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Artículo de investigación

Is there a correlation between the body condition score and the pregnancy rate of Nelore cows submitted to FTAI in the Eastern Amazon?

¿Existe correlação entre o escore de condição corporal e a taxa de prenhez de vacas nelores submetidas a IATF na Amazônia Oriental?

¿Existe una correlación entre el puntaje de condición corporal y la tasa de preñez de las vacas Nelore sometidas a IATF en la Amazonía Oriental?

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Abstract

The aim was to assess whether there is a correlation between the body condition score (BCS) and the pregnancy rate of cows submitted to fixed-time artificial insemination (FTAI) on Ilha do Marajó, Pará, in the Eastern Amazon. 159 female bovines were analyzed, submitted to FTAI, selected through clinical and gynecological evaluation, being considered clinically healthy and cyclic cows, of the *Bos taurus indicus* breed, from an extensive system property, in the municipality of Cachoeira do Arari, on Ilha do Marajó, Pará. The qualitative research method was used, with the objective of analyzing the correlation between the pregnancy rate and the BCS of this lot. Of the 159 women submitted to FTAI, 86 had a positive pregnancy diagnosis, obtaining a pregnancy rate of 54.08% and the number of pregnant animals was 73, or 45.92%. There was a positive and significant correlation (r=0.167) between BCS and pregnancy rate ($p<0.05$). Thus, the study has enabled

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us to conclude that there was a positive interdependence between BCS and the gestational diagnosis. Thus, the effect of body condition on pregnancy rate in cows raised in the Eastern Amazon is confirmed.

Keywords: *Bos taurus indicus; females; extensive system.*

Resumo

Objetivou-se avaliar se existe correlação entre o escore de condição corporal (ECC) e a taxa de prenhez de vacas submetidas a inseminação artificial em tempo fixo (IATF) na Ilha do Marajó, Pará, na Amazônia Oriental. Foram analisadas 159 fêmeas bovinas, submetidas à IATF, selecionadas mediante avaliação clínica e ginecológica, sendo consideradas vacas clinicamente saudáveis e cíclicas, da raça *Bos taurus indicus*, de uma propriedade de sistema extensivo, no município de Cachoeira do Arari, na Ilha do Marajó, Pará. Foi utilizado o método de pesquisa qualitativo, com objetivo de analisar a correlação entra a taxa de prenhez e o ECC, deste lote. Das 159 fêmeas submetidas a IATF, 86 apresentaram diagnóstico de gestação positivo, obtendo-se taxa de prenhez de 54,08% e o número de fêmeas vazias foi de 73, ou seja, 45,92%. Houve correlação positiva (r = 0,167) e significativa entre a ECC e a taxa de prenhez (p<0,05). Desta forma, o estudo permitiu concluir que houve uma interdependência positiva entre a ECC e o diagnóstico gestacional. De modo que constata o efeito da condição corporal sobre a taxa de prenhez em vacas criadas na Amazônia Oriental.

Palavras-chave: *sistema extensivo; fêmeas; Bos taurus indicus.*

Resumen

Objetivo evaluar si existe correlación entre el índice de condición corporal (BCS) y la tasa de preñez de vacas sometidas a inseminación artificial a tiempo fijo (IATF) en Ilha do Marajó, Pará, en la Amazonía Oriental. Fueron analizadas 159 hembras bovinas, sometidas al FTAI, seleccionadas mediante evaluación clínica y ginecológica, siendo consideradas vacas clínicamente sanas y cíclicas, de la raza *Bos taurus indicus*, de una propiedad de sistema extensivo, en el municipio de Cachoeira do Arari, en Ilha do Marajo, Pará. Se utilizó el método de investigación cualitativo, con el objetivo de analizar la correlación entre los taxones preñados y el CEC, de este lote. De las 159 mujeres sometidas a IATF, 86 tuvieron diagnóstico de embarazo positivo, obteniendo una tasa de embarazo de 54,08% y el número de gestantes fue de 73, o 45,92%. Hubo una correlación positiva y significativa (r=0,167) entre ECC y taxones de preñez (p<0,05). Así, el estudio permitió concluir que hubo una interdependencia positiva entre la CEC y el diagnóstico gestacional. Así, se confirma el efecto de la condición corporal sobre los taxones de gestación en vacas criadas en la Amazonía Oriental.

Palabras clave: *Bos taurus indicus; hembras; sistema extensivo.*

Introduction

Cuntless strategies have been widely used, aiming at an adequate nutritional and reproductive management, in which the maximum use of all the genetic potential of the animals is aimed [(1)]. Brazil has a bovine herd with more than 193.4 billion animals (Instituto Brasileiro de Geografia e Estatistica - IBGE) [(2)], about 95% of which are raised in an extensive system, where the pasture undergoes great quantitative and qualitative variation throughout the year, which is one of the main factors that affect the body condition and weight of the animals [(3)] interfering with the productive and reproductive efficiency of bovine females destined for meat production [(4)].

The introduction of an adequate nutritional management takes on a fundamental role. The body condition score (BCS) is a subjective measure, based on the classification of animals according to muscle mass and fat coverage, through a visual and/or tactile assessment, being considered an easy and inexpensive method, and provides a sufficiently reliable estimate of body energy reserves in *Bos indicus* cows [(5, 6)]. BCS influences production, affecting calf weight at weaning, and reproduction, affecting pregnancy rate [(7, 8, 9)].

Regarding reproductive management, fixed-time artificial insemination (FTAI) has been increasingly used [(10, 11, 12, 13, 14)]. This biotechnique aims to synchronize the ovulation of bovine females after the administration of drugs on predetermined days, so that it is possible to synchronize a batch of cows and inseminate them on the same day, without the need for estrus observation [(15, 16, 17, 18)].

Based on this information, this study aimed to assess whether there is a correlation between the BCS and the pregnancy rate of cows submitted to FTAI on Ilha do Marajó, Pará, in the Eastern Amazon.

Material and methods

Animals and experimental location

A total of 159 female Nellore (*Bos taurus indicus*) cattle, aged 5 years and average weight of 350 ± 19.5 kg, were used. The experiment was carried out from April to July 2020, on a rural property in the municipality of Cachoeira do Arari, on Ilha Marajó, Pará state. The climate of the municipality is classified as Ami according to Köppen and Geiger [(19)], with an average temperature of 27.3 °C and an average annual rainfall of 2,369 mm.

Experimental design

The females were selected through clinical and gynecological evaluation, being considered clinically healthy and cyclic cows. The body condition score (BCS) of each animal was also evaluated, as described by Ayres *et al.* [(5)] and Torres *et al.* [(20)] (1 very thin .... 5 obese). All females

were raised in an extensive system, with grasses native to the region, such as canarana-erecta-lisa (*Echinochloa pyramidalis*), taboquinha (*Panicum laxum*), Andrequicé (*Leersia hexandra*), goat's beard (*Aristida longiseta*) and mineral salt and with access to water ad libitum. Regarding sanitary management, all cows were inoculated against foot-and-mouth disease and brucellosis.

Hormonal protocol

After selection, the cows were submitted to the hormonal protocol and FTAI. The hormonal protocol lasted 10 days and was divided into four stages (Day 0 - D0, Day 8 - D8, Day 10 - D10 and Diagnosis of Pregnancy - DG), being used on D0 intravaginal progesterone implant (PRIMIER®) associated to estradiol benzoate (Ric-be® - 2 mL), as described below. On D8, the P4 Implant was removed + 1 mL of Ric-be® + 0.3 mL of ECP® + 1.5 mL of Prolise® + marking of the females with a stick ink in the sacral region. On day 10, FTAI was performed 44 h after implant removal, where semen from three bulls was used, two of the Angus breed and one of the Nelore breed, being used randomly in each animal, previously chosen by the person responsible for the animals. On D10, Fixed-Time Artificial Insemination (FTAI) was performed (Figure 1).

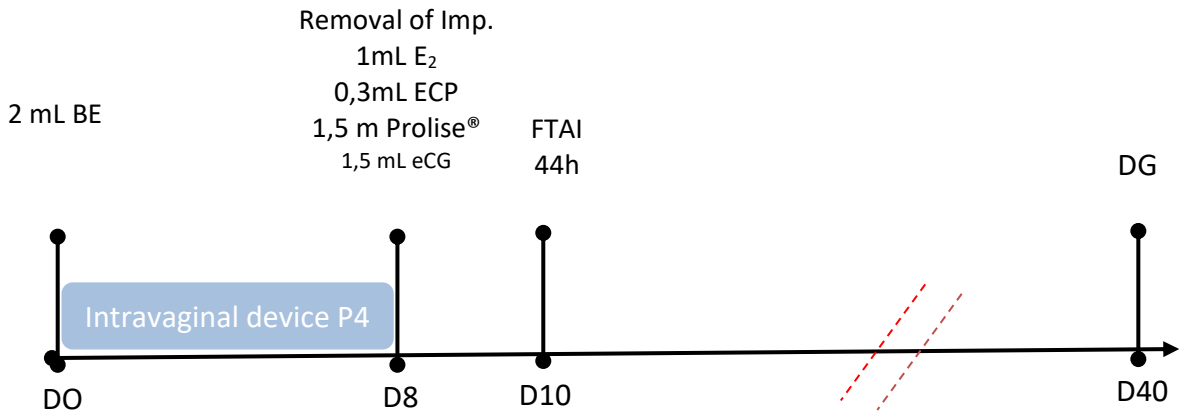

Figure 1. Schematic drawing of the established artificial insemination protocol. E2 = estrogen; ECP = Estradiol Cypionate; FTAI = fixed-time artificial insemination; PD = pregnancy diagnosis.

The pregnancy diagnosis was done by using ultrasound (Mindray®, DP-10 VET), 30 days after the FTAI, and the presence of a viable embryo with a heartbeat indicated pregnancy.

Pregnancy rate

The pregnancy rate was calculated based on the following formula:

PR = NP/NCS

On what:
PR = Pregnancy rate; NP = number of pregnant cows; NCS = number of cows studied.

Statistical analysis

Data were organized in Microsoft Office® Excel 2018 spreadsheets. Descriptive statistics were performed using the software R version 16.8, as well as Pearson's correlation by biserial point at 5% significance.

Results and discussion

Of the 159 females submitted to FTAI, 86 had a positive pregnancy diagnosis, obtaining a pregnancy rate of 54.08% and the number of empty females was 73, that is, 45.92%. There was a positive (r = 0.167) and significant correlation between BCS and pregnancy rate (p<0.05) (Table 1). This can be explained as a result of the greater accumulation of lipids in cows, and, consequently, a greater energy reserve, which are described as guarantees of the animal's body metabolism, which favors the secretion of hormones that make up the hypothalamic-pituitary axis, promoting the release of gonadotropin-releasing hormone (GnRH) by the hypothalamus and the production of follicle-stimulating hormone (FSH) and luteinizing hormone (LH) by the anterior pituitary, which are important in follicular growth and ovulation [21, 22]. Thus, when the FTAI is performed on females with an ECC greater than 2.75, the efficiency of the technique becomes more accurate and the financial gains are greater [23].

Table 1. Pearson's correlation between BCS and Pregnancy variables in Nelore cows, Cachoeira de Arari, Marajó, Pará, Brazil.

Variable	BCS	Pregnancy	Empty	P-value
N	159	159	NE	NE
N (%)	NE	86 (54,08%)	73 (45,92%)	NE
Correlação de Pearson	1	0,167**	NE	0,035

Note: p<0,05 indicates statistical difference. ** positive correlation. NE = not evaluated.

Moretto *et al.* [24], Bryk Filho *et al.* [25] warn that the nutritional status directly affects the reproductive indices of the herd. Furthermore, BCS directly influence the pregnancy rate of animals raised in an extensive system, as they tend to reduce cyclicity, as described by Michael *et al.*, [26]. This fact was evidenced in the cows of the present study, as the empty cows had lower body score indexes than the pregnant animals.

Bovine females that presented an ECC greater than 2.75 (scale from 1 to 5) had better pregnancy rates (Figure 2). Therefore, the nutritional condition of the females affected the

pregnancy rate in the herd studied. These results support what was described by Valle *et al.* [27], Meneghetti; Vasconcelos, [28] and Costa *et al.* [29]. Some authors point out that a good body condition score influences pregnancy rates in cows submitted to FTAI [22, 23, 30, 31, 32].

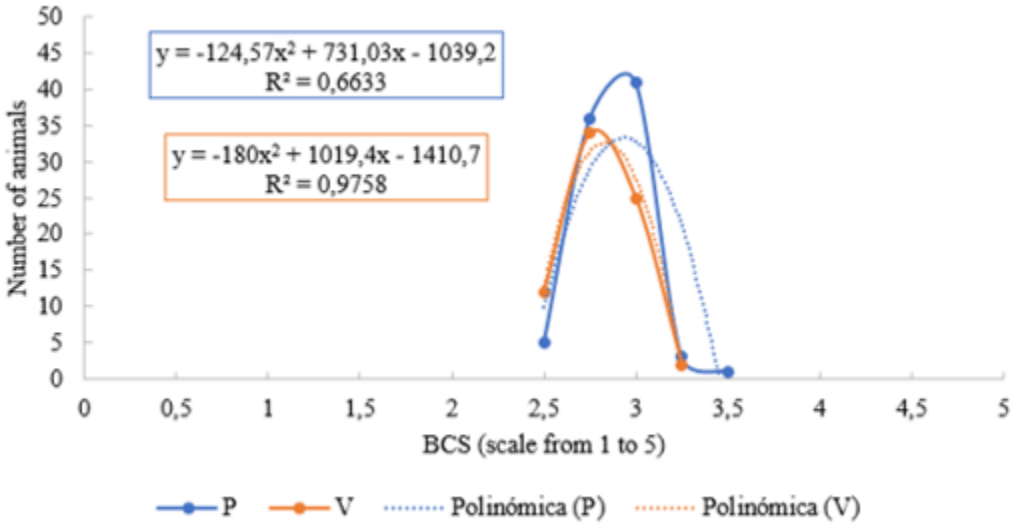

Figure 2. Linear regression of BCS according to the number of pregnant and empty animals. E = empty; P = pregnancy.

In this study, cows with BCS ≤2.75 had a higher rate of empty cows, that is, 5.74% more cows submitted to FTAI did not develop pregnancy. When the BCS was >2.75, the cows had a pregnancy rate 25% higher than the number of empty cows.

Corroborating the results obtained in this study, Brondani *et al*. [33] found that cows with BCS ≥2.75 had better pregnancy rates. Carvalho *et al.* [34] also state that females with an ECC between 3 and 3.5 had better pregnancy rates, with 59.4% and 54.8%, respectively. Torres *et al.* [20] point out that an increase of 0.5 units in the BCS can provide a 39% increase in the possibility of pregnancy.

With similar results to the present study, Santos *et al*. [35] and Sonohata *et al*. [36] also describe that the ECC is linked to the pregnancy rate, and it is observed that females tend to have better conception rates with adequate ECC.

With results close to those observed in the present study. Bo *et al.* [37] and Vale *et al.* [31] showed that cows with BCS >2.5 showed better response rates to hormonal treatment and pregnancy rate. Baruselli *et al.* [21] pointed out that Nelores cows with BCS lower than 3.0 had low conception rates. Monteiro and Viana [38] describe better pregnancy rate indices in cows with

an BCS greater than 2.5. Contrary to the results achieved in this study, Meneguetthi *et al.* [28] showed that there was no influence of the BCS on the pregnancy rate in Nellore females.

Conclusion

It is concluded that there was a positive correlation between the BCS and the pregnancy rate, with an effect of body condition on the pregnancy rate in cows raised in the Eastern Amazon, and, therefore, the nutritional status of the females at the moment should be taken of the hormonal protocol and the FTAI.

References

1. Cartros FC, Fernandes H, Leal CLV. Sistemas de manejo para maximização da eficiência reprodutiva em bovinos de corte nos trópicos. Veterinária e Zootecnia, 2018; 25 (1): 041-061.

2. IBGE - Instituto Brasileiro de Geografia e Estatística. 2020**.** Disponível em: www.agenciadenoticias.ibge.gov.br. Acesso em: 11 de Jan de 2021.

3. Hartmann W, Machado HAS. Influência do escore corporal sobre a taxa de prenhez de vacas Nelore no Estado do Tocantins. Brazilian Journal of Animal and Environmental Research (BJAER), 2022; 5 (1): 2-5.

4. Sousa RGB. et at. A importância do manejo nutricional em novilhas Nelore submetidas a protocolos de indução de puberdade e IATF. Belo Horizonte: Revista Brasileira de Reprodução Animal, 2017; 41 (1): 371.

5. Ayres H, Ferreira RM, Torres-Junior JR, Dem´etrio CGB, Lima CG, Baruselli OS. Validation of body condiction score as a predictor of subcutaneous fat in Nelore (*Bos indicus*) cows. Livestock Science, 2009; 123 (2): 175–179.

6. Silveira DD, Souza FRP, Brauner CC, Ayres DR, Silveira FA, Dionello NJ, Boligon AA. Body condition score of Nelore cows and its relation with mature size and gestation length. Livestock Science, 2015; 175 (2015): 10–17.

7. Sales JN, Crepaldi GA, Girotto RW, Souza AH, Baruselli PS. Fixed-time AI protocols replacing eCG with a single dose of FSH were less effective in stimulating follicular growth, ovulation, and fertility in suckled-anestrus Nelore beef cows. Animal Reproduction Science, 2011; 124 (May 1-2): 12–18.

8. Sa Filho MF, Penteado L, Reis EL, Reis TA, Galvao KN, Baruselli PS. Timed artificial insemination early in the breeding season improves the reproductive performance of suckled beef cows. Theriogenology, 2013; 79 (4): 625–632.

9. Pfeifer LF, Castro NA, Neves PM, Cestaro JP, Siqueira LG. Development and validation of an objective method for the assessment of body condition scores and selection of beef cows for timed artificial insemination. Livestock Production Science, 2017; 197 (March 2017): 82–87.

10. Silva FPD, Neves KAL, Correa FR, Silva LK, Batista HR, Silva WC, ... Minervino AHH. Follicular Dynamics and Pregnancy Rate in Nellore Heifers Submitted to Fixed-Time Artificial Insemination Protocols (FTAI). Veterinary Sciences, 2022; 9(8): 377.

11. Bó GA, Huguenine E, De La Mata JJ, Núñez-Olivera R, Baruselli PS, Menchaca A. Programs for fixed-time artificial insemination in South American beef cattle. Animal Reproduction, 2018; 15 (1): 952-962.

12. Oliveira BS, Silva KZ, Batista HR, da Silva WC, Júnior RNCC. Estudo retrospectivo das taxas de prenhez obtidas com uso de protocolos de inseminação artificial em tempo fixo (IATF) em vacas suplementadas com hormônio liberador de gonadotrofina (GNRH)–Mini Revisão. Brazilian Journal of Development, 2021; 7(12): 119023-119031.

13. Silva MAN, Mello MRB, Palhano HB. Inseminação artificial e inseminação artificial em tempo fixo em bovinos. Revista Científica, 2021; 23 (45): 79-97.

14. Lazarini IS, Paula Santos U, Vinhote BP, Silva WC, Júnior RNCC. Prenhez em novilhas Nelore induzidas à puberdade, criadas na Amazônia Oriental. Brazilian Journal of Development, 2021; *7* (12): 119012-119022.

15. Baruselli OS, Sales JN, Sala RV, Vieira LM, Sá Filho MF. History, evolution and perspectives of timed artificial insemination programs in Brazil. Animal Reproduction, 2012; 9 (3): 139–152.

16. Yokoo MJ, Magnabosco CU, Rosa GJM, Lôbo RB, Albuquerque LG. Características reprodutivas e suas associações com outras características deimportância econômica na raça Nelore. Arquivo Brasileiro de Medicina Veterinária e Zootecnia, 2012; 64 (1): 91–100.

17. Day MLL, Nogueira GP. Management of age at puberty in beef heirfes to optimiaze effiency of beef production. Animal frontiers, 2013; 3 (4): 6-11, 2013.

18. Uslenghi G, Vater A, Rodríguez-Aguilar S, Cabodevila J, Callejas S. Effect of estradiol cypionate and GnRH treatment on plasma estradiol-17βconcentrations, synchronization of ovulation and on pregnancy rates in suckled beef cows treated with FTAI-based protocols. Reproduction in Domestic Animals. 2016; 51 (5): 693-699.

19. Köppen W, Geiger R. Klimate der Erde. Gotha: Verlagcondicionadas. Justus Perthes, 1928.

20. Torres HAL, Tineo JSA, Raidan FSS. Influência do escore de condição corporal na probabilidade de prenhez em bovinos de corte. Archivos de Zootecnia, Córdoba, 2015; 64 (247): 255-260.

21. Laksmi DNDI, Trilaksana IGNB, Darmanta RJ, Darwan M, Bebas IW, Agustina KK. Correlation between body condition score and hormone level of Bali cattle with postpartum anestrus. Indian Journal of Animal Research, 2019; 53(12), 1599-1603.

22. Freitas Júnior JE, Rocha Júnior VR, Rennó FP, Mello MTP, Carvalho AP, Caldeira LA. Efeito da condição corporal ao parto sobre o desempenho produtivo de vacas mestiças Holandês × Zebu. Revista Brasileira de Zootecnia, 2008; 37 (1): 116– 121. https://doi.org/10.1590/S1516-35982008000100017

23. Pereira LL, Ferreira AP, Vale WG, Serique LR, Neves KAL, Morini AC, ... Minervino AHH. Effect of body condition score and reuse of progesterone-releasing intravaginal devices on conception rate following timed artificial insemination in Nelore cows. Reproduction in Domestic Animals, 2018; 53 (3): 624-628.

24. Moretto B, Tulio LM, Zanetti Junior EM. Influência dos diferentes escores corporais na taxa de prenhez de vacas zebuínas. Arquivos Brasileiros de Medicina Veterinária FAG. 2018; 1 (1): 30-36.

25. Bryk Filho J, Holzlsauer GM, Pereira FM, Oba E, Silva-Junior ER. Body condition score and its insemination in the pregnancy rate artificially at fixed insemination times in Marabárá. Revista Brasileira de Reproducão animal, 2019; 43 (2): 390.

26. Michael JD, Baruselli PS, Campanile G. Influence of nutrition, body condition, and metabolic status on reproduction in female beef cattle: A review. Theriogenology, 2019; 125: 277-284.

27. Valle ER, Andreotti R, Thiago LRLS. Estratégias para aumento da eficiência reprodutiva e produtiva em bovinos de corte. Campo Grande: EMBRAPA-CNPGC, 1998. p.19.

28. Meneguetti M, Vasconcelos JLM. Mês de parição, condição corporal e resposta ao protocolo de inseminação artificial em tempo fixo em vacas de corte primíparas. Arquivo Brasileiro de Medicina Veterinária e Zootecnia, 2008; 60 (4): 786-793.

29. Costa MG, Carvalho Araújo AC, Nonato MS, Xavier DCRXM, Murta DVF, Araujo Rufino C, ... Freitas Caldas LA. Influência do Escore de Condição Corporal sobre a taxa de prenhez de vacas Nelore submetidas ao programa de IATF no norte de Minas Gerais. Brazilian Journal of Development, 2019; 5 (11): 24724-24728.

30. Amaral T, Fernandes C, Almeida C. Inseminação artificial em bovinos de corte. In A. Pires (Ed.), Bovinocultura de corte (pp. 513– 528). 2010. Piracicaba, Brazil: FEALQ.

31. Vale W, Melo P, Walter E, Ribeiro H, Rolim-Filho S, Reis A, … Silva A. Fixed timed artificial insemination (FTAI) through the progesterone (CIDR) of 1st, 2nd, 3rd and 4th uses in bovine. I. Conception rate related to reproductive category, related to body condition scoring (BCS), related to calf withdrawal and use of eCG. Livestock Research for Rural Development, 2011; 23 (10): 1-09. http://www.lrrd.cipav.org.co/lrrd23/10/vale23205.htm.

32. Ouverney RB, Ferrer DM, Vasconcellos FS, M Bobany D. Correlação Taxa De Prenhez Em Vacas Nelore (*Bos Taurus Indicus*) Com Baixo Escore De Condição Corporal Submetidas a IATF. Revista de Medicina Veterinária do UNIFESO, 2021; 1 (2): 92-100.

33. Brondani RL, Baiaco AP, Machado Filho EF, Bortoluzzi FP, Bertão CL, Siqueira HR, *et al.* A taxa de prenhez é influenciada pela fertilidade do touro, estro e escore de condição corporal de vacas taurinas submetidas à IATF. Revista Brasileira de Reprodução Animal, 2019; 43 (2): 378.

34. Carvalho JS, Cavalcanti MO, Chaves MS, Rizzo H. Eficiência da inseminação artificial em tempo fixo em fêmeas zebuínas na mesorregião Sudeste do Pará, Brasil. Revista de Ciências Agrárias Amazonian Journal of Agricultural and Environmental Sciences, 2019; 62 (1): 01-07.

35. Santos SA, Abreu UGPD, Souza GDS, Catto JB. Condição corporal, variação de peso e desempenho reprodutivo de vacas de cria em pastagem nativa no Pantanal. Revista Brasileira de Zootecnia, 2009; 38 (2): 354-360.

36. Sonohata MM, Oliveira CAL, Canuto NGD, Abreu UGP, Fernandes DD. Escore de condição corporal e desempenho reprodutivo de vacas no Pantanal do Mato Grosso do Sul. Brasil. Revista Brasileira de Saude Produção Animal, 2009; 10 (4): 1521-1530.

37. Bó GA, Baruselli PS, Moreno D, Cutaia L, Caccia M, Tríbulo R, Tríbulo H, Mapletoft RJ. The control of follicular wave development for selfappointed embryo transfer programs in cattle. Theriogenology, 2002; 57 (1): 53–72.

38. Monteiro, B. M.; Viana, R. B. Estado da arte da inseminação artificial em tempo fixo em gado de corte no Brasil. Revista de Ciencias Agrarias, 2011; 54 (1): 89-97.