Does the scan sampling method reflect the actual behavioral frequency of pigs?

Geyssane Farias de Oliveira[1], Fabiana Ribeiro Caldara[2], Adila Vasconcelos Marcon[3], Luciana Foppa[4], Jaqueline Murback Bráz[5], Matheus Portela Pinho[6]

[1]Universidade Federal da Grande Dourados -UFGD. E-mail: geyssanesousa@hotmail.com
[2] Universidade Federal da Grande Dourados -UFGD. E-mail: fabianacaldara@ufgd.edu.br
[3]Universidade Federal da Grande Dourados- UFGD. E-mail: Adilateixeira@hotmail.com
[4]Universidade Estadual de Londrina – UEL. E-mail: lufoppa@yahoo.com
[5]Universidade Federal da Grande Dourados - UFGD. E-mail: braz_jak@hotmail.com
[6]Universidade Federal da Grande Dourados – UFGD. E-mail: matheusportelapinho@hotmail.com

Abstract: Animal behavior studies employ various methodologies to collect the frequency of activities during observations. The use of video recording technologies as a way to facilitate the observation of several animals at the same time, eliminate doubts among observers, and optimize the observation time contributes to proper analysis of data. The intervals between observations in behavioral studies vary according to the animal species and purpose of the study. This research aimed to study the behavior of pigs in the growth phase using different observation intervals (continuous, 5, and 10 min). In a pen with 46 animals, 14 female and male pigs were identified, which were observed using the focal animal sampling method for 5 h. The treatments were the observations intervals, namely: T1 = continuous, T2 = every 5 min, and T3 = every 10 min. It was seen that, among the behaviors analyzed during the experiment, the different observation intervals did not impact the time the animals spent in the activities.

KEYWORDS: ethology, methodology, pig farming

Introduction

Behavior is the part of an organism through which it interacts with the environment and can be an important indication of animal well-being conditions, particularly in confinement. Behavioral assessment has the advantage of being a non-invasive (Dupjan et al. 2008), quick, and practical technique (Poletto 2010) that measures the status of an individual in relation to the environment (Broom 1991).

Behavioral observations are used to quantify biological responses and must be validated and selected according to the specific goals of the study. Several reviews on animal behavior study methods have been published (Arrington 1943; Altmann 1974; Zuberbühler and Wittig, 2011), however, there are still doubts concerning which the most appropriate ones are. Among the methodologies most commonly employed in researches on pigs is scan sampling and focal animal sampling.

Scan sampling (SC) consists in recording the behaviors of all individuals sighted during pre-established sampling periods spaced with fixed intervals (Altmann 1974; Cullen Jr. and Valladares-Pádua 1997). Among the implicit advantages of the method is the possibility of recording different behaviors performed simultaneously by different individuals.

Focal animal (FA) sampling consists in observing a single individual of the group for a pre-determined sampling period and recording all activities performed (Altmann 1974). Data collection may be continuous, while writing down the duration of each behavior, or instantaneous, splitting the sampling period into subperiods of seconds or minutes during which the behavior seen is written down with intervals between the periods (Cullen Jr. and Valladares-Pádua 1997). Instantaneous sampling is normally used as it facilitates assessments. Among the advantages of this method, besides the greater implicit randomness, is the possibility of recording nearly unnoticeable behaviors (or performed when the individuals get away from the group), the sequences of behaviors, and data analysis either by frequency (percentage) or by duration (in hours or minutes) (Setz 1991).

Regardless of the behavioral assessment method chosen, when instantaneous sampling is chosen, in which the individuals are sighted during pre-established sampling periods, the frequency with which each behavior listed in an ethogram is observed is determined against the total volume of observations. In order for this frequency (%) to be transformed into time spent with a given behavior, it must be considered that the animal remained performing that activity observed at a certain time until the next sampling period. For example, in a hypothetical instantaneous sampling with 10-min intervals, animal 1 was eating at 7:00 A.M. and performing an exploratory activity at 7:10 A.M. It is then assumed this animal remained eating during this interval of time. Questions then arise concerning the reliability of such inference. Does the instant assessment method reflect the actual behavior of pigs over time? If so, what pre-established interval of time would be the most adequate?

This way, this study aimed to compare the results of the behavioral assessment of pigs in the growth phase employing the continuous and instantaneous methods, the latter using different pre-established intervals (5 and 10 min).

Material and Methods

The experiment was carried out in September 2015 in a commercial pig farm in the city of Dourados, MS, Brazil. The city is located at 22°13'18.54" S and 54°48'23.09" W with mean altitude of 430 m. The climate in the region, according to the Köppen classification, is humid mesothermal (Cwa) with wet summers and dry winters featuring mean annual rainfall of 1,500 mm and mean annual temperature of 22 °C. The animals were housed in a masonry barn (100.0 m x 8.0 m) containing collective pens with 84.0 m^2 of total area equipped with a water pond, automated feeding troughs, and nipple drinking troughs. The experimental pen featured environmental enrichment objects made with PVC pipes 25 cm in length and 200 mm in diameter connected to four 65 cm lengths of nontoxic clear plastic hose, which allowed the pigs to perform the chewing exploratory activity. Two objects were placed in the pen at the pigs' eye height to facilitate eye contact.

The experiment used 14 pigs of the same commercial linage, both females and boars, whose mean initial weight was 25±2 kg. The animals were identified with different symbols on the sides and back using a marking stick.

The assessments were performed using images obtained through video cameras placed at the upper part of the pen and directly connected to a device equipped with a video capture card and LCD monitor. The images were recorded from 9:00 A.M. to 2:00 P.M. for a total of five hours of continuous recording per day during the three-day experimental period. After the images were recorded, they were stored in the monitoring device's memory and later used in the assessments.

An ethogram was created for the behavioral. In order to build the frequency histogram of the behavioral activities, the images were visualized using the video software CyberLink. The footage was analyzed continuously, in 5-min intervals, and in 10-min intervals. The data were written down in a spreadsheet featuring the number of the animal and the activities performed.

Pig behavior was analyzed individually and each animal was considered an experimental unit.

The mean values concerning each behavior in the ethogram were determined in minutes and as percentages of the total time. In each observation day, 60 events were recorded for 5-min intervals and 30 events for 10-min intervals. For each event, it was considered that the pig exerted that particular behavior until the next event (5 or 10 min) (Machado et al., 2017).

The time in minutes the animals spent in each assessed behavior was calculated based on the average of 14 animals per treatment. The frequency was considered as a percent of the total evaluated time. The values presented were the average number of a given behavior over three days.

The data had non-parametric behavior and the analysis was performed using Kruskal-Wallis test at 5% probability using the statistical software R.

Results and Discussion

The different methods or observation intervals did not impact ($p>0.05$) the frequency (%) or time in minutes the animals spent in any of the behaviors assessed (Table 1).

Table 1. Mean time in minutes, frequency (%), mean and standard deviation, and median of behavioral observations of pigs in the growth phase with different observation intervals.

Behaviors	Observation Intervals						p-value
	Continuous		5 minutes		10 minutes		
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median	
Sleeping/resting	175.86±40.85 (58.62%)	167.5	174.92±50.71 (58.31%)	163.0	176.79±50.5 (58.93%)	163.5	0.997^{ns}
Eating	43.6±26.70 (14.53%)	47.0	43.8±27.36 (14.60%)	47.5	46.50±29.56 (15.50%)	45.00	0.932^{ns}
Nuzzling/exploring	23.79±19.46 (7.93%)	18.0	25.9±20.62 (8.62%)	18.5	24.72±17.46 (8.24%)	25.00	0.932^{ns}
Interaction with the object	31.50±18.30 (10.50%)	31.5	32.85±16.95 (10.95%)	37.0	30.63±19.10 (10.21%)	30.0	0.979^{ns}
Drinking	10.78±5.53 (3.60%)	11.0	9.28±6.69 (3.07%)	3.0	8.42±6.75 (2.81%)	6.00	0.349^{ns}
Agonistic behavior	4.78±4.80 (1.60%)	4.0	5.28±6.69 (1.76%)	3.0	5.79±7.60 (1.93%)	0	0.905^{ns}
Sexual behavior	0.40±1.34 (0.14%)	0	0.50±1.60 (0.17%)	0.0	0 (0%)	0	0.340^{ns}
Others	9.2±9.62 (3.08%)	6.5	7.64±6.81 (2.52%)	5.5	7.14±8.25 (2.38%)	5.0	0.622^{ns}
TOTAL	300		300		300		

NS= not significant to the level of 5% by the test of Kruskal-Wallis

The hypothesis of the present research was that when the behavioral frequency (%) assessed by the scan sampling method using different intervals of time were transformed into minutes, these values might differ from those observed continuously since, for every time a given behavior is observed using this method, it is assumed the animal performed it until the next observation, i.e., for the following 5 or 10 min,

which might not represent the actual time spent in each behavior. However, when the transformation was made, no difference was found between the continuous and scan methods using the intervals at hand.

Nonetheless, when the 10-min observation interval was used, sexual behavior was not observed, which could lead to the conclusion that it had not occurred at any time. However, using continuous observation or every 5 min, this behavior was recorded for some animals, although at a low frequency.

Massari et al. (2015) employed the focal animal methodology proposed by Altmann (1974) with 15 min of observation and 3-min intervals to assess typical behaviors (standing, lying, and eating) and continuous observation for dynamic behaviors (social interaction and agonistic, exploratory, and stereotypic behaviors) to compare the behavior of pigs in the growth phase and finishing phase using the "wean to finish" system. That methodology suggests the intervals and observation period must be determined according to the characteristics to be collected during the research. It is likely that, for specific, short-term behaviors, continuous assessments are more appropriate.

Bowden (2008) observed the behavior of pigs over 4 h with intervals of 1, 2, 3, 5, 10, 15, 30, and 60 min and found a difference in the activity of drinking water for intervals above 5 min, but no difference for the other behaviors. Jacobs and Wiggins (1982) stated that intervals between observations above 20 min lead to poor data estimates for the overall observation period of pigs. Researches on bovine behavior concluded that the main behavior patterns such as grazing can be observed with reasonable precision in intervals of up to 30 min, however, the number of animals must be larger (Hull et al. 1960). Cox and Cooper (2001), while studying behavioral responses of recently weaned piglets in different commercial systems (indoor and outdoor) employed scan sampling with 2-min intervals for the short period of 20 min.

Conclusions

Assessments with intervals of time of up to 10 min adequately reflect the actual behavioral distribution of pigs. For specific, short-term behaviors, continuous assessment or scan sampling with shorter intervals of time are recommended.

Acknowledgements

Fundect for the support.

References

Altmann J. (1974) Observational study of behavior: sampling methods. Behaviour 49:227-267

Arrington RE. (1943) Time sampling in studies of social behavior: a critical review of techniques and results with research suggestions. Psychological Bulletin 40:81

Bowden JM, Karriker LA, Stalder KJ et al. (2008) Scan Sampling Techniques for Behavioral Validation in Nursery Pigs. Animal Industry Report AS 654, ASL R2342

Broom DM. (1991) Animal welfare: concepts and measurement. Journal of Animal Science 69: 4167-4175

Cox LN, Cooper JJ. (2001) Observations on the pre- and post-weaning behaviour of piglets reared in commercial indoor and outdoor environments. Animal Science 72:75-86

Cullen JR, Valladares-padua C (1997) Métodos para estudos de ecologia, manejo e conservação de primatas na natureza. In: Valladares-Padua C, Bonder RE, Cullen JR. Editors: Manejo e conservação da vida silvestre no Brasil. Belém: Sociedade Civil Mamirauá/CNPq 239-269

Düpjan S, Schön P, Puppe B, Tuchscherer A, Manteuffel, G. (2008) Differential vocal responses to physical and mental stressors in domestic pigs (Sus scrofa). Applied Animal Behaviour Science 114:105-115

Hull JL, Lofgreen GP, Meyer JH. (1960) Continuous versus intermittent observations in behavior studies with grazing cattle. Journal of Animal Science 19:1204-1207

Jacobsen NK, Wiggins AD. (1982) Temporal and procedural influences on activity estimated by time-sampling. Journal of Wildlife Management 46:313–324

Machado SP, Caldara FR, Foppa L, et al. (2017) Behavior of Pigs Reared in Enriched Environment: Alternatives to Extend Pigs Attention. PLos 0168427. https://doi.org/10.1371/journal.pone.0168427

Massari JM, Curi TMR, Moura DJ, et al. (2015) Características comportamentais de suínos em crescimento e terminação em sistema "wean to finish". Eng. Agríc., Jaboticabal 35:646-656

Poletto, R. (2010) bem-estar-estar animal.Suíno.com, Tangará, 5 abr. 2010. Série especial bem-estar http://www.suino.com.br/SanidadeNoticia.aspx?codigoNot=zSoHh5f8w90=&title=SERIE+ESPECIAL:+BEM Acesso em: 28/08/2016

Setz EZF. (1991) Métodos de quantificação de comportamento de primatas em estudes de campo. In: Rylands AB, Bernardes AT. Editors: A Primatologia no Brasil. Belo Horizonte: Fundação Biodiversitas 3

Zuberbühler K, Wittig RM. (2011) Field experiments with non-human primates: a tutorial. In: Setchell JM, Curtis DJ. Editors: Field and Laboratory Methods in Primatology: A practical guide (2nd ed.). New York: Cambridge University Press; 207-224