CORRELATION OF THYROID HORMONES, CHEVON CHARACTERISTICS AND ELECTROLYTES DYNAMICS IN THERAPEUTIC WELFARE OF XYLAZINE AND ASCORBIC ACID IN BUCKS

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Abstract
Oxidation of anthocyanin by polyphenol oxidase (PPO) or peroxidase (POD) causes enzymatic browning. It leads to Therapeutic welfare administration of xylazine and its co-administration with ascorbic acid in bucks exposed to road stress and its effect on chevon quality was experimented in Sahel bucks.The first group was administered with (0.015mg/Kg) xylazine intramuscularly. The second test group was given xylazine intramuscularly and ascorbic acid orally, while the third group was considered as control. Each group had sixteen animals. Blood samples were collected prior to the study, midway and at the end of the journey. Thyroid hormones triiodothyronine (T3), tetraiodothryronine (T4) and some electrolytes were assessed. A Pearson correlation of the hormones and chevon characteristics was conducted and the dynamics of electrolytes at different phases of the experimental journey was monitored. Animals were slaughtered and chevon characteristics assessed. There was a significant ($P<0.05$) negative correlation between water hold capacity (WHC) and shrinkage. Significant ($P<0.01$) positive correlation between WHC and pH was recorded. There was a significant ($P<0.05$) positive correlation of thyroid hormones and some chevon characteristics parameters in the test group administered with xylazine (0.015mg/kg) and ascorbic acid (300 mg/kg). There was also a significantly ($P<0.05$) higher Na^+ plasma level at the end phase in the co-administered and control groups. The T3 was significantly ($P<0.05$) higher in xylazine at the end of the journey when compared to the co-administered group. In conclusion, xylazine and its co-administration influenced the T4 and T3 by causing adjustment in the physiology, which improved the chevon parameters namely; WHC, color, shrinkage adverse effect and ultimate pH.

Keywords: Thyroid hormones, chevon, electrolytes,therapeutic-welfare

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1. INTRODUCTION

Transportation of animals from one location to another for use after production is inevitable (Adenkola *et al.,* 2009). The proper transportation of food animals in accordance to international standards in Sub-Saharan Africa is neglected. Therefore the guidelines and rules stipulated for transportation of food animals are either not adhered to or enforced (Biobaku *et al* 2017a).The animals, when transported at long distance, especially in the tropics, undergo varying changes in their physiological parameters which is detrimental to their health and could also affect their meat quality after slaughter (Minka and Ayo, 2011; Biobaku *et al* 2016b). It was found in previous studies that animals exposed to transportation stress are predisposed to diseases due to compromise in their cell mediated and humoral immunity (Adenkola *et al.,* 2012). The metabolism of animals subjected to transportation without resting at a staging point after long distances are liable to be affected adversely. This is due to the general adaptive syndrome of the animals (Singh 2012; Biobaku *et al.,* 2016a). The metabolic changes, which the animals encounter, could be a function of the neuroendocrine role that might largely involve the body electrolytes and fluids. (Kannan *et al*., 2002; Minka and Ayo, 2011; Biobaku *et al* 2016a). The thyroid gland is one of the principal endocrine glandular organs involved in the homeostasis. It affects metabolism and basic physiologic function (Vijay *et al.,* 2011). The thyroid hormones` function also affects nutrition of the animal and adaptation to stress situation (Medrano and Hua, 2016). Animals transported in situations when standard stocking is not adhered, have higher tendency

to increase the levels of pro-inflammatory cytokines such as interleukins and tumor necrosis factors among others. These would affect the levels of metabolic hormones including thyroid hormones (Biobaku *et al* 2016a).

Triiodothyronine and tetraiodothyronine also influence homeostatic function such as metabolism, cardiac function, electrolytes level, lipids level, and skeletal muscle function amongst others (Kyung *et al.,* 1997; Medrano and Hua, 2016). The aforementioned functions of the thyroid hormone could be analogically applied in amelioration of stress in transported animals. This could also be used to improve animal meat production sequel to the transportation stress. The reversal of transportation stress using therapeutic intervention is aimed to ameliorate the detrimental effect of stress on the animals which can indirectly influence the thyroid hormone and metabolism.

Previous studies have shown that supplementation of ascorbic acid, explored by Biobaku *et al.,* (2016a) and Biobaku *et al.,* (2017b) in the amelioration of stress, suggested an improvement of products. It had also been suggested a beneficial effect of ascorbic acid on chevon in bucks subjected to long time transportation and the potential of xylazine in the improvement of animal welfare and chevon quality in bucks exposed to long time transportation. Pharmacologic agents that were exploited in the reversal of transportation stress include propofol, (Biobaku *et al.,* 2017a) xylazine, diazepam, and morphine amongst others as suggested by Ali and Al-Qarawi, (2002). There is a paucity of information on the use of pharmacologic agents for the amelioration of stress by correlating the levels of thyroid hormones on the quality of meat product. These data could be paramount to be published in terms of ensuring wholesomeness of meat product and has a socioeconomic implication in the livestock industry. This study therefore, is aimed to find out the effect of ameliorative xylazine alone and its co-administration with ascorbic acid on thyroid hormones, while drawing correlative terms on some chevon characteristics and the dynamics of some electrolytes in Sahel bucks exposed to long time transportation stress.

2. MATERIALS AND METHODS

Ethical Approval of Transportation of Animals

Ethical approval was granted by the Veterinary Directorate, Ministry of Agriculture and Natural Resources for the animals to be transportated for the experimental journey. A health certificate and Veterinary Movement loading permit was obtained as stipulated by the Animal Disease (Control) Decree of 1988. The experimental procedure was in conformity with Usmanu Danfodiyo University, Sokoto ethics for animal research and has obtained an approval after a proposal presentation in the Faculty of Veterinary Medicine.

Experimental Animals and Design

Forty-eight Sahel bucks of universal body condition 3, in the age range of one and half and two years were procured for the experiment. The animals were bought from the livestock markets at Sokoto, Tangaza, Kware, Illela, Gudu and Binji respectively. The animals were tagged for identification and were acclimatized for two weeks. They were fed with wheat bran, Crown® (Nigeria), Cowpea *(Vigna unguiculata*) husk and leaves. The animals were managed semi intensively and were not tethered to minimize psychological and any other form of stress that they could be predisposed to during the acclimatization. During acclimatization the experimental animals were treated prophylactically against helminthes using albendole® (Agbara, Nigeria) and a combination of penicillin and streptomycin (penstreptomycin®, Kepro, Holland) using standard doses as recommended by the manufacturers. This is to prevent secondary parasitic infestation and bacterial infection as previously adopted by Biobaku, (2015) and Biobaku *et al.,* 2016a). The animals were randomly allotted to three basic experimental groups with sixteen in each group. The first group was only administered

with xylazine intramuscularly at a dose of 0.015mg/Kg (group 1). The second test group was co-administered with xylazine intramuscularly and with ascorbic acid orally(group 2), while the animals from the third group were considered as control (group 3), subjected to stress none treated.

Administration of Drugs, Loading and Induction of Transportation Stress

The animals were loaded in a lorry and the inner floor of the vehicle was cushioned with dry millet leaves to prevent bruising of the animals during the journey. The animals were stocked at a space of 0.030m^2 per animal as stipulated by the Animal Disease Act of (1988) and previously described by Biobaku *et al.,* (2016a). The vehicle's speed was 40km/hr. This is in conformity with the speed stipulated for transportation of food animals. The animals were allowed to rest at a staging point midway during the journey at the quarantine post, 12 hours after the commencement of the journey. They were fed midway and were given water as previously adopted by Biobaku *et al.,* (2016a).

Xylazine (XYL-M2® Berendonk Drug, Belgium), an injectable solution, was administered xylazine as in group 1.In another (group 2) was co-administered with xylazine at 0.015mg/kg intramuscularly and ascorbic acid (Ascormed® Agbara, Nigeria) at 300mg/kg was instituted prior and mid-way during the experimental journey at the staging point at the quarantine post at Jebba. The choice for the doses of xylazine and ascorbic acid administered in this study was based on a previous study of Biobaku *et al.,* (2016a) and Biobaku *et al.,* (2016b).

Blood Collection, Analysis of Electrolytes and Hormonal Assay

Blood samples were collected from the animals prior to loading at Sokoto immediately after acclimatization. These samples were collected to assess hormones and electrolytes of experimental animals as base line for each group (control), midway into the journey that is after resting the animals at the veterinary quarantine post and after final offload at Abeokuta at the end of the experimental journey. The samples were collected using 21 gauge needles and syringes from the jugular vein after disinfecting the skin using 10% methylated spirit to ensure asepsis. Five milliliters of blood was collected from each animal in separate bottles with lithium heparin for electrolytes (Na^{2+},Ca^{2+},Mg^{2+} and K^{1+}) and thyroid hormones ;Triiodothyronine (T3) and tetraidothyronine (T4) analysis. The analysis was carried out using commercial test kits (Randox®,United Kingdom) and with Biorex® test kit (Diagnostics, United Kingdom) using spectrophotometric method and ELISA respectively as previously adopted by Muzzaffar and Gharib (1998).

Assessment of Carcasses and Chevon Characteristics

The animals were rested for twenty-four hours prior to slaughter according to the international standard and as stipulated in the Animal Disease Control Act of 1988 of the Federal Republic of Nigeria. The animals were prior to slaughter and animals were rested for a day to ensure that they have metabolized the xylazine to the most probable minimum tolerable level prior to slaughter.

The animals were assessed for excitatory score prior to slaughter using the method of Ayo *et al.,* (2006) and as adopted by Biobaku *et al* (2016a).

Thirty six animals were slaughtered at all, twelve per group."Halal" method involves severing the jugular vein, carotid arteries, trachea and oesophagus as adopted by Biobaku *et al*. (2016b) and Biobaku *et al*. (2017a). The neck region which was the slaughter point was firmly tightened with a rope prior to pumping for inflation.

The animals were then inflated using a pumping machine (Yamaha brand, China).The reason for this is to make the fur harder for ease in shaving of the slaughtered animal.

The difference of weights prior to journey and after journey multiplied by hundred is considered the shrinkage percentage. The carcass weight in South-western Nigeria was

obtained after removing the head and legs and with the intact shaved skin the testis and the scromatic sac as described by Biobaku *et al.,* (2017a). The carcass weight without offal was considered as the empty body weight which was extrapolated as Biobaku *et al.,* (2016b). The dressing percentage was obtained by taking the carcass weight divided by the live weight multiplied by a hundred as carried out by Tamir and Awuk, (2015); Biobaku *et al.,* (2016b and 2017a).

Cooking loss test was also conducted after Jibir *et al.,* (2012); and as adopted by Biobaku *et al*.,(2017a). The percentage loss in weight after boiling was deduced by subtracting the final weight after boiling from the initial weight multiplied by a hundred, using the method of Biobaku *et al*., (2016b).

Meat pH was determined using a chop from the *semi membranosus* muscle as previously described by Pethick *et al.,* (2005).Water holding capacity of the *semimembranosus* muscle was evaluated using the filter paper method in which a chromatographic paper Whatman 2 is kept for a day in desiccator to ensure its dryness prior to the experiment. Place the chevon sample on Whatman paper and cover with another then a constant weight of 1kg was placed on the paper and an aluminum foil.

This is to ensure exudation of fluid from meat. There would be an inner darker area and an outer area. The planimeter was measured and estimated and expressed in percentage as previously described by Wierbicki and Deatherage, (1958) and as adopted by Biobaku *et al*., (2017a).

Meat colour assessment was carried out using the colour chart method as adapted by Jibir *et al.,* (2012). The chart used had values to express magnitude of luminosity and extend of congestion of chevon. The higher the luminosity the lower its congestion and lighter its redness. The lower the luminosity the higher its congestion and darker its redness as previously adopted by Jibir *et al.,* (2012).

Statistical Analysis

The values in the assessment of chevon characteristics were correlated with T3 and T4, while the electrolytes T3 and T4 at different stages of the journey were compared using the analyse of variance using Graphpad Prism version 5.03. $P<0.05$ was considered as level of significance.

3. RESULTS AND DISCUSSION

Table 1 below shows the correlation of thyroid hormones and chevon characteristics parameters of bucks exposed to long term stress administered with intramuscular xylazine (0.015mg/kg).

Table 1: Pearson Correlation coefficient Analysis of Thyroid Hormones and Chevon Characteristics Parameters of Bucks Exposed to Long term Stress Administered with intramuscular Xylazine (0.015mg/kg)

Parameter	T3	Shrinkage	WHC	pH	Color	T4	Cooking loss	Life weight	Excitatory Score
T3	-								
Shrinkage	0.16								
WHC	-0.13	-0.49*							
pH	-0.29	-0.55*	0.71**						
Color	0.03	-0.33	0.49*	0.45					
T4	-0.15	0.06	-0.58	0.02	0.18				
Cooking loss	0.08	0.32	0.12	0.20	-0.07	0.148			
Life weight	-0.23	-0.65**	0.11	0.15	0.27	-0.32	-0.54*		
Excitatory Score	0.32	-0.52*	0.13	0.18	0.33	-0.18	-0.19	0.50*	-

*Correlation is significant at $P< 0.05$, **Correlation is significant at $P<0.01$
WHC : Water holding Capacity; T3: Triiodothyronine; T4: Tetraiodothronine

Table 2: Pearson Correlation coefficient Analysis of Thyroid Hormones and Chevon Characteristics Parameters of Bucks Exposed to Long term Stress when Co-administered Xylazine (0.015mg/kg) and Ascorbic acid (300 mg/kg)

Parameters	T3	T4	Shrinkage	Excitatory Score	WHC	pH	Colour	Cooking loss
T3	-							
T4	-0.03							
Shrinkage	-0.23	-0.12						
Excitatory Score	0.24	-0.10	0.14					
WHC	-0.10	-0.16	0.24	-0.29				
pH	0.20	-0.18	0.19	0.20	-0.22			
Colour	0.16	0.08	-0.01	-0.24	0.75**	-0.18		
Cooking loss	0.17	-0.02	-0.07	-0.06	-0.08	0.13	0.11	-

**Correlation is significant at the 0.01 level
WHC : Water holding Capacity; T3: Triiodothyronine; T4: Tetraiodothronine

There was a significant (P<0.05) negative correlation between water hold capacity (WHC) and shrinkage. A similar correlation was also observed between pH and shrinkage, live weight and cooking loss and excitatory score and shrinkage. There was however a significant (P<0.01) positive correlation between WHC and pH. There was also another significant (P<0.05) positive correlation recorded between excitatory score and live weight.

Table 2 below shows correlation of thyroid hormones and chevon characteristics parameters of bucks exposed to long term stress when co-administered xylazine (0.015mg/kg) and ascorbic acid (300 mg/kg) in group 2. There was a significantly (P<0.05) positive correlation.

Ameliorative effects of xylazine alone and when co-administered with ascorbic acid on thyroid hormones, dynamics of some electrolytes in correlation with chevon characteristics in Sahel bucks exposed to long time transportation stress was investigated. WHC is one of the characteristics of chevon that could be affected by some multiple-factors such as species, breed of goats, nutrition, environmental, sex, and health status. In this study WHC is increased and was improved by the xylazine (0.015mg/kg). In this study it was elucidated that this parameter was independent of shrinkage. The shrinkage was decreased by therapeutic intervention after the induction of stress. The xylazine elicited its stress ameliorative effect by decreasing catecholamine, cortisol centrally and endocrine effect which would minimize the detrimental effect of the abrupt outflow of neurotransmitters centrally and peripherally at the pre-synaptic, post synaptic neuronal and myo-neural junctions as a result of stress. The decrease in the surge of epinephrine would influence the pro-inflammatory cytokines by decreasing interleukins which includes interleukin-6 (IL-6), in the tissue due to the stress of transportation. The administration of xylazine might have interfered with the synthesis of epinephrine resulting to down regulatory of epinephrine that transcends to glands, organs, voluntary muscles the skeletal muscles and invariably the chevon. In the same vein epinephrine-induced stimulation of IL-6 expression was down-regulated by some drugs acting on α –adrenergic (Robert *et al.,* (2004)). These findings could infer that the use of xylazine which acts on α_2-adrenergic receptors might be speculated to interfere with epinephrine and this would cause an associated decrease in IL-6, which is a proinflammatory cytokine. The xylazine and its co-administration with ascorbic acid could add therapeutic value by delaying inflammation sequel to transportation stress which could improve chevon quality characteristics.

In this study the ultimate pH which is an important characteristic of chevon was influenced by xylazine a myo-relaxing agent which decreases caloric energy expenditure involved in muscular contraction. This gives insight and evidence of enhancing chevon

quality. It would improve the shelf–life of chevon since the metabolism of myocytes would be adjusted due lower energy conversion at contraction of the myofibrils. This would spare muscular glycogen involved in cellular energetics of metabolism which would also involve energetic units in the mitochondria such as the adenosine triphosphate and its congeners. This would improve the pH of the chevon as observed in this study by making the chevon's ultimate pH tend towards the favorable pH comparable to the pH of meat from animal not exposed to stress thus, improving its shelf-life. Xylazine from our study caused an increase in the level of T3. This would increase basal metabolic rate and improve the homeostasis toward the preservation of muscle glycogen during the high utilization of muscle glucose. Previous study by Khan *et al.,* (2014), had shown that xylazine-induced reduction of tissue sensitivity to insulin in normoglycaemic animals. The high level of glucose in the blood which perfuse the muscles would physiologically improve the ultimate pH of chevon.

The improvement of pH of chevon was further proven scientifically by a previous study by Afshar *et al.,* (2005) in xylazine pre-anaesthetized goats although the study was conducted in another breed of goats it gave clues of the effect of xylazine in relation to pH in bucks exposed to long tern transportation. The effect of improvement of WHC, pH, Sodium retention would decrease the shrinkage rate of chevon and would also reflect on the live weight of the animals. The facts on xylazine in improvement of chevon in this study could be supported by previous literature by Ali *et al*., (2006) and Biobaku *et al.,* (2017a), which supports that xylazine has been used in transportation stress alleviation in bucks improving the animal welfare and chevon quality.

The xylazine and ascorbic acid co-administered group improved color luminosity, although Afshar *et al.,* (2005), observed an effect on arterial blood when ascorbic acid was supplemented, that could improve the perfusion of tissues. It is very evident that the stress antioxidative ameliorative potentials of ascorbic acid pharmacologically supersede that of xylazine.Ascorbic acid possesses a haematinic property, so it enhances erythropoiesis during the transportation stress which would compensate the lost erythrocytes due to stress and could cause procreation of reactive oxygen species and other radicals that cause compromise in the integrity of cell membrane and affects the fluidity, hereby causing osmotic fragility and haemolysis. Ascorbic acid in animals could also restore normal metabolism and recovery from stress.It could also be associated with the improvement of the intermediary metabolic pathway in stress due to transportation as suggested by Biobaku *et al.,* (2017b). This would improve and aid the formation of oxymyoglobin and oxyhaemoglobin and this is an important factor that influences color of chevon. On the other hand the structure of the II B myofibres are relatively larger (Simela, 2005) which could bear a hold to higher quantum of the readily available energy compounds such as creatine phosphate, adenosine triphosphate (ATP) but to lower magnitude of myoglycogen than red muscles (Simela, 2005).This biochemical dynamics in the myocytes coupled with the diversification in structures could play a role in the meat color. The various types of myofibrils exemplified as type-I myofibrils are considered the smallest in diameter (Simela, 2005). These myofibrils are intimately associated with a higher density of blood capillaries, high lipid, myoglobin, mitochondria and tricarboxylic acid cycle enzymes constituents for high oxidative metabolism. This assumption is in agreement with the previous findings of Jibir *et al*.,(2012). The myocytes cellular biochemical dynamics might have been influenced by the antistress intervention in the use of the α-$_2$ adrenergic agonist, xylazine and ascorbic acid which could also account for changes in chevon luminosity and the obvious appearance as the chevon color (Biobaku *et al.,* 2017a). The use of xylazine in the attenuation of stress could interfere with basal metabolic rate which would invariably affect the cellular myocytes and other tissues. This could improve the

wholesomeness of chevon as a result of the improvement of the characteristics. The improvement of perfusion would subsequently improve the fluid and electrolyte balance which eventually reflects on WHC and explains the relationship between WHC and meat color. In a recent study by Biobaku *et al.* (2017a) xylazine improved WHC and chevon color. Similarly Biobaku *et al.* (2016b) also in suggested in a previous study that ascorbic acid also improved some of chevon characteristics. This gives insight to the antistress potentiating property of ascorbic acid in this study in the co-administered group of experimental animals.

Excitatory score at slaughter was slightly decreased by xylazine due to its anxiolytic effect on the central nervous system. The decrease in anxiety in the transported animals decreased the surge of cortisol and adrenaline which would induce detrimental changes in haemogram, biochemical and neuroendocrine parameters. In the same vein it would also improve the temperament of the animals that would predispose to dark dry firm syndrome caused by compromise in capillaries due to trauma in muscles leading to internal hemorrhages. This assumption is in line with the previous findings in cattle by Minka and Ayo, (2007). The sedative effect of the xylazine would minimize bullying and territorialism in the transported animals. This findings of this study also is in line with the previous study of Ayo *et al.*,(2006), Minka and Ayo, (2007), Biobaku *et al.,* (2016a) and Biobaku *et al.,* (2017b). These previous researchers observed the influence of ascorbic acid on excitatory score in goats and the physiology after transportation. The xylazine was also proven to improve excitability due to its tranquilizing effect when administered in stress of transportation (Biobaku *et al.,* 2016a). The improvement of the excitatory score at stress would improve the detrimental effect of weight loss and shrinkage.This is the elucidating the negative correlation of excitatory score and shrinkage in this present study.

Figure 1 below shows that the xylazine (0.015mg/kg) treated group, at the end of the journey, had significantly ($P<0.05$) higher Na^+ plasma concentration than other phases of the same group and other groups namely; the co-administered and control group.

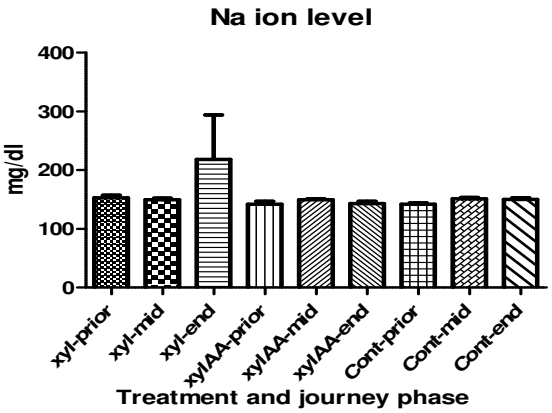

Figure 1: (Na^+) concentration in plasma of bucks exposed to long term transportation treated with xylazine alone and when co administered with ascorbic acid

xyl-prior : xyl (xylazine at 0.015mg/kg), after which the phase is written applicable to (prior) the three phases of the journey, where samples were collected in other groups

xylAA-prior: xyl (xylazine at 0.015mg/kg) co-administered with ascorbic acid after which the phase is written applicable to (prior) the three phases of the journey (300mg/kg);

Cont: control groups

Transportation stress amelioration and welfare using central and a peripheral acting agent xylazine and ascorbic acid was evaluated in this work. In previous studies agents such diazepam, morphine and propofol were evaluated Ali and Al-Qarawi, (2002) and Biobaku *et al.*, (2016c). These agents were found to be promising in the alleviation of stress in food animals. However the withdrawal periods of such drugs if used in rendering welfare in food animals should be strictly adhered to prior to slaughter. The effect of the ameliorative xylazine could be elucidated in the light of its agonistic action on the adrenoceptors distributed in different tissues including the urinary systems functional unit the nephron. Xylazine during the course of eliciting its effect centrally and peripherally it had secondary influence on the osmotic regulatory mechanism. This further resulted to retention of sodium ion as it was obtained in this study at the end of the journey phase. The

sodium retention effect of xylazine could also reduce shrinkage due to the general adaptive syndrome which supports and gives credence to its ameliorative effect in the improvement of WHC.

The fluid retention effect of sodium ion and its sparing at stress during amelioration of stress could be attributable to xylazine. The suggestion about the influence of xylazine on sodium is in agreement with the previous study of Ajibola *et al*., (2014) which was conducted in dogs. In stress condition however, Sahel bucks might be influenced by some physiological compensatory effect as observed in the study by Biobaku *et al.,* (2016a).

Figures 2, 3, 4 show no significant difference in the concentration of K, Mg, Ca ions in all groups.

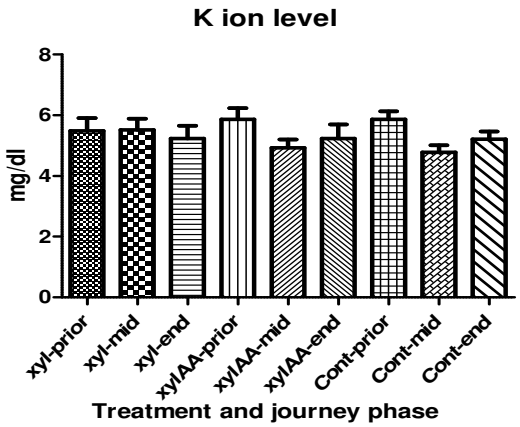

Figure 2. (K^+) concentration in plasma of bucks exposed to long term transportation treated with xylazine alone and when co administered with ascorbic acid

xyl-prior : xyl (xylazine at 0.015mg/kg), after which the phase is written applicable to (prior) the three phases of the journey, where samples were collected in other groups

xylAA-prior: xyl (xylazine at 0.015mg/kg) co-administered with ascorbic acid after which the phase is written applicable to (prior) the three phases of the journey (300mg/kg);

Cont: control groups

The electrolytes were not influenced by the xylazine and its co-administration with ascorbic acid. In previous studies the electrolytes were decreased significantly after stress of transportation (Minka and Ayo, 2010) and ascorbic acid ameliorated this deficit after supplementation. In this study there was no significant influence of the stress ameliorative therapy on most electrolytes except Na ion which was significantly increased at the end stage of the experimental journey in the xylazine ameliorated group.

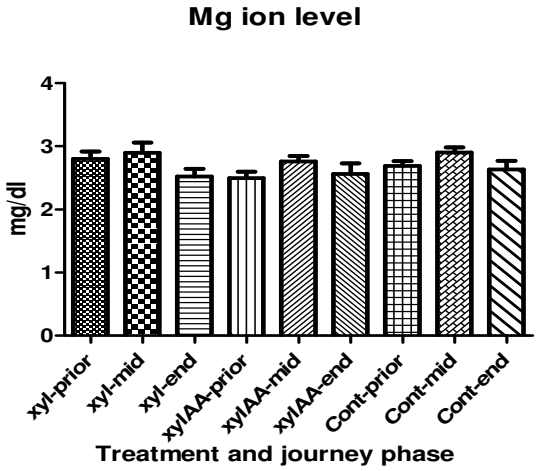

Figure 3. Mg^{2+} concentration in plasma of bucks exposed to long term transportation treated with xylazine alone and when co administered with ascorbic acid

xyl-prior : xyl (xylazine at 0.015mg/kg), after which the phase is written applicable to (prior) the three phases of the journey, where samples were collected in other groups xylAA-prior: xyl (xylazine at 0.015mg/kg) co-administered with ascorbic acid (300mg/kg) after which the phase is written applicable to (prior) the three phases of the journey, where samples were collected in other groups ; Cont: control groups

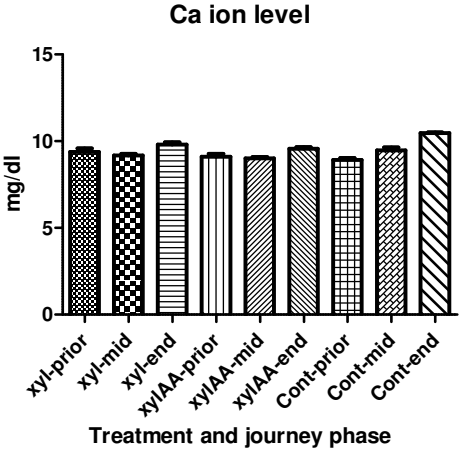

Figure 4. Ca^{2+} concentration in plasma of bucks exposed to long term transportation treated with xylazine alone and when co administered with ascorbic acid

xyl-prior : xyl (xylazine at 0.015mg/kg), after which the phase is written applicable to the three phases of the journey, where samples were collected in other groups

xylAA-prior: xyl (xylazine at 0.015mg/kg) co-administered with ascorbic acid (300mg/kg) after which the phase is written applicable to (prior) the three phases of the journey, where samples were collected in other groups;

Cont: control groups

The decrease in K^+ ion at the end of the journey in the xylazine and ascorbic acid co-administered group could be due to extend of the stress of the long transportation and the xylazine alone and co-administered did not improve this electrolyte. Speculation could be made that the general adaptive syndrome in the Sahel breed used in this study might have resulted in the electrolytic compensatory mechanism as mentioned in previous findings of Minka and Ayo, (2010) and Biobaku *et al.,* (2016a).

The adherence to animal welfare by resting the animals at the staging point could be scientifically provides the explanations to the improvement of electrolytes and recovery sequel to therapeutic intervention. The findings in this study were not in total agreement with the previous studies of Minka and Ayo, (2010). This disparity could be attributed to the difference in breed of the goats used in the previous study in which the Sokoto red goats were experimented upon, while in this study the Sahel breed were experimented upon. The travelled distance and duration of stress and the environmental changes confronted by the animals which include wind speed, ambient temperature and the variation of the relative humidity at different locations along the trans-Savannah zone to the tropical rain forest of Abeokuta during the experimental journey.

Figures 5 and 6 show the levels of triiodothyronine (T3) and tetraidothyronine (T4) in xylazine (0.015mg/kg) (group 1), co-administered xylazine (0.015mg/kg) and ascorbic acid (300mg/kg) (group 2) and control (group 3) of the animals exposed to long term transportation at different stages. Figure 5 shows significantly ($P<0.05$) higher levels of T3 in the (group 1) at the end of the journey and when compared to groups 2 and the control (group 3) at all phases of the experimental journey. In Figure 6, a higher level of significance ($P<0.05$) in the T4, in group 2, the co- administration of xylazine (0.015mg/kg) and ascorbic acid (300mg/kg) at the end of the journey than the xylazine treated group at the end of the journey and to the control group (group 3) at all phases of the journey.

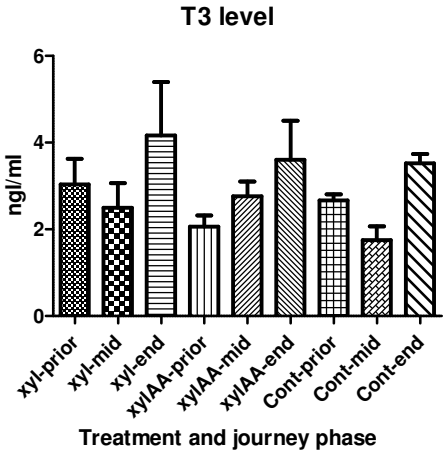

Figure 5: T3 level in bucks exposed to long term transportation treated with xylazine alone and when co administered with ascorbic acid

xyl-prior : xyl (xylazine at 0.015mg/kg), after which the phase is written applicable to the three phases of the journey, where samples were collected in other groupsxylAA-prior:
xyl (xylazine at 0.015mg/kg) co-administered with ascorbic acid (300mg/kg);
Cont: control groups

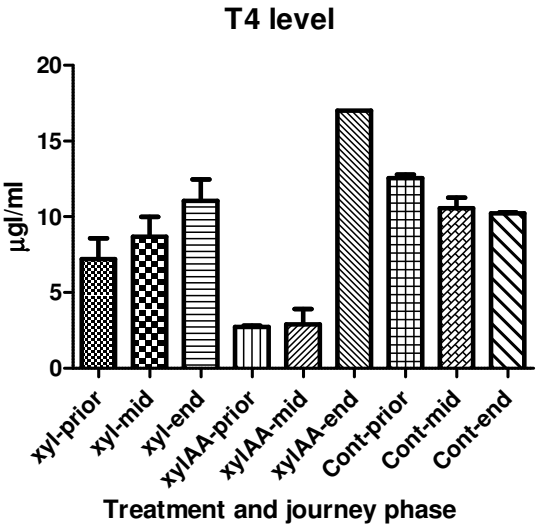

Figure 6: Shows T3 level in bucks exposed to long term transportation treated with xylazine alone and when co administered with ascorbic acid

xyl-prior : xyl (xylazine at 0.015mg/kg), after which the phase is written applicable to the three phases of the journey, where samples were collected in other groups
xylAA-prior: xyl (xylazine at 0.015mg/kg) co-administered with ascorbic acid (300mg/kg);
Cont: control groups

The thyroid hormones T3 and T4 had similar trends which increase at the end phase of the journey in the xylazine and co-administered

groups. This could be due to the enhancing metabolic effect towards recovery from the general adaptive syndrome. There are two perspectives to the response of T3 and T4 to stress. There could be hypothyroidism as suggested by Cano-Europa *et al.*, (2010) or hyperthyroidism as observed by Venditti and Di Meo, (2006) to enhance adaptation towards survival and physiologic compensation. In this study the hormone levels were significantly lower in the control (non treated) group than in the treated one at the end phase of the journey.The physiological response of the experimental animals caused a decrease in the level of the T3 and T4 to mitigate oxidative stress by generation of reactive oxygen species. This is speculated to be due to the activation of NFkβ produced due to the increased hyper-metabolites and increase in respiratory rate. This subsequently might trigger kupffer-cells in the physiologic interplay in cell mediated response of the reticuloendothelial system. The ascorbic acid might be involved in this antistress mechanism.This explanation is as in line with the previous suggestion of Minka and Ayo, (2010). The xylazine at the end phase of the journey increased the level of T3.This could be due to the central effect of the drug sequel to stress. The xylazine could also prompt the release of the thyroid stimulating hormone secreted from the adenohypophysis to cause the increase in the T3. The increase in T3 would prompt the basal metabolism and oxygen utilization that would improve chevon quality at transportation stress. The prompted metabolism would enhance oxygenation of myoglobin to result to the formation of oxymyoglobin and influencing color of chevon. Conversely, xylazine co-administered group with ascorbic acid triggered an effect towards lowering of T3 to a level comparable to the level at the prior phase of the journey and to the control (non treated group transported) .This decrease in the levothyroxine might subsequently decrease the rate of redox reactions at the cellular level involving production of reactive oxygen species.This would aid faster recovery from stress and adjustment towards homeostasis. The triiodothyronine is an active thyroid hormone and influences all cells in the body. This would enhance better adaptability that would improve chevon. Xylazine co-administered with ascorbic acid influenced T4 by increasing it at the end phase of the journey as observed in this study. This could be attributed to the supplementation of ascorbic acid which is also involved in intermediary metabolism and enhancement of recovery from the long term stress of transportation in goats while the xylazine might influence T4 at long term transportation in a similar mechanism as the T3 through its central action thus improving metabolism at stress bringing about adaptation recovery and improvement to chevon quality.

4. CONCLUSIONS

In conclusion, the xylazine and its co-administration with ascorbic acid influenced the T4 and T3 by causing adjustment in the physiologic compensatory mechanism which caused the improvement of WHC, color, shrinkage adverse effect and ultimate pH. These drugs, if rationally used by professionals in rendering animal welfare could enhance achieving improved chevon quality. The withdrawal period of xylazine is advised to be adhered prior to slaughter for the safety of the consuming public. This could be one of the ways used to improve animal welfare especially in the tropics and other parts of the world where transportation of animals to abattoirs, breeding, and research is inevitable and standards for humane animal handling are desired.

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