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Packed Cell Volume Values of Sudanese Camels Grazing Under Open System: With Emphasis to its Importance for "*Guffar*" Management and Control

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ABSTRACT

Anaemia is regarded as the main pathological feature of trypanosomosis in man and animals. Trypanosomosis is ranked as a major threat for camel industry. In clinical diagnosis, values such as packed red cell volume (PCV), Hb concentration, RBCs counts and RBCs indices are used to measure the degree of anaemia and its morphology. However, in most instances, PCV alone is used to determine the degree of anaemia. There is a meager data on reference clinical parameters and haematological values of Sudanese animals including camels. This paper reports the PCV values of camels from three different States located in the camels zone as depicted from field surveys designed for camel trypanosomosis "Guffar" management and control in the Sudan. Moreover, the study discussed the effect of the disease on camels PCV. The PCV values of 362 examined camels from 19 areas in 10 localities from Kassala, Gadarif and West-Kordofan States were recorded. Thereafter, the range and the mean PCVs of the non-infected and the infected camels were determined. The mean PCV values of parasitologically infected camels were found to be significantly ($p=0.000$) lower than that of non-infected. Although there was no significant differences ($p=0.079$) between the three States in the prevalence of the disease, geographical variations have significant effect ($p=0.004$) on camels PCV values in this study. Based on the results of the present study as well as the difficulty of Parasitological detection and confirmation of the infection, it was concluded that PCV, can be used as clinical indicator for "Guffar" of herds at risk. This is may be helpful for strategic and effective use of trypanocides in the disease management and control. Programmed field application of this technique may also reduce the distribution of drug resistant strains of these parasites in the Country.

Keywords: Camels, Haematocrit, Trypanosomosis, Control, Sudan.

INTRODUCTION

Although anaemia is not itself pathognomonic, it remains, however, one of the most important indicators of animal trypanosomosis (Fiennes 1970; Losos and Ikede 1972; Ikede *et al.* 1977; Ismail 1988; Rahman *et al.* 1997; and Ibrahim 2006). The ability of trypanosome-infected animal to control development of anaemia is a

criterion of trypanotolerance which is measured by the PCV levels (Trail *et al*., 1992). Studies on camel haematology have been reported world-wide since (Banerjee *et al*. 1962; Lakhotia *et al*. 1964). Higgins (1986) reported the range of normal camel PCV to be 24% to 42%. Similar studies, however, on small number or in a few camel herds were conducted in the Sudan by Holler and Hassan (1966), Salaheldin *et al*. (1979) and Musa and Mukhtar (1983). The latter authors reported a mean PCV of 30.0% with a range of 25-34% from 96 Sudanese camels in Tamboul area. The effect of camel age on PCV values was recorded by Omer *et al.* (2006). They reported PCV% of 26.69±3.25 for suckling calves (<1 year) and 24.87±2.63 for weaned calves (>1 year). Seasonal variations on the haematological values of 100 camels had been reported by Nawal *et al.* (2006).

The most recent large scale report on PCV values was available in 2011 where the effect of different parasites (Trypanosomes, Haemonchus and Fasciola) and season was discussed (Ibrahim *et al.* 2011). Parasitic infections especially trypanosomosis are one of the major constraints hindering camel industry in the Sudan (Mahmoud and Gray 1980; Losos 1986; Shommein and Osman 1987; Majid 1998; Ibrahim *et al.* 2011). A prevalence of 2.04%, and 1.12% in Gedarif and Kassala were reported by Dafalla (1988). A prevalence of 2.46% was recently reported by Ibrahim *et al.* (2011).

Micro-haematocrit centrifugation technique, improved by Murray *et al.* (1977) is widely used for diagnosis of trypanosomosis. It is useful in that the PCV can be assessed at the same time of parasite detection. Demeke (2003) reported lower PCV values in camels infected with *T. evansi* in Ethiopia. Similar observations were previously recorded in the Sudan by Yagoub, (1989). The haematological studies carried out so far on the camel-in their natural pasture- in the Sudan are far from being complete. More baseline data is needed on the haematology of normal and infected camels raised under open range system.

The present paper reported the PCV values of camels raised in the natural pasture of the most important three States occupying the camel's zone in the Sudan. Then the PCV values of infected and non-infected camels with trypanosomes were assessed and the importance of using PCV for management and control of camel trypanosomosis "Guffar" in the Sudan was discussed.

MATERIALS AND METHODS

Animals and Study Area: In the present study, PCV values were recorded during a cross-sectional survey undertaken to determine the prevalence of camel trypanosomosis in three different States (Figure 1) along the camel zone in the Sudan (Figure 2).

A total of 362 Sudanese camels (*Camelus dromedarius*) were sampled. Of these, 132 head from Kassala, 186 from Gedarif and 44 head from West Kordofan were examined for presence of trypanosomes parasitologically (Murray *et al.* 1977). The owners were asked to bring all their camels for examination and treatment with Quinapyramine sulphate (Antrycide Rhone-Merieux, France) and Ivermectin injection (Panmectin®, Pantex Holland B.V.).

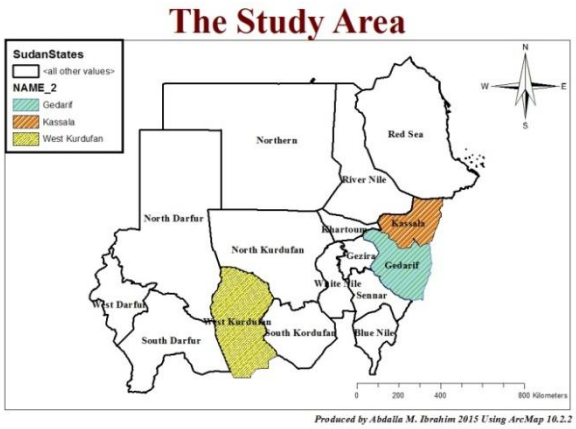

Figure 1: The study area

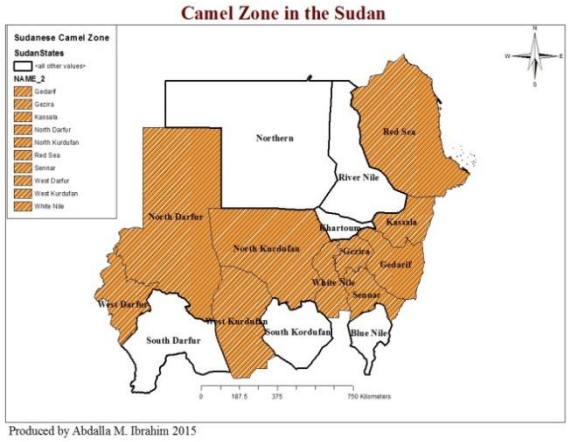

Figure 2: The camel zone in the Sudan

***Blood Samples*:** Blood samples were collected from camels using the methods of Schalm (1971). Briefly: Tow heparinised capillary tubes (7.5×1.5mm) were filled with blood (about 70µl) from camel's ear vein. The capillary tubes were then sealed at one end with "Plasticele" and centrifuged in haematocrit centrifuge (SH 120, Shanghai Surgical Instruments factory) for four minutes at 12000 revolutions per minute (rpm). The PCV was recorded using haematocrit reader (Shanghai Surgical Instruments Factory) and then the buffy coat was examined for parasites following the method of Murray *et al.* (1977). Blood smears were also made from positive animals, air-dried, fixed with methanol and stained with Giemsa's stain. These slides were later examined for parasite speciation.

Statistical analysis: All collected data were entered, coded and stored in a Microsoft® Excel spread sheet for Windows® 2007 data base. The Statistical Package for Social Sciences (SPSS) for Windows® version 17 was used for all appropriate statistical analysis. The differences were considered statistically significant when $p \leq 0.05$ and highly significant when $p \leq 0.01$.

Maps were produced using *Arc GIS version 10.2 (ESRI, Redlands, California)* to show the study area.

RESULTS

Out of 362 camels examined, 22 camels were found infected with Trypanosomes and hence constitute a prevalence rate of 6.08% in the total areas surveyed. The PCV value of the diseased camels was 17.25±2.77% with highly statistically significant (p=0.000) differences compare to the

Trypanosome-N-ve (healthy) camels which scored 23.44±3.97% (Table 1). Out of the 22 infected camels, 19 heads (86.4%) had PCV of lower than 20% ranging from 10-19%, while only three Trypanosome-P+ve camels recorded a PCV value of ≥20% (2 camels, 20% and one camel 21%).

Table 1: Prevalence of "Guffar" and the effect of the disease on the PCV values of Sudanese Camels Raised Under Open Range System

Trypanosomosis	N of Camels	Percent	Mean PCV%	±SD
Not Diseased	340	93.92	23.44	3.97
Diseased	22	6.08	17.25	2.77
Total	362	100	23.07	4.10
	P value		0.000	

As presented in the following Table (2), there was no significant variation (p=0.08) in the prevalence rate of camels trypanosomosis among the three States. Gadarif States reported the highest prevalence rate (7.53%) followed by the other two States which reported similar prevalence rate of Guffar (4.55%).

Table 2: Prevalence of "Guffar" and the effect of the disease on the PCV values of Sudanese Camels Raised Under Open Range System in the three Sudanese States

State	Trypanosomosis	N of Camels	%	Mean PCV%	±SD
	N-ve	126	95.45	24.64	4.04
Kassala	P+ve	6	4.55	16.13	3.76
	Total	132	36.5	24.25	4.42
	N-ve	172	92.47	22.8	3.59
Gadarif	P+ve	14	7.53	17.88	1.9
	Total	186	51.4	22.43	3.73
	N-ve	42	95.45	22.52	5.05
West Kordofan	P+ve	2	4.55	16.50	1.50
	Total	44	12.2	22.26	5.10
Total		362	100	23.07	4.10
P value		0.08		0.004	

The range, and the mean and standard deviation of the PCV values of the infected and non-infected camels from the different States were presented in Table (3). The non-infected camels from Kassala revealed higher PCV (24.64±4.04%) followed by Gadarif (22.8±3.59%) and West Kordofan (22.52±5.05%). The lowest PCV values of infected camels were reported from Kassala States (16.13±3.76%) followed by West Kordofan (16.50±1.50%) and Gadarif (17.88±1.90%) with highly statistically significant differences (p=0.004) among the three States.

Table 3: Descriptive PCV% Values of Sudanese Camels Raised Under Open Range System in the three Sudanese States

State	Camel PCV%					
	Trypanosome N-ve			Trypanosome P+ve		
	Min	Max	Mean±SD	Min	Max	Mean±SD
Kassala	14	35	24.64±4.04	10	19	16.13±3.76
Gadarif	16	33	22.8±3.59	15	21	17.88±1.90
West Kordofan	14	34	22.52±5.05	15	18	16.50±1.50
Total	14	35	23.44±3.97	10	21	17.48±2.40
p value			0.004			

DISCUSSION

The overall prevalence rate of "Guffar" in the present study was 6.08% in the three geographically different areas surveyed. This result was higher than that (2.46%) we reported before (Ibrahim *et al.,* 2011). That is just because of the fewer number of camels of few states investigated in the present work compare to the previous one (Ibrahim *et al.*, 2011). Moreover, most of the areas surveyed in the present study were neglected from veterinary services particularly trypanocidal drugs. Gadarif State showed higher prevalence rate compared to the other investigated States. This may be only due to the higher number of camels examined in the area as well as the high density of biting flies in the Gadarif State. Lower prevalence of 2.04% and 1.12% were reported in Gedarif and Kassala respectively (Dafalla 1988).

The range of PCV of healthy camel recorded in this study was found to be within the ranges reported by several authors such as Salaheldin *et al.* (1979), Musa and Mukhtar (1983), Higgins (1986), Majid, *et al*. (2002) and Omer *et al*. (2006). However, the mean PCV of the non-infected camels in our study was found to be lower than that reported by Salaheldin *et al*. (1979). This may be because of the incomparable number of camels that we sampled from different geographic areas. Additionally, their camels were housed in experimental shade and given food and water *ad lib*. In contrast, the present data were collected from camels in their natural habitat.

Studies on erythrokinetics and ferrokinetics have shown that anaemia and its underlying process broadly dependent on the number of trypanosomes in the blood. Anaemia is primarily due to the excessive haemolysis in addition to the increased erythrocyte fragility of the infected animals (Ikede *et al.*, 1977; Ismail *et al.*, 1985; Ismail 1988 and Ibrahim 2006). In the present study, anaemia as measured by PCV value was found to be a reliable indicator for camel trypanosomosis. The PCV of the infected camels was significantly ($p<0.01$) lower than the non-infected animals. Similar observations were recorded by Yagoub (1989), Ibrahim *et al.* (2011) and Demeke (2003) in the Sudan and in Ethiopia respectively. PCV values of both infected and non-infected camels were found not affected by seasonal variation (Nawal *et al.*, 2006; Ibrahim *et al.*, 2011). About 86.4% of the trypanosomes infected camels recorded PCV of lower than 20%. This result is higher than our previous observation (Ibrahim *et al.*, 2011). Mohamed *et al.*, (2006) reported a decrease of PCV values post experimental infection with *T. evansi* in Sudanese camels. They also mentioned that the PCV values increased post treatment. A warning was foreseeable the moment diminishing PCV values reached 23% in cattle (Mbwambo *et al.*, 2007). Effective treatment at this stage of PCV will help the animal to maintain productivity. Close follow-up of the trend of PCV, level of parasitaemia and productivity will allow for strategic and effective use of trypanocides in trypanosomosis control (Mbwambo *et al.*, 2007). They also use PCV values of less than 25% as indicator to improve the sensitivity of mouse inoculation technique. Ismail *et al.* (1985) used a PCV of 15% as the life expectancy in cattle experimentally infected with *T. congolense* or *T. vivax.* It worth mentioning that, PCV values in the low range of (14% - 19%) rarely reported in this study from camels that trypanosome was not detected in their blood. This may be due to the continuous haemolysis observed

following trypanosome infection even when trypanosomes are eliminated (Ikede *et al.*, 1977). Possible association of helminthes infection with the low PCV in camels was also reported in Sudanese camels (Yagoub 1989 and Ibrahim *et al.* 2011).

From the results of this study we concluded that PCV is significantly integrated with the parasitological findings of camel trypanosomosis. Thus because the disease is a herd problem in addition to the unfriendly environment of camels and the neglected veterinary services, as well as the difficulty of microscopical demonstration of the parasite, the PCV profile can be used to indicate differences in disease challenge (Trypanotolerant) or treatment response. The study recommended PCV values of ≤20% to be used as indicator for decision making on trypanocidal drug intervention even when parasite was not demonstrated from camels at risk. This would be helpful for the disease management and control in herds at risk.

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