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# Understanding the behavioural response of three pre-slaughter cattle breeds in Bauchi Central Abattoir, Nigeria

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**ABSTRACT:** Livestock play a vital role in food production and are a major source of income in developing countries. Cattle are commonly slaughtered in abattoirs, where pre-slaughter handling and environmental conditions can significantly influence their behaviour. This study investigated the pre-slaughter behaviours of cattle at the Bauchi Central Abattoir. The cattle breeds assessed were White Fulani (WHF), Red Bororo (RBR) and Sokoto Gudali (SKG). Behavioural data were collected using scan sampling, while cattle breeds were selected through purposive sampling. Aggressive (AG) and calm (CA) behaviours were recorded at arrival, whereas lying-and-ruminating (LR), standing-and-ruminating (SR), standing (ST), resting (RT), eating (ET), defecating (DF) and urinating (UR) were observed five minutes after arrival (post arrival). The results showed AG (53.25%) and ST (41.19%) had the highest proportion among the observed behaviours. Positive coefficients were recorded for both AG and CA across all the breeds. Both behaviours were significantly ($p<0.05$) influenced by all the breeds, except AG in SKG and CA in RBR. Furthermore, all the breeds showed a positive influence on RT, ST and DF, whereas ET was negatively influenced. Irrespective of the breed, SR, LR and UR exhibited both positive and negative influences. Significant differences ($p<0.05$) were observed for ST across all breeds; for SR in RBR and SKG; for LR and RT in WHF; and for while UR in both WHF and RBR. It is concluded that WHF and RBR cattle breeds exert a greater influence on pre-slaughter behaviours than the SKG breed. These findings provide a foundation for future research aimed at investigating the relationship between pre-slaughter behaviours and post-slaughter meat quality. Therefore, studies examining the effects of stocking density and modes of transportation on cattle pre-slaughter behaviours are recommended.

**Keywords:** Behaviour, lairage, livestock, scan sampling.

## INTRODUCTION

Livestock play a crucial role in global food systems, significantly contributing to total food production by supplying high-quality animal-based products. In developing countries, these products not only enhance food security but also serve as a major source of livelihood for millions of smallholder farmers and rural households (Gaughan *et al*., 2019). The livestock sector provides essential nutrients, contributing approximately 17% of total kilocalorie intake and 33% of total protein consumption globally (Shima *et al*., 2015). In Nigeria, cattle are the predominant large livestock species slaughtered for meat (Shittu *et al*., 2014). Beef, in particular, constitutes about 45% of the total meat consumed in the country, highlighting its importance in the national diet and economy (Kubkomawa, 2017).

Livestock, especially large animals, are mostly slaughtered in abattoirs (Abiola, 1995). Njoga *et al*. (2021) reviewed that globally, achieving high-level beef quality

from any given cattle slaughterhouse requires optimum levels of good practices, which must be upheld. Regardless of location, cattle pre-slaughter and slaughter operations remain very critical to meat quality and food security. The most stressful situations that occur on animals in abattoirs are pre-slaughter handling and longer lairage period, which sometimes lead to attempts to escape, vocalisation, frequent urination and defecation (Moura *et al*., 2021). Lairage is purposely designed to provide a stick yard between transport and slaughter of livestock to maintain a constant speed of slaughter line and to allow animals to recover from loading and transport stress (Faucitano, 2010). Mostly, these behaviours (body postures and activities) are exhibited by the ruminant at lairage, such as walking (without rumination), lying, standing (ST), ruminating, drinking, conflicts (bumps with the head and mounting), positive social behaviour and self-grooming (del Campo *et al*., 2021).

There are many concerns that are raised on pre-slaughter stress, contributing factors and the consequent effects on cattle behavioural responses and the quality of beef. Daily, slaughter animals are exposed to different conditions during production and transportation to abattoirs (Njisane and Muchen, 2017). These conditions can be very high, and there is no possibility of knowing the individual history, background or habits of each animal. The animals are unfamiliar to the staff and vice versa (Disanto *et al*., 2014). Similarly, during handling and transport, animals are subjected to a variety of potential stressors such as heat, cold, poor air quality, vibration and noise. Many of these factors compromise the welfare and health of the animals and also reduce meat quality and may even cause death (Bulitta *et al*., 2015). Furthermore, most animals will be unknown to each other even if they may be delivered in groups or batches, and it is not rare to see mixing of completely unfamiliar animals (Disanto *et al*., 2014). Sudden change in weather elements is a threat to livestock's adaptation to the environment (Ratnakaran *et al*., 2017). Animal breed also plays a vital role in determining behavioural exhibition in slaughter facilities (Grandin, 1980). It is necessary, therefore, to understand not only their behavioural but also their cognitive needs and capacities (Nawroth *et al*., 2019; Terlouw and Bourgue, 2022).

The attention of the researchers was drawn to the behavioural response of cattle in Nigerian abattoirs before slaughtering, thus leading to unethical slaughter. The objective of this study was therefore designed to understand pre-slaughter behaviours of cattle breeds in Bauchi Central Abattoir.

## MATERIALS AND METHODS

### Study area

The study was carried out in the Bauchi Central Abattoir situated in Inkil Village, along Bauchi-Gombe highway, Bauchi Local Government Area (LGA), Bauchi State, Nigeria. The LGA lies between latitude 9°N and 12°N of the equator and between longitude 8°E and 11°E of the Greenwich Meridian (Nuhu *et al*., 2014; Yahaya *et al*., 2023; Yahaya *et al*., 2025). Abubakar *et al*. (2017) stated that it has an altitude of 690.2 m above sea level and occupies an estimated land area of 3,687 km$^2$. The abattoir serves as the major or central slaughter point providing the entire population of Bauchi town with the meat of large animals (cattle, sheep, goats and recently camels).

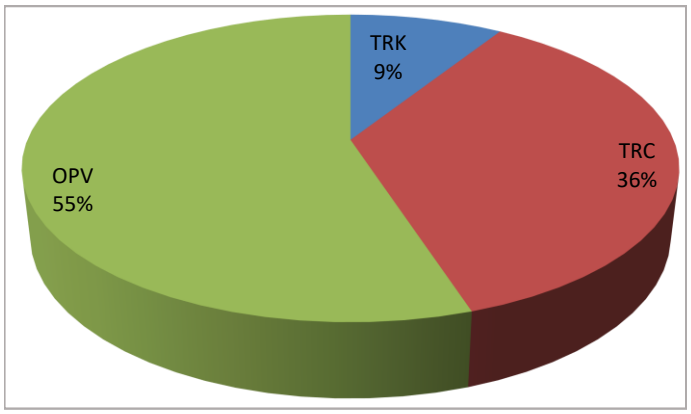


**Figure 1.** Proportion of means of transportation of cattle to the Bauchi Central Abattoir. OPV, TRC and TRK referred to Open van, Tricycle and trekking (by foot) respectively.

### Data collection

Traditionally, livestock are brought to the abattoir by the owners daily, early in the morning. The breeds of cattle brought to the abattoir during the study period were White Fulani (WHF), Red Bororo (RBR) and Sokoto Gudali (SKG). The means of transportation (Figure 1) are usually by trekking (accompanied by stick holder herder or herders), open vans and tricycles also known as *Keke Napep*. The data were collected between January and May 2022. The abattoir was visited between 6:00 am and 8:30 am on every data collection day.

### Temperature status of the abattoir

The room temperature of the abattoir was recorded using a digital thermometer. The temperature ranged from 19.4-30.6°C.

### Feeding of the cattle

The butchers were verbally asked about the feeding status of the cattle. Most of them (89.7%) responded that the cattle were mostly fed on groundnut haulms (protein source) and maize bran (energy and fibre source) for 8-12 hours daily prior to the transportation. The water was

**Table 1.** Description of the ethograms exhibited by the cattle at the observational centre during the period of the study.

| Ethograms | Abbreviation | Description |
|---|---|---|
| Aggressive | AG | The animal exhibits confronting or attacking behaviour towards either the stockperson or any available objects. That is, the animal is nervous. |
| Calm | CA | The animal does not show or feeling of nervousness, anger or other strong emotions. |
| Standing-and-ruminating | SR | The animal ruminates (chew cuds) while in a standing positional posture on all four legs or one leg is up. |
| Lying-and-ruminating | LR | The animal ruminates (chew cuds) while lying in a horizontal or flat positional posture |
| Resting | RT | The animal is in recumbent positional posture (on the side, back or stomach), neither eating nor ruminating |
| Standing | ST | The animal stands stationary, neither exhibiting eating, ruminating, defecating, nor urinating |
| Eating | ET | The animal consumes the available feeding material at unrestricted posture. |
| Defecating | DF | The animal discharges faeces irrespective of other behaviours exhibited, unless urinating. |
| Urinating | UR | The animal passes urine irrespective of other behaviours exhibited, unless defecating. |

served *ad libitum*. However, the remaining butchers (20.3%) fed the cattle with only maize bran or kitchen waste and water *ad libitum*. Most of the butchers do not bring feed along with the cattle to the abattoir. Very small amounts were supplied by some workers.

### Age and sex of the cattle

The age of the cattle brought to the abattoir during the study period for slaughter was estimated using the dentition method as 4-8 years old. On the other hand, the cattle were of both sexes (male and female). The animals were not separated based on sex or age.

### Behavioural observation (sampling procedure)

The breeds of the cattle were purposively sampled. The butchers brought their cattle to the abattoir for slaughtering (different breeds). Furthermore, scan sampling was employed to observe individual behaviour exhibited by the cattle.

The total of one hundred and six (106) observations was recorded at the end of the visitation. Table 1 describes the ethograms of the observed behaviours. The behaviours observed were divided into two groups:

1. those at the arrival of the cattle, such as aggressive (AG) and calm (CA)
2. those five minutes after arrival (post-arrival), such as standing-and-ruminating (SR), lying-and- ruminating (LR), standing (ST), resting (RT), eating (ET), defecating (DF) and urinating (UR).

### Data analysis

The data obtained on the pre-slaughtered behaviours of the cattle breeds were analysed using simple percentages and Generalised Linear Model (GLM) of Statistical Package for Social Science (SPSS) version 2.0. The following statistical model was used:

$$g(\mu\_i) = \beta\_0 + \beta\_1.Breed1 + \beta\_2.Breed2 + \beta\_3.Breed3$$

Where: $g(\mu\_i)$ is the link function that connects the mean of the response to the linear predictor, $(\mu\_i)$ is the expected value of the behavioural response of an individual breed, $\beta\_0$ is the intercept, $\beta\_1$ is the coefficient representing the effect of breed 1 (White Fulani), $\beta\_2$ is the coefficient representing the effect of breed 2 (Red Bororo), $\beta\_3$ is the coefficient representing the effect of the breed 3 (Sokoto Gudali).

## RESULTS

Table 2 presents the mean and simple percentage (%) distribution for pre-slaughter behaviours exhibited by the cattle breeds (WHF, RBR and SKG) at the Bauchi Central Abattoir. Observations made at the point of arrival of the breed showed AG behaviour had the highest proportion (53.25%). Furthermore, five minutes after arrival, ST behaviour was the most frequently observed (41.19%), whereas ET behaviour was the least common (2.89%).

Tables 3 and 4 present the influence of breeds (WHF, RBR and SKG) on the behavioural responses of cattle during the pre-slaughter period at the Bauchi Central Abattoir. Table 3 describes the pre-slaughter behaviours

**Table 2.** Mean and percentages of the behavioural responses exhibited by the pre-slaughter cattle at and after arrival.

| Response | Breed | | | Percentage (%) |
|---|---|---|---|---|
| | WHF | RBR | SKG | |
| Behaviours observed at arrival | | | | |
| AG | 2.34 | 3.60 | 2.67 | 53,25 |
| CA | 1.76 | 2.80 | 3.00 | 47.25 |
| Behaviours observed after arrival | | | | |
| SR | 0.32 | 1.40 | 0.67 | 16.46 |
| LR | 0.39 | 0.00 | 0.67 | 7.30 |
| RT | 1.06 | 1.80 | 1.67 | 32.16 |
| ST | 1.51 | 2.60 | 1.87 | 41.19 |
| ET | 0.22 | 0.20 | 0.00 | 2.89 |

WHF, RBR and SKG referred to White Fulani, Red Bororo and Sokoto Gudali breeds of cattle, respectively; AG, CA, SR, LR, RT, ST, ET, DF and UR are defined as aggressive, calming, standing-and-ruminating, lying-and-ruminating, resting, standing, eating, defecating and urinating behaviours.

**Table 3.** Generalised Linear Model showing breed influence on behavioural responses of cattle observed at the arrival of pre-slaughtered cattle at Bauchi Central Abattoir.

| Response | Variable | B | Standard error | Wald interval | | p-value |
|---|---|---|---|---|---|---|
| | | | | Lower | Upper | |
| AG (%) | (Intercept) | -0.038 | 0.183 | -0.395 | 0.320 | 0.837 |
| | WHF | 0.206 | 0.039 | 0.131 | 0.282 | 0.001 |
| | RBR | 0.224 | 0.067 | 0.093 | 0.355 | 0.001 |
| | SKG | 0.086 | 0.097 | -0.104 | 0.277 | 0.373 |
| CA (%) | (Intercept) | -0.459 | 0.210 | -0.870 | -0.047 | 0.029 |
| | WHF | 0.235 | 0.044 | 0.149 | 0.321 | 0.001 |
| | RBR | 0.135 | 0.091 | -0.043 | 0.314 | 0.137 |
| | SKG | 0.265 | 0.097 | 0.075 | 0.455 | 0.006 |

WHF, RBR and SKG referred to White Fulani, Red Bororo and Sokoto Gudali breeds of cattle, respectively; AG and CA are defined as aggressive and calm behaviours.

exhibited by the breeds at the point of arrival at the abattoir. At this stage, the behaviours observed were AG and CA. On the other hand, Table 4 shows the breed influence on pre-slaughter behaviours after arrival (5 minutes post arrival). The behaviours recorded during this period were SR, LR, ST, RT, UR, DF and ET.

The results presented in Table 3 indicate that AG behaviour was significantly influenced by the WHF and RBR, with p=0.001, respectively, whereas no significant influence was observed for SKG (p=0.373). In contrast, CA behaviour was significantly influenced by WHF (p=0.001) and SKG (p=0.006), while no significant influence was recorded for RBR (p=0.137). The regression coefficients for AG behaviour were positive for the WHF (0.206), RBR (0.224) and SKG (0.086). Similarly, positive coefficients were observed for CA behaviour in WHF (0.235), RBR (0.135) and SKG (0.265). This indicates a positive association between the breeds and the respective behaviours. Furthermore, the post arrival (5 minutes after arrival) behaviours were differently influenced by the cattle breeds, as shown in Table 4. For SR behaviour, RBR and SKG breeds showed positive association (0.285 and 0.731, respectively) with significant influences (p=0.018 and p=0.001), whereas the WHF breed exhibited a negative association (-0.062) with no significant influence (p=0.523).

In the case of LR behaviour, WHF had a positive and significant influence (coefficient = 0.262; p = 0.008). Conversely, RBR and SKG showed negative coefficients (-0.781 and -0.193 respectively) and non-significant influences (p = 0.290 and p = 0.564).

For RT and ST behaviours, positive coefficients were observed across all the breeds. RT coefficients were 0.267, 0.213 and 0.086 for WHF, RBR and SKG, respectively, while ST coefficients were 0.224, 0.213 and 0.223 for the same breeds. RT behaviour was significantly influenced by WHF (p = 0.001) and RBR (0.045), but not

**Table 4.** Generalised linear model showing breed influence on behavioural responses of cattle observed after arrival of pre-slaughtered cattle at Bauchi Central Abattoir.

| Response | Variable | B | Standard error | Wald interval | | p-value |
|---|---|---|---|---|---|---|
| | | | | Lower | Upper | |
| SR (%) | (Intercept) | -1.100 | 0.414 | -1.911 | 0.289 | 0.008 |
| | WHF | -0.062 | 0.097 | -0.252 | 0.128 | 0.523 |
| | RBR | 0.285 | 0.120 | 0.050 | 0.519 | 0.018 |
| | SKG | 0.731 | 0.159 | 0.420 | 1.041 | 0.001 |
| LR (%) | (Intercept) | -1.980 | 0.478 | -2.916 | 1.045 | 0.001 |
| | WHF | 0.262 | 0.099 | 0.068 | 0.456 | 0.008 |
| | RBR | -0.781 | 0.738 | -2.226 | 0.664 | 0.290 |
| | SKG | -0.193 | 0.334 | -0.848 | 0.462 | 0.564 |
| RT (%) | (Intercept) | -1.076 | 0.276 | -1.617 | -0.535 | 0.001 |
| | WHF | 0.267 | 0.057 | 0.156 | 0.378 | 0.001 |
| | RBR | 0.213 | 0.107 | 0.005 | 0.422 | 0.045 |
| | SKG | 0.086 | 0.142 | -0.192 | 0.365 | 0.544 |
| ST (%) | (Intercept) | -0.585 | 0.227 | -1.029 | -0.140 | 0.010 |
| | WHF | 0.224 | 0.048 | 0.131 | 0.317 | 0.001 |
| | RBR | 0.213 | 0.086 | 0.045 | 0.382 | 0.013 |
| | SKG | 0.223 | 0.108 | 0.011 | 0.436 | 0.039 |
| ET (%) | (Intercept) | -1.382 | 0.560 | -2.480 | -0.284 | 0.014 |
| | WHF | -0.031 | 0.135 | -0.296 | 0.235 | 0.821 |
| | RBR | -0.067 | 0.313 | -0.681 | 0.547 | 0.831 |
| | SKG | -0.401 | 0.529 | -1.437 | 0.636 | 0.449 |
| DF (%) | (Intercept) | -2.459 | 0.664 | -3.762 | -1.157 | 0.001 |
| | WHF | 0.103 | 0.145 | -0.181 | 0.388 | 0.477 |
| | RBR | 0.352 | 0.187 | -0.015 | 0.718 | 0.060 |
| | SKG | 0.407 | 0.298 | -0.177 | 0.990 | 0.172 |
| UR (%) | (Intercept) | -1.475 | 0.349 | -2.159 | -0.790 | 0.001 |
| | WHF | 0.262 | 0.072 | 0.120 | 0.403 | 0.001 |
| | RBR | 0.224 | 0.132 | -0.035 | 0.482 | 0.090 |
| | SKG | -0.089 | 0.206 | -0.492 | 0.314 | 0.665 |

WHF, RBR and SKG referred to White Fulani, Red Bororo and Sokoto Gudali breeds of cattle, respectively; SR, LR, RT, ST, ET, DF and UR are defined as standing-and-ruminating, lying-and-ruminating, resting, standing, eating, defecation and urinating behaviours.

by SKG (p = 0.544). In contrast, ST behaviour was significantly influenced by all the breeds (p =0.001, 0.001 and 0.019 for WHF, RBR and SKG, respectively).

However, ET behaviour was negatively influenced by all the breeds, with coefficients of -0.031, -0.067 and -0.401 for WHF, RBR and SKG, respectively. Although these effects were not statistically significant (p = 0.821, 0.831 and 0.449). The negative trend may be attributed to the lack of feed supply by cattle owners and the absence of feed provision by abattoir workers.

Moreover, DF behaviour exhibited positive coefficients across all the breeds (0.103, 0.352 and 0.407 for WHF, RBR and SKG, respectively). Although non-significant effects were observed (p = 0.477, 0.060 and 0.172).

Contrary to the DF, UR was positively and significantly influenced by WHF (coefficient = 0.262, p = 0.009), positively but non-significantly influenced by RBR (coefficient = 0.262, p = 0.090), and negatively and non-significantly influenced by SKG (coefficient = -0.089, p = 0.665).

## DISCUSSION

Negative handling of animals often induces fear and aggressive behaviour, which may result in injuries to both

handlers and animals, increased losses in productivity and compromised welfare (Molale *et al*., 2017). When animals are frustrated, they exhibit some behavioural responses that serve as a replacement for the normal behaviours (Relić *et al*., 2012). Such behavioural changes can ultimately affect the overall physiological and welfare status of cattle (Cantor and Costa, 2022).

Calming behaviour is positive. Therefore, aggression is negative (Njisane and Muchen, 2017). The significant level and positive coefficients in aggressive behaviour of WF and RBR observed in the present study may be connected to an increase in serum cortisol and glucose levels, which correlate positively with animal temperament as reported by Moura *et al*. (2021). This is because, according to del Campo *et al*. (2021), individual temperament had a positive impact on all physiological indicators at different pre-slaughter stages.

Antanaitis *et al*. (2023) stated that many studies have characterised rumination as a herd-level indicator, forming the basis for significant and emerging benefits of breeding as well as reproduction itself. In the present study, the proportions for SR and LR were 16.46% and 7.30%, respectively, giving a combined total of 23.79%. This proportion of the behaviour followed RT (32.16%) and ST (41.19%). According to Džermeikaitė *et al*. (2025), rumination is an indicator of the health status of the cattle, with higher rumination associated with healthier animals.

When in their comfort zone, cattle spend almost 60% of their budget in laying, ruminating or sleeping. However, if the RT area is not comfortable, cattle spend most of the budgeting time ST on their feet (Relić *et al*., 2012). The ST behaviour (41.19%) obtained in the present study was found to be higher than the RT behaviour (32.16%). This might not be unconnected with the number of animals brought to the facility at almost the same time. Studies also revealed that floor type and housing system contribute to the time cattle spend at RT or ST (Haley *et al*., 2000; Relić *et al*., 2012).

Cattle spend most of their time lying down to rest, and therefore an increase in standing signifies discomfort in the environment (Ratnakaran *et al*., 2017). Ruminants are known to ruminate while rest-laying and this indicates their welfare (del Campo *et al*., 2021). Our result shows that only the WHF cattle breed differed in LR behaviour. Food deprivation was reported to influence the emotional status of the animal, leading to immeasurable character (Terlouw and Bourgue, 2022).

Furthermore, a study comparing ET and RT behaviours showed that RT (1.02) was averagely less compared with ET (5.16). This might be due to free access to the feed by the animals. This is contrary to this study, where ET (2.89%) was proportionally lower than RT (32.16%). This is because the animals in the study area (Bauchi Central Abattoir) were less or not supplied with feed at pre-slaughter lairage.

Ratnakaran *et al*. (2017) stated that urination and defecation are common natural physiological processes of The livestock, and the frequency of either urination or defecation varies with the factors affecting the livestock, like water intake, feed intake, type of feed, environmental temperature, disease condition, immunity of the animal and stresses.

## Conclusion

Pre-slaughter behaviours are influenced by the genetic makeup of the cattle breeds. The most exhibited behaviours at arrival and after (post arrival) were AG and ST. Among the breeds studied, WHF and RBR breeds exhibited a greater impact on pre-slaughter behaviours compared to the SKG. These findings highlight the role of breed-specific genetic factors in shaping animal responses prior to slaughter. Consequently, this study provides a foundation for future research aimed at exploring the relationship between pre-slaughter behaviours and post-slaughter meat quality. Understanding this connection could offer valuable insights for improving animal welfare practices and optimising meat production standards. Furthermore, the studies examining the effects of stocking density and modes of transportation on cattle pre-slaughter behaviours are recommended.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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