Changes in blood and physio-clinical indices of West African Dwarf goat during road transport

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Abstract

The study was carried out to determine the effect of road transportation on some blood and physioclinical indices in West African Dwarf (WAD) goats. Nineteen (19) WAD goats aged between 6 and 8 months weighing between 4.16Kg and 5.90Kg were transported in a wagon for 3 hours 18 minutes. Collection of data on rectal temperature (RT) and heart rate (HR), and blood sampling were carried out just before loading the animals into the wagon and repeated immediately on arrival at the destination. The blood samples were analyzed for packed cell volume (PCV), haemoglobin concentration (HB), red blood cell (RBC), white blood cell (WBC), neutrophil (NEU), lymphocyte (LYM), eosinophil (EOS), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin (MCH) and mean corpuscular volume (MCV). Serum alkaline phosphatase (ALP), aminotransferase (AST) and alanine transaminase (ALT) concentrations were also determined. Except the reduced ($P < 0.05$) haemoglobin (Hb) after transportation, the results showed that haematological parameters and pulse rate were comparable before departure and on arrival ($P > 0.05$). Rectal temperature was however slightly higher ($P < 0.05$) on arrival compared to departure in mixed sex and male goats. Serum AST, ALT and ALP were higher ($P < 0.05$) before transportation compared to the values obtained on arrival. The findings showed no remarkable influence of transport by road on the haematological parameters and pulse rate of WAD goats except reduced HB, serum AST, ALT and ALP and increased rectal temperature observed after transportation.

Keywords: goats, physiological parameters, stress, transport

Introduction

It has been reported that in different parts of Nigeria the domestic animals are kept and managed in harsh environments and such animals suffer prolonged drought and some other ecological catastrophes (Baker and Rege, 1994; Adeloye and Daramola, 2004). Notable are inadequate nutrition, poor housing, inadequate management, poor infrastructure, poor transport facilities and bad road conditions. The animals that are managed in these states loose condition due

to stress and often fail to perform. Physiological changes do occur when animals are stressed but paramount and fundamental are loss of form (weight), loss of performance (production) and loss of life (death) (Adeloye and Daramola, 2004). Notwithstanding, the WAD goat is hardy and thrives in harsh conditions of management (Adeloye, 1998) and this is made possible because of the innate adaptogenic power of the animal to react to a particular quantum stressors (Adeloye

and Daramola, 2004).

Road transport of livestock is a complex process that encompasses human and animal behaviour during assembling, loading, confinement, motion, unloading and penning. Handling and transportation of animals impacts their welfare (Smidt, 1983; Grandin, 1997). Physiological responses have been used to measure animal welfare during transportation in goat (Kannan *et al.*, 2000; Aoyama *et al.* 2003). Stressors can be identified from measurement of specific physiological parameters induced during or immediately after a stressor. In Nigeria, WAD goats are frequently transported from owners to market or from market to slaughter house mainly by commercial vehicles. To the best of our knowledge, no previous report has shown the blood and physioclinical indices. Haematological indices of animals may give some insight into the health status of West African Dwarf goats (Taiwo and Ogunsanmi, 2003) as stress and transportation are known to affect haematological and biochemical parameters (Balikei *et al.*, 2007). of WAD goats in transit. This study was therefore carried out to determine the physiological responses of WAD goats to transport on a road covering a distance of 102km in about 3 hours 18minutes from market to research farm.

Materials and Methods

The study was carried out on 19 WAD goats (15 females and 4 males) at Owode market (point of departure) in Oyo, Oyo State (The area has a tropical humid climate (3° E 7° N) with mean annual rainfall of 1415 mm and the average daily temperature between 28 and 35°C and Animal Production Pavilion of the Department of Animal Production, University of Ilorin, Nigeria (point of arrival) located in sub humid tropical

environment (14° N 11° E) with an annual rainfall range of 1500-1700 mm and average maximum and minimum temperature readings of 18°C and 25° C respectively. A Peugeot 504 station wagon was used and the goats loaded in the booth. Transporting started at 11.35h and ended at 02.53h when the ambient temperature was at its peak. The delay between loading and departure was about 30mins during which time the blood was collected and rectal temperature and pulse rate were taken. The animals did not have access to food and water during the study period. Collection of blood and rectal temperature and pulse rate were taken again immediately on arrival at Animal Pavilion.

The goats were bled before departure and on arrival through jugular vein and 10ml of blood collected. 3ml of the blood sample was collected into plastic tube containing EDTA for haematological studies. The remaining 7ml of blood sample was deposited in anticoagulant free plastic tube and allowed to clot at room temperature. The serum samples were stored at -20°C for biochemical studies. Total erythrocytes counts and total leukocyte counts were determined with the aid of Neubaur counting chamber (Haemocytometer) and Haemoglobin (Hb) concentration was determined by Sahl's (acid haematin) method (Benjamin, 1978). Mean Corpuscular Haemoglobin Concentration (MCHC), mean corpuscular haemoglobin (MCH), mean corpuscular volume (MCV) and Haemoglobin/Lymphocyte(N/L) were calculated (Jain, 1986). Serum Aspartate Transaminase (AST), Serum alanine Transaminase (ALT) and Alkaline Phosphatase (ALP) were analysed spectrophotometrically by using commercially available diagnostic kits (RANDOX® Test Kits). The rectal temperature of each animal was taken by

inserting the bulb of clinical thermometer into the rectum for 1 minute before reading. Stethoscope was placed near the fore limbs close to the heart to measure the pulsation or sound of the heart produced per minute for the determination of Pulse rate (PR).

Statistical analysis

The data collected were subjected to one-way analysis of variance using the procedure of SAS (1999). Significantly different means were compared using Duncan Multiple Range Test.

Results

The Means ($\pm$ SE) rectal temperature, pulse rate and blood indices of mixed sex, male and female WAD goats prior to and after road transportation are presented in Table 1, 2 and 3. The results showed that packed cell volume (PCV), total white blood cell (WBC), Red Blood Cell (RBC), total leukocyte and erythrocyte counts and pulse rate were comparable ($P>0.05$) on departure and arrival. The results showed reduced ($P<0.05$) haemoglobin (HB) after

transportation. Rectal temperature value was however slightly higher on arrival compared ($P<0.05$) to departure in mixed sex and male goats. However, serum AST, ALT and ALP were higher ($P<0.05$) before transportation compared to the values obtained on arrival before transportation and arrival.

Discussion

Pulse rate is one of the most widely used acute stress indicators (Broom and Johnson, 1993) and is considered to be an objective way of assessing the autonomic nervous response to psychological stressors. The sustained pulse rate observed during transportation contradicted results obtained by Horalek and Jones (1993) in red deer who attributed the increase to the movement of vehicle. The Pulse rate obtained in this study fell within the normal value (70-90bpm) for goats and show that the animals were able to cope with stress associated with transportation.

The increase in rectal temperature observed from departure to arrival in this study fell

Table 1: Means ($\pm$ SE) physioclinical and blood indices of mixed sex goats before and after road transportation

	Before departure	On arrival	SEM
Parameter			
RT ($^{\circ}$ C)	39.33 ^b	39.78 ^a	0.119
PR (beat/min)	79.07	81.17	1.542
PCV (%)	23.95	21.98	0.977
HB (g/dL)	8.21 ^a	7.06 ^b	0.382
RBC ($\times 10^6/\mu$ l)	3.69	3.35	0.294
WBC ($\times 10^3/\mu$ l)	7.10	6.68	0.528
NEU I (%)	31.47	34.50	2.342
LYM (%)	67.01	64.85	2.298
EOS (%)	2.22	1.42	0.692
ALP (IU/litre)	53.88 ^a	46.17 ^b	5.172
AST (IU/litre)	27.60 ^a	21.8 ^b	1.756
ALT (IU/litre)	14.22 ^a	8.73 ^b	1.347
MCV (fl)	66.22	66.89	1.85
MCH (pg)	22.97	21.60	0.67
MCHC (g/%)	34.73	32.44	0.64
N/L	0.66	0.67	0.02

^{a,b} Means with different superscripts in the same row differ significantly ($P<0.05$)

Table 2: Means ($\pm$ SE) physioclinical and blood indices of male goats before and after road transportation

Parameter	Before departure	On arrival	SEM
RT ($^{\circ}$ C)	39.03 ^b	39.75 ^a	0.272
PR (beat/min)	80.00	81.00	2.121
PCV (%)	22.50	20.75	1.350
HB (g/dL)	7.53 ^a	6.60 ^b	0.468
RBC ($\times 10^6/\mu$ l)	3.28	3.23	0.095
WBC ($\times 10^3/\mu$ l)	7.48	6.75	1.341
NEU (%)	33.00	35.00	3.973
LYM (%)	65.75	64.50	4.030
EOS (%)	2.00	1.00	0.707
ALP (IU/litre)	55.50 ^a	40.00 ^b	7.700
AST (IU/litre)	28.00 ^a	20.00 ^b	3.416
ALT (IU/litre)	14.50 ^a	8.00 ^b	3.102
MCV (fl)	68.48	70.98	3.280
MCH (pg)	22.88	21.83	0.930
MCHC (g/%)	33.37	30.92	0.623
N/L	0.52	0.56	0.070

^{a,b}Means with different superscripts in the same row differ significantly ($P < 0.05$)

within the range value obtained for WAD (Otoikhian, 2009). The increase could be attributed to the physiological mechanism of panting that serves as the control mechanism for keeping the body heat production associated with heat stress during transportation. The PCV on

departure and arrival fell within the normal value reported for WAD goats (Daramola *et al.*, 2005). Although PCV varies from breed to breed (Tambuwal *et al.*, 2002), Rusoff *et al.* (1954), Bianca (1955), Isidahomen (2010) and Patterson *et al.* (1960) attributed increase in PCV values in cattle to increase

Table 3: Means ($\pm$ SE) physioclinical and blood indices of female goats before and after road transportation

Parameter	Before departure	On arrival	SEM
RT ($^{\circ}$ C)	39.64	39.80	0.101
PR (beat/min)	78.13	81.33	1.474
PCV (%)	25.40	23.20	0.934
HB (g/dL)	8.90 ^a	7.51 ^b	0.370
RBC ($\times 10^6/\mu$ l)	4.10	3.47	0.296
WBC ($\times 10^3/\mu$ l)	6.72	6.61	0.427
NEU (%)	29.93	34.00	2.173
LYM (%)	68.27	65.20	2.114
EOS (%)	2.44	1.83	0.692
ALP (IU/litre)	52.27	52.33	4.896
AST (IU/litre)	27.20 ^a	23.67 ^b	1.576
ALT (IU/litre)	13.93 ^a	9.467 ^b	1.143
MCV (fl)	66.51	65.02	2.17
MCH (pg)	22.99	21.54	0.81
MCHC (g/%)	35.09	32.85	0.78
N/L	0.46	0.55	0.04

^{a,b}Means with different superscripts in the same row differ significantly ($P < 0.05$)

in environmental temperature. The sustained value of PCV obtained in this study in spite of period of transportation when the ambient temperature was at its peak could possibly be due to the tendency for compensatory accelerated production (CAP) of PCV by WAD goats during stress. Compensatory accelerated production of PCV has been shown to return PCV to normal following stress (Dargie and Allonby, 1975; Daramola *et al.*, 2005). In goats, like other ruminants there are more lymphocytes than neutrophils in circulation (Olusanya *et al.*, 1976). However, the values obtained in this study fell within the broad range recorded for Red Sokoto goats (Tambuwal *et al.*, 2002) cattle, (Benjamin, 1978; Schalm *et al.*, 1975) and WAD goats (Daramola *et al.*, 2005) suggestive of well develop immune system of the WAD goats with such number of immune cells to proffer good health and physiological basis for the adaptation of this species to this eco-zone characterised with high temperature. Of particular importance in evaluating prolonged effects of transportation stress are the numbers of leukocytes, including neutrophils, lymphocytes and eosinophils. In this study, these parameters were similar indicating that the animals were able to cope with the stress associated with road transportation. In contrast, decreased lymphocyte percentage and increased neutrophils percentage was reported due to transportation stress in cattle (Kent and Ewbank, 1983). In addition, there was no significant change in the percentages of eosinophils due to transportation in the present study. Contrary to earlier reports (Schaefer *et al.*, 1997; Kegley *et al.*, 1997) of an increase in N: L ratio with transportation stress in cattle, the sustained N:L ratio obtained in this study was in agreement with Nwe *et al.* (1996) who also

noted that eosinophil counts returned to baseline levels after the end of transportation.

The reduced haemoglobin concentration obtained after transportation were however within the range of values obtained for WAD goats (Daramola *et al.*, 2005). The RBC value in this study is low to value earlier reported for WAD goats (Daramola *et al.*, 2005). The reason for this is not clear, but high RBC in ruminants is associated among other things with excitement or strenuous exercise during handling (Gartner *et al.*, 1969). As a result, there is a release of adrenaline and hence spleen contracts and this causes the release of more RBC into circulation. The RBC obtained in this study indicate that the animals were able to cope with transportation stress.

In conclusion, the findings did not indicate remarkable influence of transport by road on the haematological parameters and pulse rate of WAD goats except reduced HB, serum AST, ALT and ALP and increased rectal temperature observed after transportation.

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