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Effect of short distance travel on haematology, physiological and behavioural changes of sheep transported in the savanna area of Northern Nigeria

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Abstract

*Transportation is one of the stressful events in an animal's life. Stress and injuries have been known to be associated with transportation especially short distance travels. This study was designed to evaluate the effect of short distance road transport stress on some Physiological and Hematological parameters in three breeds of sheep (Yankasa, Balami and Sudanese Fat tail) in Bauchi State, Nigeria. Twenty two physically healthy adult sheep (Rams 11 ewes11, Yankasa and Balami, four each of rams and ewe were selected while three each for Sudanese fat tail) age 1.4-1.5 years old were transported from Hardawa (Misau LGA) to Bauchi covering a distance of 217 km for up to 3hr during the dry season. Physiological parameters (Rectal temperatures (RT), respiratory rates (RR), pulse rates (PR) and body weights (BW)) and Hematological parameters (*Packed cell volume (PCV), White Blood Cell (WBC) Mean cell haemoglobin volume *Red blood cell (RBC) and Mean Cell Haemoglobin (MCH)) were evaluated just before the start of the journey (0 Hr) and on arrival at the destination. Rectal temperatures (RT), respiratory rates (RR), pulse rates (PR) and body weights (BW) were measured before and after transportation using standard procedures. Behavioral changes and external injuries were also observed. The result showed a significant (P<0.01) increase in RT (in all the three breeds) and PR (in Balami and Sudanese fat tail) however, there was a decrease of BW, in Yankasa and Sudanese fat tail sheep. Significant (P<0.05) increase was observed in Red blood cell count (RBC) and Mean Cell Haemoglobin (MCH) in Balami breeds. In the fat tail Sudanese, there were significant (P<0.05) increase in Lymphocytes while decrease in Neutrophils(P<0.05) was observed. Glucose and ALP (*Alkaline phosphatase*) level significantly (P<0.05) increased in Balami and Fat tail Sudanese. Freeze, back-off, escape attempt, vocalization, kicking was observed among the breeds during transportation. In conclusion, apart from Body Weight loss (BW), short distance transportation and shorter duration has little deleterious effect on welfare of sheep in the study area.*

Keywords: Animal welfare, Body Temperature, Body weight, Hematology, Sheep, Transportation

Effet des déplacements à courte distance sur l'hématologie, les changements physiologiques et comportementaux des moutons transportés dans la zone de savane du nord du Nigéria

Resume

Le transport est l'un des événements stressants de la vie d'un animal. Le stress et les blessures sont connus pour être associés au transport, en particulier aux déplacements sur de courtes distances. Cette étude a été conçue pour évaluer l'effet du stress du transport routier à courte distance sur certains paramètres physiologiques et hématologiques chez trois races de moutons (Yankasa, Balami et Sudanese Fat Tail) dans l'État de Bauchi, au Nigéria. Vingt-deux moutons adultes physiquement sains (Béliers 11 brebis 11, Yankasa et Balami, quatre de chacun des béliers et des brebis ont été sélectionnés tandis que trois chacun pour la queue grasse soudanaise) âgés de 1,4 à 1,5 ans ont été transportés de Hardawa (Misau LGA) à Bauchi couvrant une distance de 217 km pour un maximum de 3 heures pendant la saison sèche. Paramètres physiologiques (températures rectales (TR), fréquences respiratoires (FR), pouls (PR) et poids corporels (PC)) et paramètres hématologiques (hématocrite (PCV), globules blancs (GB), volume moyen d'hémoglobine des cellules Sang rouge (CSR) et moyen d'hémoglobine des cellules (MHC)) ont été évalués juste avant le début du voyage (0 Hr) et à l'arrivée à destination. Les températures rectales (TR), les fréquences

respiratoires (FR), les pouls (PR) et les poids corporels (PC) ont été mesurés avant et après le transport en utilisant des procédures standard. Des changements de comportement et des blessures externes ont également été observés. Le résultat a montré une augmentation significative (P <0,01) de TR (dans les trois races) et de PR (chez Balami et la queue grasse soudanaise) cependant, il y a eu une diminution de PC, chez les moutons Yankasa et la queue grasse soudanaise. Une augmentation significative (P <0,05) a été observée dans le nombre de globules rouges (CSR) et l'hémoglobine cellulaire moyenne (HCM) chez les races Balami. Chez les Soudanais à queue grasse, il y a eu une augmentation significative (P <0,05) des lymphocytes tandis qu'une diminution des neutrophiles (P <0,05) a été observée. Les niveaux de glucose et d'ALP (phosphatase alcaline) ont augmenté de manière significative (P <0,05) chez les Balami et les Soudanais à queue grasse. Des blocages, des reculs, des tentatives d'évasion, des vocalisations, des coups de pied ont été observés parmi les races pendant le transport. En conclusion, à part la perte de poids corporel (PC), le transport à courte distance et de plus courte durée a peu d'effet délétère sur le bien-être des moutons dans la zone d'étude.

Mots-clés : Bien-être d'animal, Température corporelle, Poids corporel, Hématologie, Ovins, Transport

Introduction

Transportation of livestock is a stressful and many a times injurious stage in the chain of operations between farm and slaughterhouse. Road transportation represents a critical phase in animal production and utilization and it is often considered as one of the main causes of stress, adversely affecting production both in economic and animal welfare terms (Broom, 2003). It has been shown that transportation contributes significantly to poor animal welfare, loss of production and poor meat quality (Knowles *et al*, 1999). Live sheep are frequently transported on short and long journeys in Nigeria mostly from the North to the South. The transporters frequently either ignore or are not aware of legislation of animal welfare. Animals are not given rest, food and water as required during transport. Sheep are regularly transported in overcrowded trucks, pickups and other vehicles with insufficient ventilation (Sanusi*et al*. 2016). Poor transportation can have serious deleterious effects on the welfare of livestock and can lead to significant loss of quality and production. When animals are transported on land, a competently operated and suitably designed vehicle should be used (Minca and Ayo, 2010). At all times, sheep must be handled to prevent injury and minimizes stress. These principles apply to all journeys involving sheep. A number of factors must be taken into account during the journey in order that the animals do not suffer, become injured or die. When these conditions are not provided, animals attempt to cope with the environment and include both the extent of failure to cope and the ease or difficulty in coping (Broom, 1986). In short distance transport, the coping strategies include changes in physiological parameters, pain, fear and various forms of pleasure – are components of the mechanisms for attempting to cope. Broom (2005) reported that where an individual is failing to cope with a problem, it is said to be stressed. Consequently, the present study was undertaken to establish the base line values for selected physiological and hematology values in three breeds of sheep as influenced by road transportation in the Savanna area of northern Nigeria.

Materials andmethods

Study Area

The research was conducted in Bauchi state which occupies a total land area of 49,299.01sq km representing about 5.3% total land mass of Nigeria. Bauchi is located between latitudes 9^0 3′ and 12^0 3′ north of the Equator and longitudes 8^0 50′ and 11^0 East (BSGD, 2007). The sheep were transported over a distance of about 217km; from a village near Hardawa in Misau Local Government Area (LGA) to Abubakar Tafawa Balewa University (ATBU) farm at Gubi Bauchi for a period of about 3h 15min.

A total of 22 (11 male and 11 female) adult sheep were purposive selected for the study. The average age of the sheep was 1.4 to 1.5 years old; the breeds of sheep transported were Yankasa, Balami and Sudanese fat tail. For the Yankasa and Balami, four each of rams and ewe were selected while three each for Sudanese fat tail. All the sheep were

purchased from Hardawa and surrounding livestock markets. Before purchase, the sheep were physically examined by a veterinarian, and were kept for two weeks to acclimatized before they were transported. Groundnut haulms and wheat offal were fed *ad libitum*. Also, they had access to clean drinking water *ad libitum*. At the end of the two weeks, all the sheep were fasted for 15hr before the commencement of the journey. Animals were loaded manually to a Toyota Pick-up van (V6 Japan) with total floor area of 5.07m^2 (average Stocking density of 0.21m^2/head). The floor of the vehicle was covered with straw (to avoid slipping and to absorb faeces and urine during transit). The sheep were transported from 1.00 to 4.15pm in open air without feed and water available during the transportation period atmospheric temperature ranged between 38°C and 40°C, and the average humidity was 20%. At the end of the journey, all the sheep were unloaded and weighed, Also the physiological and heamatological parameters was collected as before transit.

Before the start and at the end of the journey the physiological parameters such as the rectal temperature (RT), Respiratory Rate (RR), Pulse Rate (PR) and Body Weight (BW) were noted and recorded using conventional techniques. The rectal temperature was determined by a digital thermometer (Hangzhou Sejoy Electronic & Instruments Co., China) place in the rectum for 2-3 minute and the temperature measured in degrees centigrade. The respiratory rate was obtained using a Littman Stethoscope (Healthcare, U.S.A) and monitoring nasal air currents with a piece of cotton wool used. The pulse rates were determined by finger occluded on the femoral artery and the number of beats/pulsations per minute was documented for each animal. The body weight was determined by a calibrated weighing scale (Camry weighing scale)**.**

Blood sampling

Prior to blood collection, the animals were manually restrained by trained personnel to reduce struggling, which could result into stress and injury. Blood samples was collected through the jugular vein using 10mL disposable syringe (Green safe syringe, Wuxi Yushou medical appliance) into two bottles, one with anticoagulant EDTA (5ml, test tubes, non-vacuum, skytec medical) and the other plain tubes without anticoagulant (5mls, test tubes non vacuum, skytec medical). Blood samples were collected between 9.00am and 11.30am immediately before loading. Loading took place between 12.00 and 12.45noon. The journey began at 1.00pm and ended at 4.15pm. On arrival at the destination, unloading of the sheep was done within 30 minutes. At this point, the final blood samples were collected between 4.45pm and 6.00pm. Blood samples collected were placed in an ice bath and taken to the National Veterinary Research Institute Vom, Plateau state (Bauchi Outreach) for laboratory analysis.

Haematological analysis done including; Packed cell volume (PCV) using (Hawksley and sons heamatocrit centrifuge and reader), total white blood cell count (WBC) using (Turks fluid as reagent and new improved neubaeur counting chamber, Nikon type 104 microscope), red blood cell count (RBC) using formal saline as reagent and same equipment as for WBC., Haemoglobin concentration (Hb) using drabskin solution as reagent and Jenway 6400 spectrophotometer, Mean cell volume (MCV), Mean cell haemoglobin (MCH), Mean cell haemoglobin volume (MCHV), Neutrophil (N), Lymphocyte (L), Monocyte (M), Eosinophil (E) and Basophil (B).

The serum was obtained by allowing the blood to clot at room temperature, centrifuged. Serum samples were stored at required temperature until used. Serum was analyzed using Colorimetric method for: Alinine aminotransferase (ALT), Aspartate aminotransferase (AAT), Alkaline phosphatase (ALP), Creatine (C), Urea (U), Glucose (G) using HettichZentrifugen RPM 6000 (Germany) TttLingen, Spectrophotometer (JENWAY 6310 UK Bibby scientific Ltd).

Behavioral activities such as attempt to escape, noise making. lying down, aggression, elimination e.t.c were observed by the help of two assistants (care giver) who occupied the front and the back of the van during transit.

Data obtained were analyzed using descriptive statistic, mean values and standard errors were calculated and the results were tested statistically using t- test and One- way Analysis of variance (ANOVA) were used to assess differences between means of the parameters using SPSS 20.

Results and Discussion

Table 1 shows the comparatives effect of transportation stress on some physiological parameters (temperature, heart rate, respiratory rate and body weight) in sheep transported from Hardawa to Bauchi. The three breeds responded differently with significant ($P < 0.05$) changes

observed on Body Temperature and Body weight in Yankasa and Sudanese. Apart from Sudanese breed no significant difference (P> 0.05) was observed in HR while in all the breeds RR remained stable.

Physiological parameters of sheep observed in this study shows response to transportation stress differently in the three breeds transported. At the end of the journey, higher values were recorded for body temperature in all the breed of sheep. This result is consistent with the findings of Appleby*et al.* (2008) who reported that when the animals were loaded into a vehicle and transported for 2.5h, their body temperatures increased by about 1^0C and in males by 0.5^0C. Prolonged increase in body temperature is considered as indicator of poor welfare. In the present study, there were no significant increases in heart rate in the three breeds of sheep after the 3.15h road transportation, this is probably due to the fact that the distance travelled were relatively short as compared to animals that were transported for longer hours. It could also be that the journey is less stressful and that the sheep were calm in transit with minimal distress. However, this finding is at variance with that of Ioana*, et al.,* 2004 and Androne, *et al*., 2008 who observed increases in HR of sheep only after 7hrs of transportation. Appleby *et al*. (2008) reported that increase in heart rate in most farm animals is associated with disturbing situations. Therefore, heart rate increase is not just a consequence of increased activity; heart rate can also be an increase in preparation for an expected future flight response.

The increases observed in both RR in all the breeds of sheep after transportation, was not enough to show any significant difference, this could mean that, the time, duration and possibly the condition of transportation during the study might be less stressful or probably the sheep were able to maintain stability within a short time of travel. Biobaku, (2014) reported that short trekking and medium distance road transport have no significant effect on respiratory and pulse rates in animals.

Body Weight were significantly affected after transportation of Yankasa and Sudanese fat tail sheep ($p<0.05$) however,it was not significant for Balami ($p>0.05$). The non-significant effect of BW in Balami could be that the breed is more rugged than the Yankasa and the Sudanese fat tail. Animals lose weight in transit mostly as a result of stress. BW (11.35% and 10.55%). The results observed in this study is at variance with the findings of Esterina (2011) who reported that there were no significant differences in BW loss after sheep were transported for 125km by road for 3hr. However, Ritter *et al*., (2009) and Adenkola*et al*., (2009a) reported that road transportation of livestock results in live-weight loss.

Table 1: Comparatives effect on physiological parameters of Sheep transportation from Hardawa to Bauchi.

Parameters	Breed	N	Mean ± SD		p-Value	Remarks
			Before	After		
Body Temperature (^{o}C)	Yankasa	8	38.38±0.53	39.69 ± 0.75	0.001	**
	Balami	8	39.25±0.56	40.42 ± 0.60	0.052	NS
	Sudanese	6	39.62±0.63	40.58 ± 0.52	0.004	**
HR beat/min	Yankasa	8	92.25±16.06	80.50 ± 4.50	0.053	NS
	Balami	8	117.75±28.47	69.25 ± 7.26	0.275	NS
	Sudanese	6	132.00±17.28	94.00 ± 9.52	0.027	*
RR breath/min	Yankasa	8	73.65±12.99	68.00 ± 16.28	0.575	NS
	Balami	8	49.75±13.26	52.12 ± 24.73	0.762	NS
	Sudanese	6	62.00±5.16	75.00± 8.25	0.051	NS
BW(Kg)	Yankasa	8	25.38±2.77	22.50 ± 2.56	0.003	**
	Balami	8	28.25±5.06	20.38 ± 8.86	0.102	NS
	Sudanese	6	49.75±10.66	44.50 ± 10.66	0.001	**

BW = Body Weight. NS = not significant, **= levels of significance. HR= Heart Rate. RR= Respiratory Rate
N=Number of Animal

Shows in Table 2 are the haematological parameters of sheep transportation from Hardawa to Bauchi. The result showed that there was no significant difference (P>0.05) in the PVC, WBC and HB obtained for all the breeds of sheep transported during the study. However, there was

significant difference (P<0.05) in the RBC for only the Balami while Yankasa and Sudanese were not significant. Therefore, haematological parameters obtained for sheep transported in this study did not show tangible changes in the breeds of sheep after transportation, although there is a slight difference in values within the breeds.

The haematological parameters in this study responded differently to transport stress in all the breeds of sheep transported. In Yankasa breed, the values studied showed no significant variations after the journey. This finding is in line with that of Ioana*et al.* (2004) who reported that the haematological responses of experimental animals transported, were not significant (P>0.05). In the current study, the RBC and MCH values were significantly affected (P<0.05) in Balami RBC before transport was 6.50 ± 0.96 and after was 8.01 ± 1.20 (the value increased) and MCH before transport was 15.03 and after was 13.04 (the value decreased), also the enzymes (ALP) were significantly (P<0.05) in Balami sheep while for Sudanese fat tail sheep Neutrophil (NEU) and lymphocytes (LYM) and Glucose were significantly (P<0.05) affected after transportation.

Table 2: Haematological parameters of sheep transportation from Hardawa to Bauchi

Parameters	Breed	Mean ± SD		p-Value	Remarks
		Before	After		
	Yankasa	26.62 ± 5.55	27.29 ± 5.22	0.905	NS
PCV (%)	Balami	30.57 ± 1.99	30.12 ± 2.10	0.681	NS
	Sudanese	32.33 ± 3.33	34.33 ± 5.35	0.455	NS
RBC × ×10^6/µL	Yankasa	5.89 ± 2.06	5.79 ± 2.09	0.926	NS
	Balami	6.50 ± 0.96	8.01 ± 1.20	0.017	*
	Sudanese	6.78 ±1.71	8.47 ± 1.33	0.086	NS
WBC ×10^3/µL	Yankasa	5.80 ± 0.94	5.86 ± 1.64	0.934	NS
	Balami	6.29±1.55	5.56 ± 1.61	0.664	NS
	Sudanese	6.52 ± 1.94	5.00 ± 1.46	0.157	NS
HB g/dL	Yankasa	8.98 ± 1.80	8.97 ± 1.74	0.997	NS
	Balami	10.20 ± 0.64	9.80 ± 0.65	0.253	NS
	Sudanese	10.33 ± 1.45	10.62 ± 2.40	0.81	NS
MCH *pg*	Yankasa	18.42 ± 4.66	15.60 ± 5.50	0.255	NS
	Balami	15.03 ± 1.96	13.04 ± 1.39	0.044	*
	Sudanese	16.35 ± 7.56	13.02 ± 2.15	0.323	NS
MCV (*fl*)	Yankasa	51.00 ± 14.81	51.63 ± 15.11	0.936	NS
	Balami	39.20 ± 4.42	40.80 ± 15.54	0.794	NS
	Sudanese	50.50 ± 21.77	42.08 ± 5.22	0.379	NS
MCHC (g/dL)	Yankasa	0.32 ± 0.01	0.33 ± 0.01	0.838	NS
	Balami	0.33 ± 0.02	0.32 ± 0.01	0.805	NS
	Sudanese	0.32 ± 0.03	0.33 ± 0.01	0.284	NS
NEU (g/L)	Yankasa	58.50 ± 11.94	50.86 ± 10.57	0.215	NS
	Balami	61.86 ± 3.98	58.46 ±5.86	0.107	NS
	Sudanese	66.33 ± 6.83	48.00 ± 8.79	0.002	*
LYM (µL)	Yankasa	40.75 ± 12.66	44.86 ± 10.25	0.506	NS
	Balami	35.43 ± 3.95	36.5 ± 6.72	0.096	NS
	Sudanese	33.50 ± 6.83	42.83 ± 6.62	0.037	*
EOSINO (cells/mcL)	Yankasa	0.12 ± 0.35	2.86 ± 3.76	0.060	NS
	Balami	2.43 ± 3.16	1.25 ± 2.05	0.400	NS
	Sudanese	0.33 ± 0.82	2.00 ± 2.76	0.186	NS

PCV=Packed cell volume; RBC = Red blood cell; WBC= White blood cell; HB= Haemoglobin; MCV=Mean cell volume; MCH= Mean cell volume; MCHC= Mean cell haemoglobin concentration; EOSINO = Eosinophil; NEU= Neutrophil; LYM= Lymphocytes. NS= not significant.

Zhong*et al.* (2014) reported that road transportation significantly affected haemoglobin concentration and percentages of WBC, RBC, NEU and Monocytes in whole blood.

The packed cell volume (PCV) would increase if animals were subjected to dehydration (Broom, 2000; Knowles and Warris, 2007) these results did not show any significant changes in PCV, which is consistent with the studies reported by Tadich*et al.*(2009) in which PCV of lambs was not affected after 48hr of transport. Also, Zhong*et al.* (2011) reported that there were no significant changes in PCV of sheep as a result of transportation for 8hr. Knowles *et al*., (1995) and Hall *et al.* (1998) have documented the use of PCV as a potent indicator to evaluate dehydration of animals during transportation. Blood leucocytes count investigation has been used to assess the health of animals. In a study conducted by Fisher *et al*. (2010) it was reported that NEU: LYM ratio of sheep blood increases after transport. However, significant difference was only observed in the NEU: LYM ratio in Sudanese fat tail after transportation in this study.

The reason behind the differences from previous work might be due to different transportation duration, conditions and the animal species chosen. According to the physiological measures observed in this study, the results indicated that the sheep did not encounter severe physiological stress or that the sheep recovered during transport. The biochemical parameters of sheep after transportation from Hardawa to Bauchi is as presented in Table 3. The result showed that in Yankasa, there were no significant difference (P>0.05) in the values observed from the result in all the biochemical parameters investigated except ALP. While in Balami, there were no significant difference (P>0.05) across the level of ALT, ASP, CREAT, UREA and GLUCOSE with the exception of ALP value, which showed significant difference (P>0.05) after transportation. Also in Sudanese fat tail, there was no significant difference (P>0.05) in all the parameters except Glucose.

Table 3: Biochemical parameters of sheep after transportation from Hardawa to Bauchi

Breeds	Parameters	Unit	Before Mean±SD	After Mean±SD	P-value	Level of significance
Yankasa	ALT	u/l	2.88 ± 0.84	3.12 ± 1.36	0.664	NS
	ASP	u/l	15.5 ± 5.35	14.50 ± 3.59	0.667	NS
	ALP	u/l	331.64 ± 65.98	371.22 ± 24.36	0.762	NS
	CREAT	u mol/l	154.14 ± 18.57	94.25 ± 14.60	0.366	NS
	UREA	m mol/l	5.55 ± 3.56	4.18 ± 2.98	0.421	NS
	GLUCOSE	m mol/l	3.47 ± 1.48	2.35 ± 0.51	0.063	NS
Balami						
	ALT	u/l	3.75 ± 1.04	3.12 ± 1.36	0.318	NS
	ASP	u/l	17.75 ± 6.36	14.62 ± 4.20	0.266	NS
	ALP	u/l	231.32 ± 65.09	383.34 ± 157.12	0.024	*
	CREAT	umol/l	75.46 ± 17.12	84.14 ± 24.26	0.422	NS
	UREA	m mol/l	4.78 ± 1.69	5.14 ± 1.31	0.649	NS
	GLUCOSE	mmol/l	3.61 ± 1.45	3.57 ± 2.22	0.964	NS
Sudanese						
	ALT	u/l	3.67 ± 1.03	2.67 ± 1.03	0.124	NS
	ASP	u/l	19.83 ± 2.99	17.17 ± 1.47	0.079	NS
	ALP	u/l	154.92 ± 122.53	197.81 ± 237.92	0.703	NS
	CREAT	u mol/l	100.37 ± 28.05	77.376 ± 8.67	0.126	NS
	UREA	m mol/l	3.52 ± 0.92	3.19 ± 1.90	0.708	NS
	GLUCOSE	m mol/l	2.8 ± 0.34	5.17 ± 2.57	0.049	*

ALT= Alanine aminotransferase; ASP= Aspartate aminotransferase; ALP=Alkaline phosphatase; CREAT= Creatinin. NS= not significant; SFTS= Sudanese fat tail sheep.

Knowles *et al.* (1995) reported that decreased plasma glucose for up to 24h would indicate metabolic exhaustion and increase plasma glucose, was probably due to initial stress responsible. Moreover, Andronie*et al.* (2008) reported that there is a plasmatic glucose response in sheep transported over longer journey duration with a decrease in its levels. The metabolic changes in sheep during transport are significant and constant over a longer period of time due to the lack of fodder and animal movement restrictions on the vehicle.

In another report by Zhong*et al.* (2011), after 9h of journey, an animal's body releases its reserves and uses glucose as energy source until the existing supply of hepatic glycogen is exhausted, generally within 24h. Also, Zhong*et al*. (2011) reported that though 8h of road transport did not affect blood cell count and serum cortisol concentration they varied among different ages of sheep. The biochemical parameters of sheep not altered in this study could be because the animals were transported for a shorter distance and duration. Stress may be more or less severe depending on a number of factors such as crowding, temperature, feed and water deprivation and length of travel Dalin*et al*. (1993); Ritter *et al*., (2007); Adenkola*et al*. (2008); Adenkola *et al*. (2009a).
Presented in Table 4 are the behavioural patterns of sheep observed during transportation from Hardawa to Bauchi. The behavioral indicators of discomfort observed in animals during loading and transportation includes attempting to escape, vocalization, and a few of them were standing still when approached. Most observed behavior among the sheep transported was vocalization (bellowing) (86.9%) while the least were lying down on transit (54.5%) and Aggressiveness (54.5%). In the study carried out by Chandra and Das (2001), on the handling and short-haul road, eliminative behaviour measured as an indication of the nervousness of the animals was evident from the high frequency of urination and defecation and this was more pronounced during loading than unloading. It is However different in this study because the animals were faster for 15h before transportation.

A little more than half were observed to be restless and became aggressive to other animals. The rest either stood calm or lay down on the floor of the van.

Table 4: Behavioral pattern of Sheep transported from Hardawa to Bauchi

Behaviour observed	Yankasa	Balami	Sudanese	Total (%)
Number	**8**	**8**	**6**	**22 (100)**
During loading				
Attempt to escape	6	7	4	17 (77.3)
Vocalizing (bellowing)	7	8	5	20 (86.9)
Stop moving	6	7	5	18 (81.8)
On transit				
Lay down	2	7	3	12 (54.5)
Aggression to other animals	3	5	4	12 (54.5)
Urination or defaecation	0	0	0	0 (00)

Conclusion

Road transportation of tropical breeds of sheep for 217km from Hardawa (Misau) to Bauchi resulted in significant increase of heart rate, rectal temperature and reduction in body weight. No significant changes in respiratory rates were observed and blood metabolites were not significantly influenced by transport stress.

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