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Effect of transportation stress on the thermoregulatory response of young and adult rabbits

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Target Audience: Ruminant Nutritionists, Livestock Extensionists, Farmers

Abstract

The aim of this experiment was to investigate the effect of stress due to road transportation on rabbits of different age groups. A total of 30 local mixed breed rabbits of different age groups were used. They were ten (10) rabbits per group and were grouped as follows; age 4-6 weeks (T_1), age 8-12 weeks (T_2), age 7-12 months (convert to weeks for uniformity) (T_3) and the animals were considered to be young, growers and adult respectively. The weight of the animals was 400g, 1070g and 1600g respectively. All the rabbits were transported by road for 3 h and their rectal temperature (RT), ear temperature, (ET), respiratory rate (RR), and heart rate (HR) values were recorded before, during and after the transportation. The results showed that road transportation was stressful to all the rabbits, as evidenced by increase in RT, ET, RR and HR values of all the animals. The values were significantly ($P<0.05$) higher in adult rabbits compared to the young and growers. On arrival, HR and RT values were higher in adult and grower animals than in the young. This study revealed that adult and growing rabbits are more stressed during transportation than the young rabbits.

Key Words: Age Group, Transportation Stress, Thermoregulatory Response

Description of Problem

In Nigeria, like in other parts of the world, farm animals are often transported by road for long distances from where they are in abundance to regions where they are scarce and needed either for rearing or direct slaughter. Transportation of animals is known to induce both psychological and physiological stress, which may result in major physiological disturbances such as aberrant behaviours, immune-suppression, and disruption of general homeostasis [1, 2]. Important indices of stress due to road transportation in livestock include rectal temperature (RT) [3, 4] and live-weight [4, 2]. Signs of this stress have been reported in different animal species by previous studies; for example, increased heart rate [5], increased rectal temperature [6], increased adrenal-cortical activity [7], decrease hormonal immunity [8], increased morbidity and mortality [9].

Most studies that were carried out by some authors [10, 4, 11-13, 3, 1-2] were on transportation of Goats, Pigs and Pullets and a very few [14-15, 6] on rabbits. However, the effect of transportation on different age group of rabbits is yet to be explored. The neutral zone of growing rabbit (6-12 weeks of age) is 15-18^{o}C [16]. This value shows that the neutral zone is narrow and may be narrower in newly weaned rabbits which may cause a great variation in stress tolerance in rabbits of different age groups.

This study was aimed at evaluating the effect of road transportation on thermoregulatory response of rabbits of different age groups.

Materials and Methods

Experimental Site

The study was carried out from 31st March to 3rd April, during the peak of the heat season in Kaduna and Zaria (11° 10/ N, 07° 38/ E), located in the Northern Guinea Savannah zone of Nigeria. Zaria lies between 11° 12' 42" N and 7° 33' 14" E at an altitude of 691 m above sea level [17]. Zaria has an average rain fall of 1100mm which starts from late April and early May to mid-October and an average temperature of 37°C and average relative humidity of 75%.

Experimental Procedure

Pre-conditioning period

A total of 30 rabbits were divided into 3 treatment groups comprising five newly weaned (4-6 weeks old), Growers (8-12 weeks old) and adult (25 – 52 weeks old) with mean weight 400g, 1070g and 1600g respectively. Pelletized feed and water was given *ad libitum* for three consecutive days before the commencement of the experiment. 30 min (at 12 h) before the transportation Rectal Temperature (RT), Ear Temperature (ET), Respiration Rate (RT), Heart Rate (RT) and Live weight were measured for each rabbit. The RT and ET were measured by inserting a digital clinical thermometer (Electron thermometer, COCET, China) for about 1 to 2 min into the rectum and center of the auricle of each rabbit respectively until alarm sound was produced, indicating the end of the reading. RR values was recorded after counting the movement of the flanks of each rabbit for 1 min with the aid of a stop clock and HR values was measured by counting the heart beat of each rabbit for one min with the help of a stethoscope. Temperatures and relative humidity of the pen house were also recorded during this period using digital thermometer (COCET, Shenzhen, Guangdong, China). The relative humidity (RH) was calculated from the values obtained using the instruction attached by the manufacturer.

Transportation Period

Six hours prior to the commencement of transportation, feed and water was withdrawn from the animals. The rabbits were transported on road on the back seat of a 206 Peugeot car 2000 model. The rabbits were loaded in a perforated rectangle carton of 1m x 0.4m size from Samaru-Zaria to Kaduna and back to Samaru-Zaria, covering a distance of 140 km at a speed of about 45 km/h. The journey lasted for 3 h. During the journey, RT, ET, RR HR and temperature values were recorded at 30, 60, and 90 min into the journey, and immediately on arrival in Zaria (at 3 h of the transportation), when the journey was completed.

Statistical Analysis

Data generated from the study was analyzed using the general linear model of SAS software [18]. Significant differences in means were separated using the Duncan's multiple range test in the SAS package.

Results and Discussion

The temperature values of the car recorded before transportation ranged between 30 – 32°C, with mean and range values of 31.0 ± 0.48°C. As shown in Table 1, the temperature inside the vehicle ranged between 33 – 38 °C, with mean and range values of 35.3 ± 0.55°C. The RH values ranged between 48 – 58 %, with mean and range values of 49.3 ± 3.01%.

Before transportation, the values of thermo-regulation obtained showed that the animals were not heat stressed as they were within the normal range for rabbits [16]. However, adult rabbits recorded significantly

higher values for ET and RR compared to the young and growing rabbits (Table 2). Other parameters such as RT and HR did not show any significant difference. Table 3 summarizes the thermoregulatory response of rabbits during transportation. Transportation stress negatively affected all the age groups of rabbits studied. At 30 min, adult rabbits recorded a significantly ($P<0.05$) higher ET and RT values than the growers and the young. There was no significant difference in their HR and RR. At 60 min, all the thermoregulatory parameters (ET, RT, RR, and HR) were significantly ($P<0.05$) affected by transportation stress. Adult rabbits recorded a significantly higher ET, RT and RR values than the young and growers. The young rabbits however recorded a significantly higher value for HR. At 90 min the values recorded by the adult rabbits for ET, RT and RR were significantly higher than those recorded by the young and growers. There was no significant difference in their HR.

On arrival, it was observed (Table 4) that the animals were more stressed with adult and growing rabbits recording significantly ($P<0.05$) higher values for HR, RT, and RR. There was no significant difference in their ear temperature.

The high temperature values (33 – 38 °C) during the transportation showed that the temperature inside the vehicle was higher than the upper limit of the optimum air temperature of 20°C [18]. The values were above the thermo-neutral zone of dry bulb temperature of 13 to 20°C and RH of 55 to 65% for the rabbit [19]. The DBT and RH values recorded from the study period were considerably higher than the optimum values for rabbit production, and the wide fluctuations in the parameters showed that the environmental conditions were thermally stressful and may have adverse effects on the rabbits.

The RT, RR and HR values obtained for the young and growing rabbits before transportation are within the established normal range of 38.6 – 39.5 ^{o}C, 35 – 50 br/min and 130 – 260 beats/min for domestic rabbits [20]. The significantly higher value for ET and RR in the adult was more than the recommended values for domestic rabbits. This difference could be due to more adipose tissue that has been deposited by the adult rabbits making them to be more prone to heat stress. It should be known that rabbits use general body position, breathing rate and peripheral temperature, especially ear, as three devices to modify heat loss. However, respiration and ear are the most important dissipation pathways. Marai and Habeeb [21] indicated that between 0 – 30^{o}C, latent heat evacuation is only controlled by altering the breathing rate.

RT, RR, ET and HR values kept increasing as the duration in transportation increases indicating that road transportation was stressful to all the rabbits. Similar results on the negative effect due to road transportation stress on rabbits have been reported [14-15, 6]. The adult rabbits recorded significant values throughout the period of transportation than the growing and young rabbits, it was however observed that at 60 min, the heart rate of the young rabbits was higher than those of the adults and growers. This observation may be attributed to fear as a result of the vibration from the vehicle during transportation. On arrival, it was also observed that animals were more stressed. These findings were in agreement with the result obtained by Farghly, [22], who reported that heat stress was apparent in the rabbits during the hot period due to failure of thermoregulatory mechanism.

Conclusion and Applications

The findings of this study revealed that

1. Adult rabbits are more prone to transportation stress than the growing and young rabbits.

2. It was also revealed that the higher the weight, age of the animal and environmental temperature, the more heat stressed the animal would be.
3. It was recommended from this study that the best age to transport rabbits is when they are still young.

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Table 1 Ambient temperature and relative humidity before transportation, during transportation and on arrival

Period	Ambient temperature (°C)	Relative humidity (%)
Before transportation	31	48
30 min into transportation	33	48
60 min into transportation	37	50
90 min into transportation	38	55
On arrival (3-h transportation)	35	58

Table 2 Thermoregulatory response of rabbits before transportation

Parameters	T_1	T_2	T_3	SEM
Ear Temperature (°C)	36.94^b	37.90^b	39.56^a	0.32
Rectal Temperature (°C)	38.80	38.81	38.96	0.19
Respiratory Rate (br/min)	45.40^b	43.20^b	61.20^a	0.72
Heart Rate (b/min)	115.40	120.80	118.60	1.79

b: beat, br: breath

Table 3 Thermoregulatory response of rabbits during transportation

Parameters	T_1	T_2	T_3	SEM
30 min.				
Ear Temperature (°C)	37.70^{c}	38.74^{b}	39.60^{a}	0.26
Rectal Temperature (°C)	40.34^{b}	39.98^{b}	41.52^{a}	0.32
Respiratory Rate (br/min)	103.80	86.75	108.67	7.75
Heart Rate (b/min)	118.20	122.50	122.0	1.43
60 min.				
Ear Temperature (°C)	39.72^{b}	40.03^{b}	41.78^{a}	0.19
Rectal Temperature (°C)	40.54^{b}	41.53^{a}	41.78^{a}	0.26
Respiratory Rate (br/min)	124.60^{b}	132.25^{b}	148.83^{a}	2.72
Heart Rate (b/min)	152.00^{a}	142.75^{b}	150.53^{ab}	2.82
90 min				
Ear Temperature (°C)	39.98^{b}	40.35^{a}	40.60^{a}	0.09
Rectal Temperature (°C)	40.74^{b}	41.60^{a}	42.01^{a}	0.20
Respiratory Rate (br/min)	123.80^{b}	136.25^{b}	151.33^{a}	2.21
Heart Rate (b/min)	140.00	148.75	152.17	1.90

b: beat, br: breath

Table 4 Thermoregulatory response of rabbits on arrival after three hours

Parameters	T_1	T_2	T_3	SEM
Ear Temperature (°C)	40.22	40.22	40.24	0.06
Rectal Temperature (°C)	41.00^{b}	41.98^{a}	150.60^{a}	0.18
Respiratory Rate (br/min)	121.80^{c}	138.20^{b}	61.20^{a}	0.72
Heart Rate (b/min)	136.20^{b}	142.4^{a}	146.80^{a}	1.68

b: beat, br: breath