related to the high incidence of brucellosis (28.5%) and that of low value at KH stable could be related to the high number of parasitic cases (Snow *et al.*, 1982). Similar findings were reported by Risøy *et al.*, (2003).

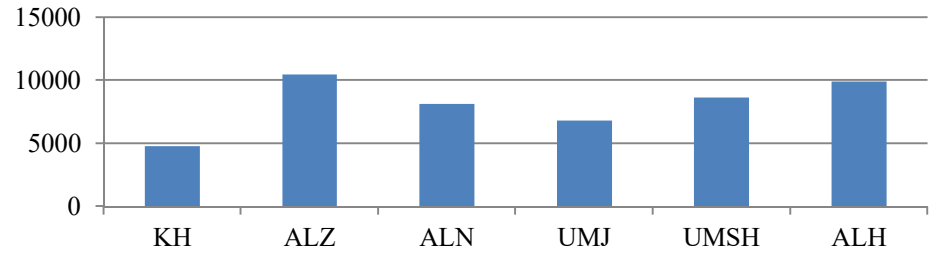


**Figure 2:** Total leukocytes count, TLC ($X10^3$µl) of Patrolling Police horses (*Sawari*) in Different stables.

Figure (3) and Figure (4) Shows the obtained values of Hb and PCV of Sawari horses in some stables which were in the normal range (10-16/g/dl) and (27-43%) respectively according to (The Merck Veterinary Manual, 2015). This response could be related to the ability of horses to increase total circulating red blood cells during exercise. Thomas and Fregin (1981) indicated that horses are able to increase their spleen contraction and eventually Hb and PCV to increase oxygen carrying capacity during exercise.

However, the different values of PCV obtained from different stables could be related to the rate of sweat loss. Snow *et al.* (1982) and Schott *et al.*, (1996)

reported that fluid deficits of 20-40 liters after rides for more than 80 Km are common. Rose *et al*., (1980) indicated electrolyte disturbance 30 minutes post-exercise occurs due to evaporative heat loss and re-hydration. However, the loss of sweat decreases post-exercise (McCutcheon and Geor, 2010).

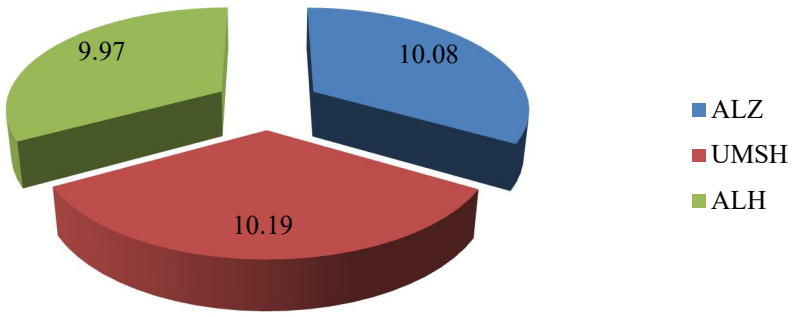


**Figure 3:** Hb (g/dl) in some patrolling police horses (*Sawari*)

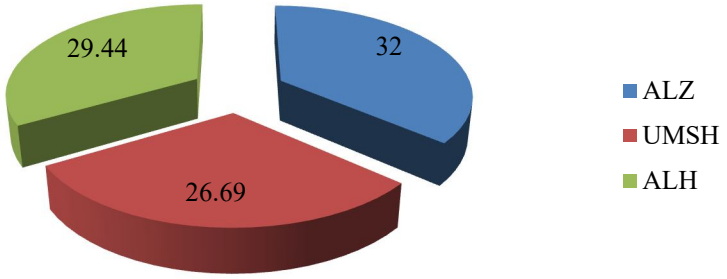


**Figure 4:** PCV% of Patrolling Police horses (*Sawari*) in Some Stable of Ommdurman

Figure (5) **s**hows the values of DLC in different investigated stables. The normal range of percentages values reported for horse's. LYM., NEU , MON, and OES. were (52-72%,21-42%,0-6% and 0-7%) respectively (The Merck Veterinary Manual, 2015). These values could be related to adaptation to exercise stress. Hoffman-Goetz and Pedersen (1994) indicated that homeostasis was maintained with daily exposure to exercise with a gradual reduction of the magnitude of stress hormone which increases immune cells release. However, compared to other stables, the percentage of LYM was significantly ($p<0.01$) higher (73%) in KH stable. This result could be attributed to the observed cases of laminitis and arthritis in addition to some cases of brucellosis and parasitism (Mohammed and Mahammed, 2015). Similar results were reported by Risøy *et al*., (2003).

The percentage of NEU. was significantly ($p<0.01$) higher (45.2%) in

UMSH stables .This increase is associated with muscular damage in response to exercise and to the effect of cortisol hormone. Rossdale and Burguez (1982) indicated neutrophilia in response to exercise stress and muscular damage (Suzuki *et al.*, 1999). Similar findings were reported by (Pizza *et al.*, 1999); and significantly ($p<0.05$) lower (19%) in KH stable, this neutropenia is related to drug induced neutropenia (DIN) .According to the records antibiotic treatment is applied extensively due to high infection in the stable. Kaufman *et al.*, (19991) indicated that DIN is a reaction that is mediated by immune or allergic and toxic mechanisms, and results in profound neutropenia .Similar findings were reported by Lee *et al.*, (2009). The percent of EOS. Was significantly ($p<0.01$) higher (8%) than the normal range (The Merck Veterinary Manual, 2015) in KH stable only. According to (Mohammed and Mahammed, 2015) horses of this stable suffered from high incidence of parasites, brucellosis and leg infection. Eosinophils have exclusive role in the defense against helminthes infections, and inflammatory reaction and regulation of immune responses (Walsh, 1999). Similar findings were report by Staumont-Sallé *et al.*, (2006).

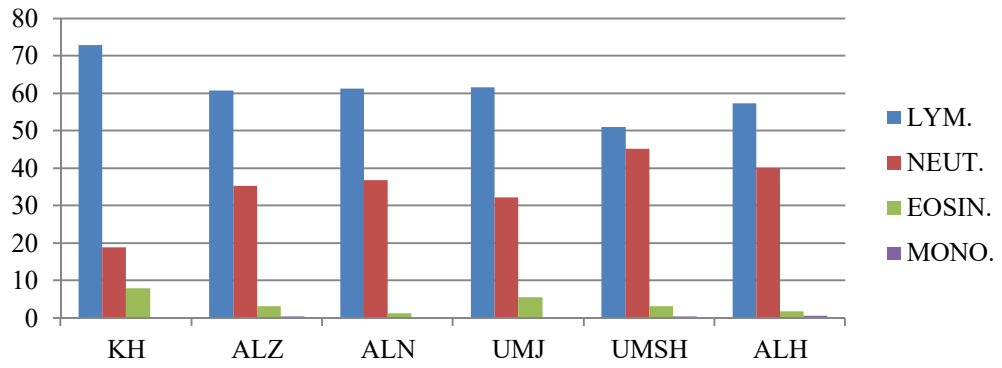


**Figure 5:** Differential Leukocytes count (%) of Patrolling Police horses (*Sawari*) in Different stables.

## CONCLUSIONS

Patrolling police horses (Sawari) have to take over different security activities, which subject them to stresses. Their welfare includes a balanced ration rich in protein and supplements to withstand any complications associated with musculoskeletal and respiratory systems. Moreover, their immune system should be protected by applying a proper hygiene measures to control various bacterial and parasitic infections. The broad spectrum treatment and over use of antibiotics adversely affect horses′ immunity. Animal welfare should be highly considered by organizing a conference.


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