Searching for phenotypes to improve welfare in Avileña-Negra Ibérica beef cattle breed: preliminary results

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Abstract

Animal welfare is of big concern for the civil society, and we know that animal under stress is an animal with lack of welfare, and so, with losses in its productive life. The Avileña-Negra Ibérica (ANI) breed is a Spanish local beef cattle reared under extensive conditions. This breed has shown a large variability in their reactivity when exposed to common triggers of stress. The objective of this work was to establish a procedure to evaluate temperament in ANI calves in the post-weaning phase and estimate the repeatability of temperament indicators. Eighty data were recorded from 25 male calves under commercial conditions. The number of records per animal varied between three and four. Temperament indicators were flight time (FT) which is the time (in second) needed to cover a distance of 1.83 m. FT was recorded digitally, using a timing system with two infrared sensors (FarmTek, North Wylie, TX) or manually, using a conventional chronometer. In addition, two subjective scores were assigned: flight score (FS) measured in four categories and restraint score (RS) in five categories. The repeatabilities of measurements were 0.29, 0.55 and 0.26 for FT, FS and RS, respectively. The objective indicator (FT) showed lower repeatability than expected. The manual system tended to increase FT. Some discrepancies were observed in the inter-observer consistency.

Keywords: animal welfare, stress, behaviour, temperament, repeatability.

Introduction

Nowadays, animal welfare is of big concern for the civil society, and is increasing (Alonso, *et al.* 2020). Regardless the ethical issues, welfare is also a main priority for beef farmers because lack of welfare in an animal is caused by stress as the result of its reaction to internal or external factors such as high temperatures, diseases, social isolation or changes in social groups, handling and injuries (Salvin *et al.*, 2021) Stress affects any aspect of an the productive life of an animal as well as increases the maintenance requirements (Collier *et al.*, 2017) due to physiological changes resulting from disturbed homeostasis.

The reactions of animals when they are exposed to different sources of stress (social, handling environmental, etc) trigger an emotional response that changes their behaviour. Changes in behaviour generated as an emotional response to stressors is what is understood as the temperament of the animal (Burrow and Dillon, 1982, Grandin, 2000). Temperament is a very complex trait and comprise a number of attributes such as shyness, aggressiveness, sociability, avoidance, fear (Reale *et al.*, 2007). Poor temperament in an animal is a risk factor, an indicator of lack of welfare. Temperament affects production, reproduction, immunocompetency as well as meat quality therefore, it could be considered an indicator of poor performance to be selected against (Yu *et al.*, 2020).

Several measurements of temperament have been proposed to evaluate temperament in beef cattle, such as chute score (Tulloh, 1961), flight speed (Burrow *et al.*, 1988), exit score (Vertter et. al 2013), among others. All of these measurements are easy to record. All of them are an attempt to summarize all the different attributes of temperament. Except flight speed, the other two traits are subjective evaluations of temperament. Thus, the recording of these traits requires trained observers in order to obtain consistent measurements.

Calves from Avileña-Negra Ibérica (ANI), are an interesting population to understand temperament in animals. These animals show a large variability in their reactivity when they are exposed to a common stress factor (Meneses, *et al.*, 2022). Because of this variability, it is a trait of interest for the selection program of the breed.

he objective of this work was to set up a procedure to evaluate temperament in Avileña Negra Ibérica (ANI) calves at the Control Center of the Breed in the postweaning phase and to evaluate for the first time, the repeatability of these traits in this breed.

Material and methods

Data were recorded from twenty-nine male ANI calves every month, between 200 and 400 days of age. Animals were passed through the chute to be weighted in the Control Center of the Avileña-Negra Ibérica Breed. Data were taken under commercial conditions. Animals were handled in two different batches or groups. Depending upon the group, the number of controls per animal varied from three to four; three for group 1 and four in group 2 (Table 1).

The protocol to evaluate temperament comprised three measurements: flight time (FT), exit or flight score (FS) and chute or restraint score (RS). The FT is the time taken by an animal to cover a distance of 1.83m (6 feet distance). Since that distance is measured at exiting from the weighting chute, we refer to it as flying score. FT was taken in two ways; in the first recording, FT was manually measured with a chronometer (control 1 and 2); for the third and fourth recordings, data were automatically recorded with an infrared system (control 3 and 4). The infrared equipment (FarmTek, North Welie, TX) was made up of two wireless electric eyes that were turned on and off when the animal passed, and the time was registered in a timer console. The two subjective scores were FS and RS, with four and five categories, respectively. Categories for FS were; 1: walk, 2: trot, 3: canter and 4: run, the same categories as described by Vetters *et al.* (2013). RS was recorded in the weighting chute in five categories: 1: for quiet animals, 2: for animals with slow movements, 3: for animals with frequent movements with vocalization, 4: for animals with constant movements, lateral displacements and vocalization, and 5: for animals with violent movements, and continues intention to leave. Two observers recorded FS and RS. A total number of 80 observations were obtained (Table 1). In addition to total number of observations, Table 1 also show the distribution of number of observations in groups and control number.

Table 1. Number of animals by group and control number.

Group		G1	G2	Total
Nº animals		14	11	
Control	C1	14	11	25
	C2	14	11	25
	C3	14	8	22
	C4		8	8
Total		42	38	80

G: group or batch of management, C: control number.

Pearson correlations were obtained between successive controls for FT. Spearman correlations within and across observers were obtained for FS and RS between controls. These correlations are interpreted as a measurement of consistency between controls and observers. Remlf90 estimates of repeatability and correlations were obtained (Misztal, *et al.*, 2009) in a multi-trait model where the animal effects were assumed to be independent within traits. Covariances between traits were assumed. In addition to random effects, the models included age of calves at recording as covariates and batch (3 levels) for all traits, in addition, observer (2 levels) was included for FS and RS, and recording device (2 levels) for FT. The repeatability was estimated as the ratio between the variance associated to the animal and the total variance.

Results and discussion

On average ANI, calves took 1,5 seconds (0,618) to cover the 1.83 m of distance. The average FS and RS were 1.89 (0.79) and 2.26 (0.97), respectively. We analyzed the inter-observer consistency for FS and RS. Results are shown in Table 2 and Table 3, respectively. As it can be observed in both tables some discrepancies between observers occurred. For FS both observers used all levels of the scale from 1 to 4, however only observer 1used the whole scale for RS. The number of discrepancies per traits were 9 out of 80 (Table 2) and 15 out of 80 (Table 3) for FS and RS. Thus, it is clear than evaluation of RS is more complex than FS and it seems to involve a larger degree of subjectivity than FS. In general, observer 2 tended to assign higher scores for RS than observer 1 while the opposite occurred for FS.

Correlations between consecutives measures of FS and RS are shown in Table 4. The magnitude of correlations between subsequent measures for FS were much higher than the correlation for RS. This was so, on average as well as within observer. In both traits, the correlations between controls two (C2) and three (C3) were higher than the ones between control one and two. Control 1 was a new experience for the calves, while C2 and C3 involved a learning process for calves (Kamel *et al.*, 2006; Vetters *et al.*, 2013)

Table 2. Contingency matrix for categorical classification Flight Score by observer.

		Cat Observer 2			
		1	2	3	4
Cat Observer 1	1	26	2		
	2	2	36	4	
	3			12	
	4			1	1

Table 5 shows estimates of repeatability and correlations between traits. Repeatabilities were 0.29, 0.55 and 0.26 for FT, FS and RS, respectively. The objective indicator, FT, showed lower repeatabilities than expected according to literature, but there are a number of factors that may be causing this result. Firstly, the sample size is very small; secondly, in order to measure FT, we used two different systems, manual vs automatic and the correlation between them were lower than expected (0.207). The manual system overestimated FT (1.77 vs 1.07 sec. for manual versus automatic systems.) In addition to those reasons, we have to take into consideration that the animals were growing while the trials were performed therefore, it is not strange that the time required by an animal to cover the same distance decreases over time what affect variability. In any case, the repeatability for FT was lower than others published in the literature 0.40 (Kamel *et al.*, 2006) and 0.5 (Vetters *et al.*, 2013) Correlation between traits are also shown in Table 4. Correlation between FT and FS was very high and negative (-0.98). Thus, animals that took more time to cover the distance also received a lower FS. This finding if confirmed, is a positive result because it means that both, FT and FS are pointing out toward the same trait. From a recording point of view, it could help to record more data in the absence of an automatic recording system. The correlations between FT and RS, and between FS and RS were in the expected sense and very high, -0.95 and 0.92. respectively. These results may suggest that all these temperament indicators are measuring the same trait however, the magnitude of correlations between FT and FS with RS are much higher than estimates of genetic

Table 3. Contingency matrix for categorical classification Restraint Score by observer.

		Observer 2			
		1	2	3	4
Observer 1	1	18	3		
	2	3	24	3	
	3		2	19	
	4			3	8
	5				1

Table 4. Correlations between subsequent evaluations of Flight speed (FS) and restraint score (RS) by observer and on average.

	FS		RS	
Observers	**C1-C2**	**C2-C3**	**C1-C2**	**C2-C3**
1	0.542	0.632	0.052	0.152
2	0.426	0.621	0.005	0.134
Average	0.489	0.635	0.052	0.149
N	25	22	25	22

Table 5. Repeatabilities of the traits (diagonal), and correlations between traits (off diagonal).

	FT	**FS**	**RS**
FT	0.29	-0.98	-0.95
FS		0.55	0.92
RS			0.26

FT: flight time, FS: flight score and RS: restraint score.

correlations between those temperament indicators found in the literature (Kadel *et al.*, 2006). Kadel *et al.* (2006) found a genetic correlation between FT and FS with of -0.37 and 0.39, respectively.

Conclusions

Our main objective was to set up a protocol to evaluate temperament in this breed as an indicator of welfare. Regardless the magnitude of repeatabilities our main objective was achieved. However, taking into consideration the sample size of the assay, we cannot draw many conclusions from the results. Moreover, we need to understand if results are due to the protocol in itself or caused by changes in the animals to deal with stress when they are exposed several times to the same management/stressor. The consistency between observers needs to be periodically revised. We are now recording more data as well as additional information to understand the underlying physiological processes in response to stress.

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