11º SIRAA
SIMPÓSIO INTERNACIONAL
DE REPRODUÇÃO ANIMAL APLICADA

Novas tecnologias de diagnóstico precoce de gestação: além da ultrassonografia Doppler

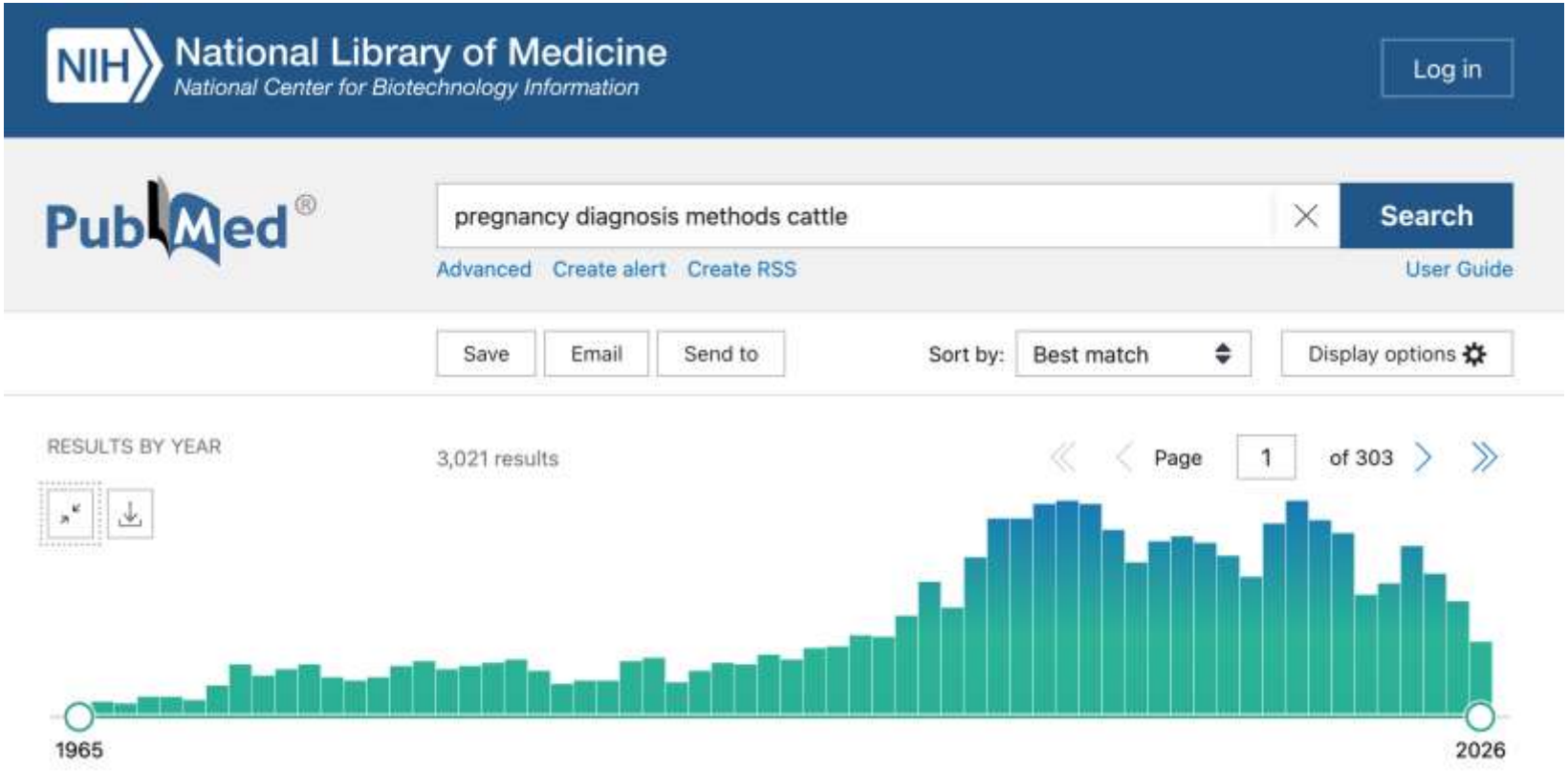
Guilherme Pugliesi
Professor Associado
Departamento de Reprodução Animal
Faculdade de Medicina Veterinária e Zootecnia
Universidade de São Paulo

Julho - 2026

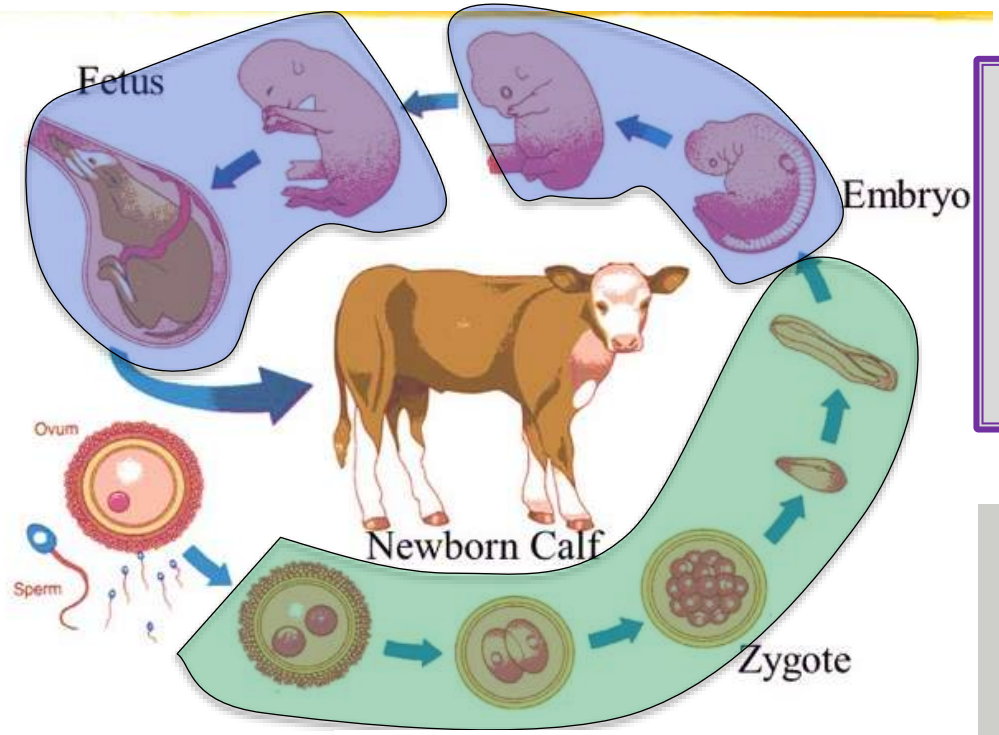
Tópicos

- Métodos de Diagnóstico de Gestação Convencionais
- Ferramentas para Antecipar a Detecção do Status Gestacional
- Marcadores Gestacionais e Potenciais Métodos
- Considerações Finais

Importância nas duas últimas décadas



Qual a importância do diagnóstico gestacional?



Embionário Inicial:
Maior perda gestacional

Identificar as fêmeas não-gestantes → Nova chance

Redução dos dias em aberto

Aumento da taxa de serviço

O principal desafio reprodutivo atual não é saber qual vaca está prenhe, mas sim **identificar precocemente qual fêmea está vazia**.

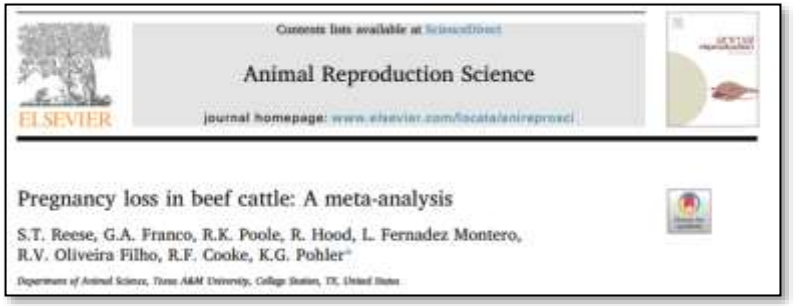
30 dias

10 dias

IATF1

Diagnóstico de gestação +
Ressincronização

IATF2



Contents lists available at ScienceDirect

Animal Reproduction Science

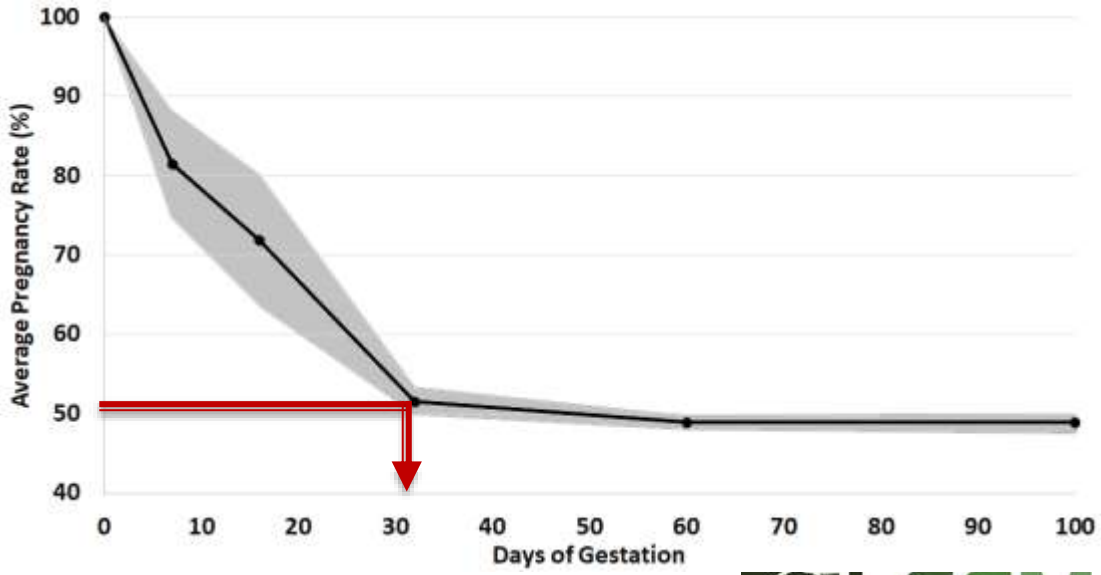
journal homepage: www.elsevier.com/locate/anireprosci

ELSEVIER

Pregnancy loss in beef cattle: A meta-analysis

S.T. Reese, G.A. Franco, R.K. Poole, R. Hood, L. Fernadez Montero, R.V. Oliveira Filho, R.F. Cooke, K.G. Pohler*

Department of Animal Science, Texas A&M University, College Station, TX, United States



(REESE et al., 2020)

LFEM
REPRODUÇÃO ANIMAL - FMVZ - USP

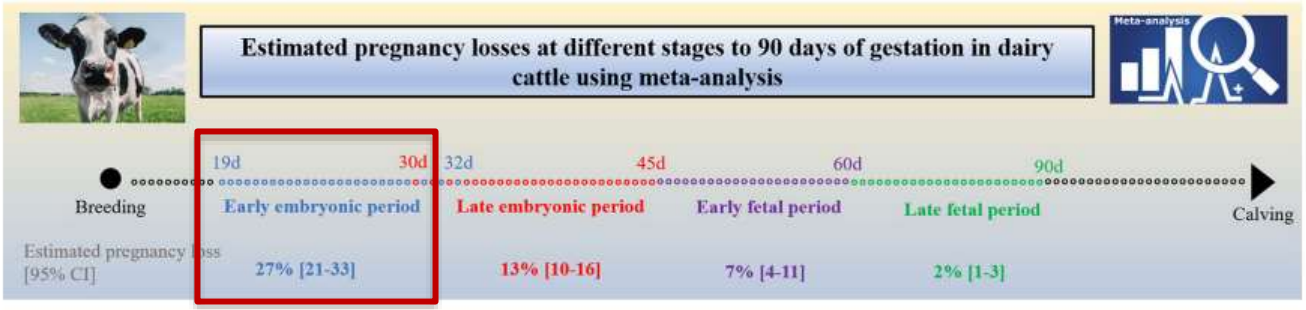
JDS Communications®
2023; 4:144–148

https://doi.org/10.3168/jdsc.2022-0278
Short Communication
Physiology

Meta-analysis of the incidence of pregnancy losses in dairy cows at different stages to 90 days of gestation

A. Albaaj,[1]* J. Durocher,[2] S. J. LeBlanc,[3] and S. Dufour[1]

Graphical Abstract



(ALBAAJ et al., 2023)

Estabelecimento da gestação

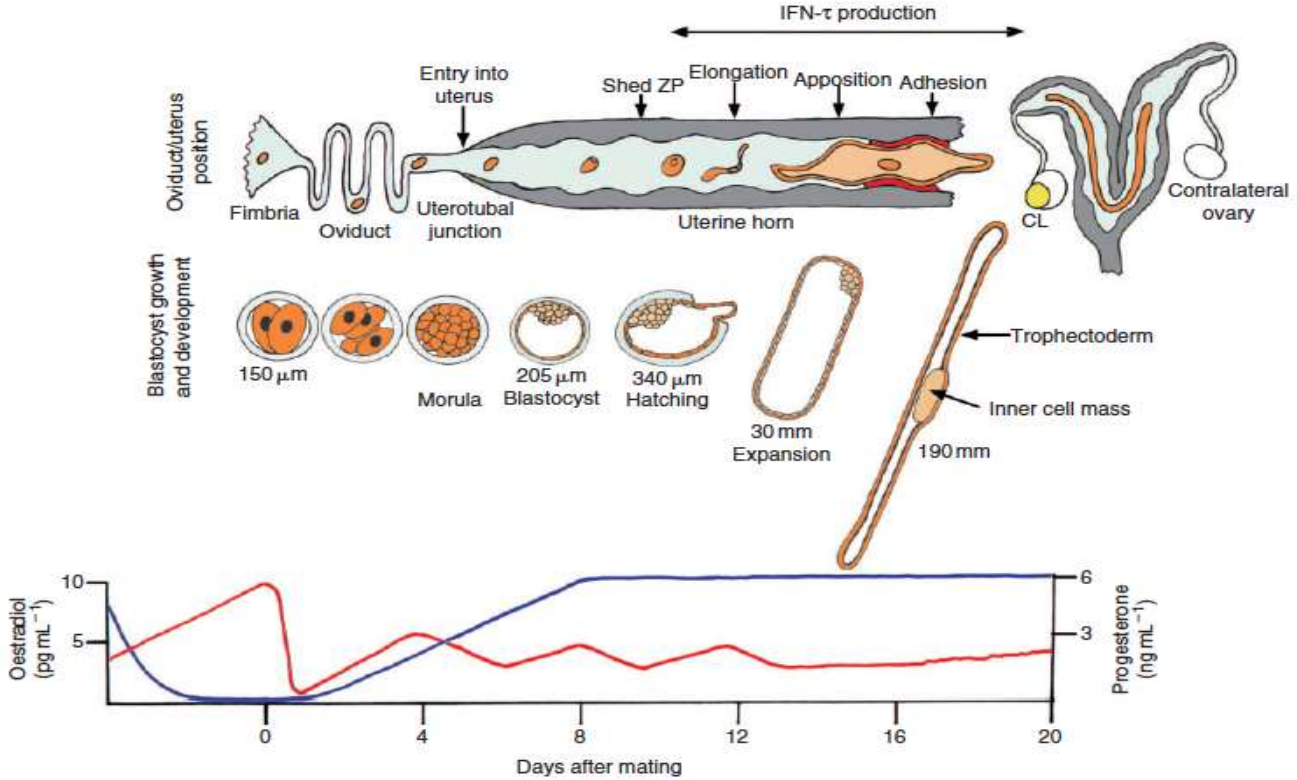
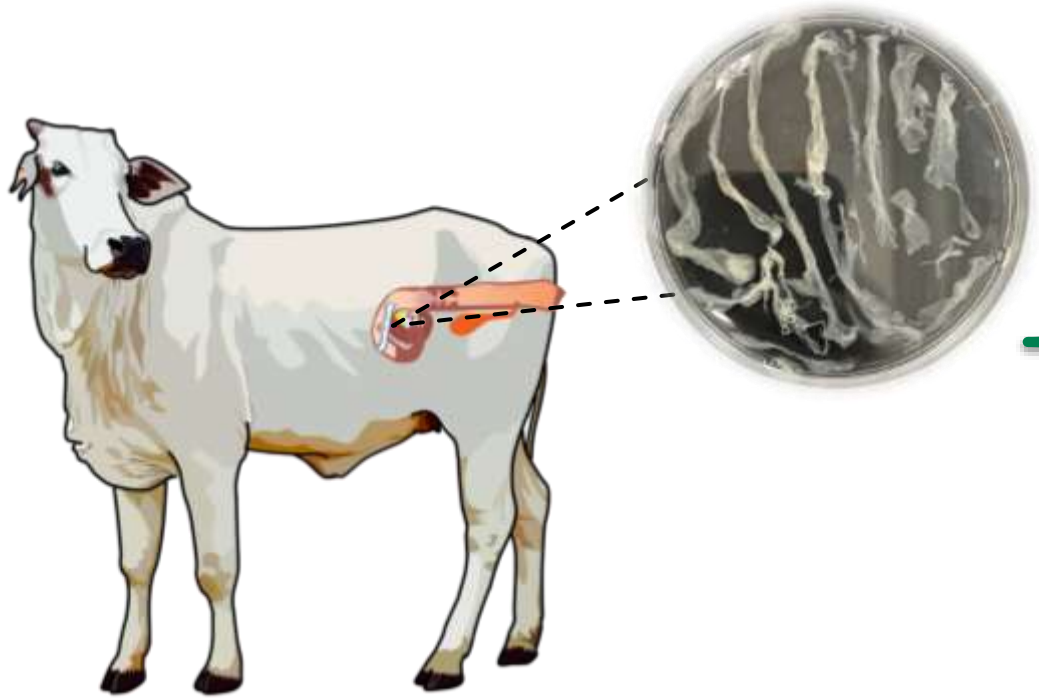


Fig. 1. Early pregnancy events in sheep. This schematic summarises changes in embryo/blastocyst development after fertilisation in relation to

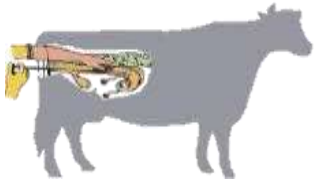
(Spencer et al., 2007)

Período Crítico – 14° e 19° dia pós-estro



- ✓ **Reconhecimento Materno da sinalização embrionária**
  - Produção adequada de moléculas sinalizadoras (IFN-tau)
- ✓ **Bloqueio da Luteólise**
  - Manutenção da produção de P4
- ✓ **Modulação do sistema imune materno**
- ✓ **Genes estimulados por Interferon-tau (ISGs)?**

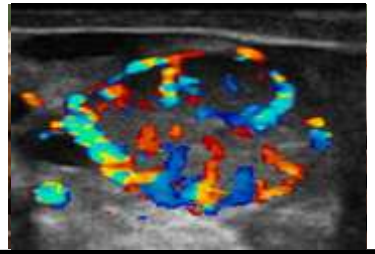
Abordagens para DG à campo



IA

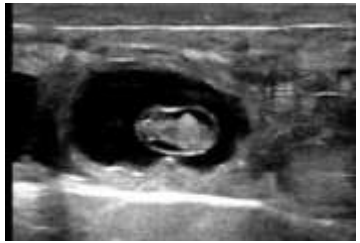
Retorno ao cio

Ultrassonografia Doppler



29-24 dias

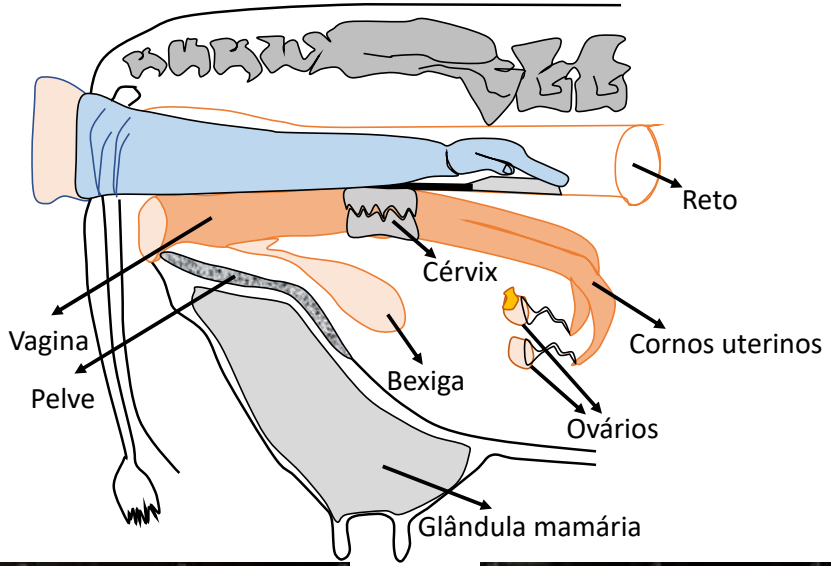
Ultrassonografia Transretal



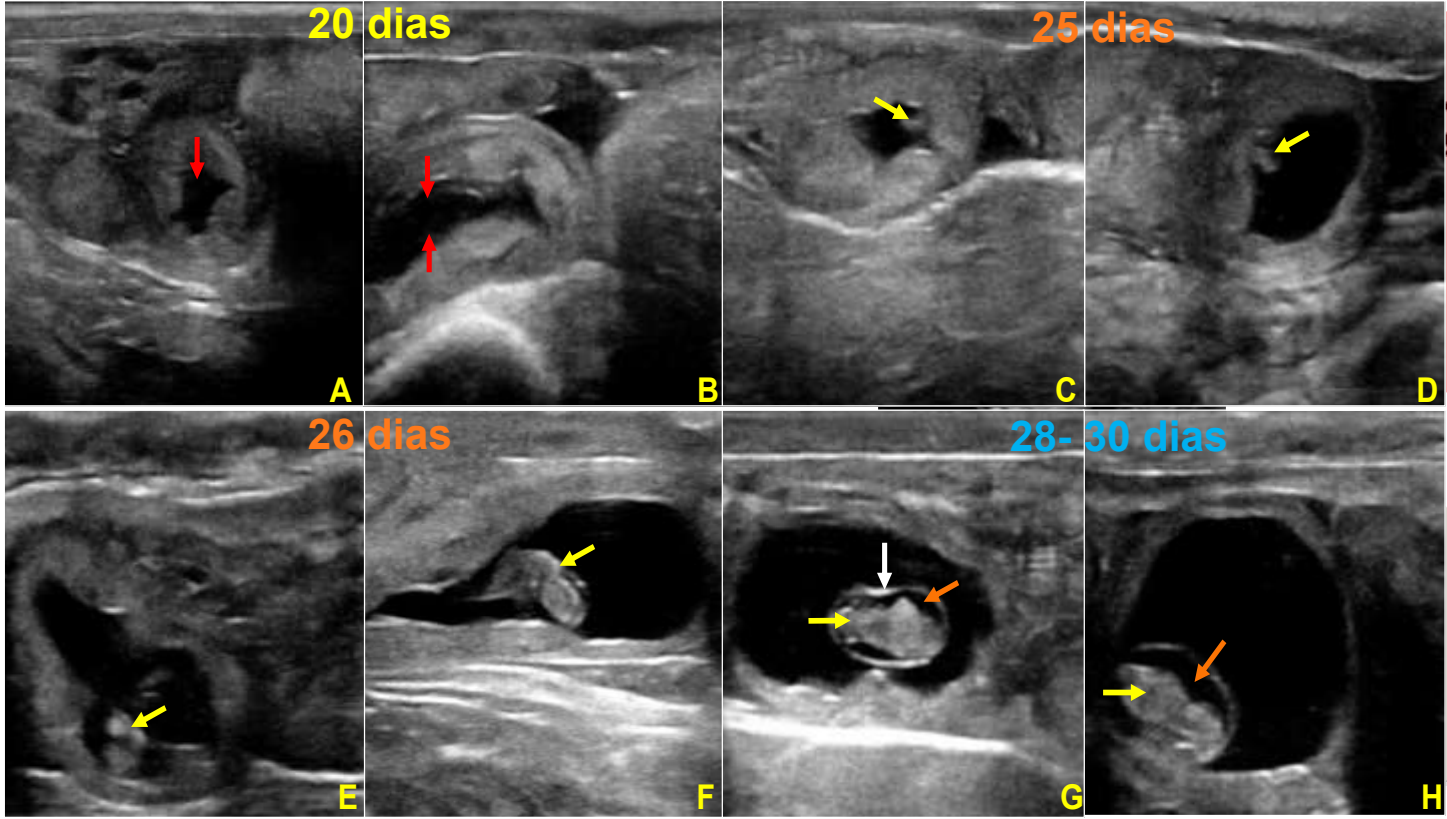
28 dias

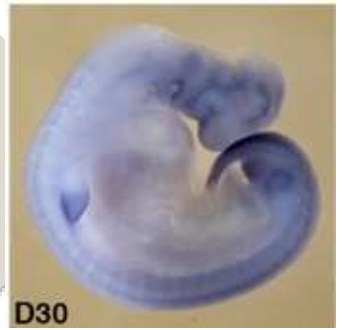
Palpação Transretal

40 dias



Fonte: Google Imagens





Imagens ultrassonográficas em modo B de corno uterino. As setas vermelhas indicam o acúmulo de fluido no lúmen uterino (imagem anecogênica) de fêmeas bovinas aos **20 dias de gestação (Painéis A e B)**. As setas amarelas indicam embriões bovinos (estrutura hiperecogênica) aos **25 dias (Painéis C e D)** aos **26 (Painéis E e F), 28 (Painel G) e 30 (Painel H)** dias de gestação. As setas laranjas indicam o líquido amniótico (estrutura anecogênica) e a seta branca indica a membrana amniótica (estrutura hiperecogênica).

Tópicos

- Métodos de Diagnóstico de Gestação Convencionais
- Ferramentas para Antecipar a Detecção do Status Gestacional
- Marcadores Gestacionais e Potenciais Métodos
- Considerações Finais

Como detectar mais cedo o status gestacional?

☐ **Inovações no diagnóstico precoce da gestação em bovinos**

Processo: 15/10606-9
Linha de fomento: Auxílio à Pesquisa - Jovens Pesquisadores
Vigência: 01 de dezembro de 2016 - 30 de novembro de 2021
Área do conhecimento: Ciências Agrárias - Medicina Veterinária - Reprodução Animal

Pesquisador responsável: Guilherme Pugliesi
Beneficiário: Guilherme Pugliesi

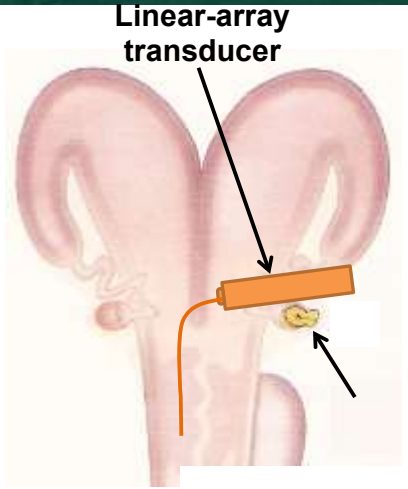
Instituição-sede: Faculdade de Medicina Veterinária e Zootecnia (FMVZ). Universidade de São Paulo (USP). São Paulo , SP, Brasil

Pesquisadores associados: **Adroaldo Jose Zanella ; Augusto Hauber Gameiro ; Claudia Maria Bertan Membrive ; Ed Hoffmann Madureira ; Fernando Silveira Mesquita ; Luciano Andrade Silva ; Luiz Lehmann Coutinho ; Mario Binelli ; Sónia Cristina da Silva Andrade**

Dia 16-20

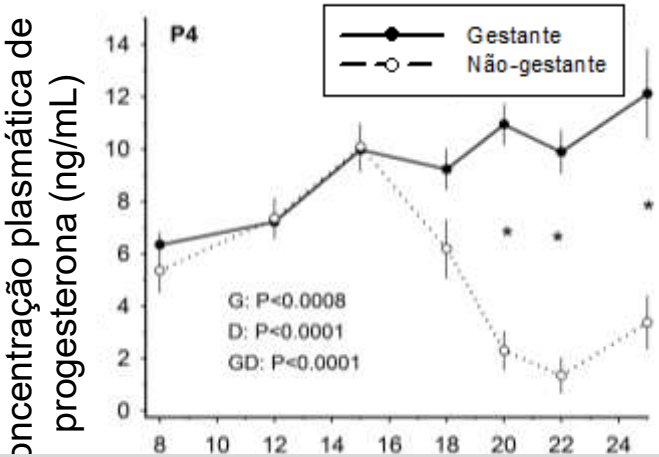
FAPESP
SÃO PAULO RESEARCH FOUNDATION

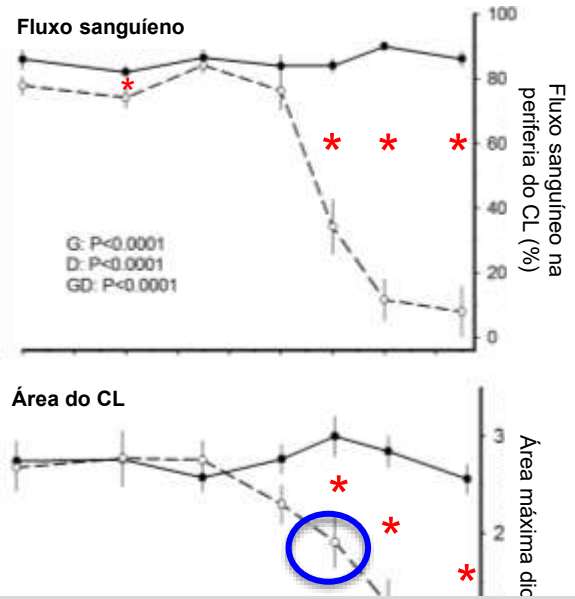
Avaliação do CL com o Doppler

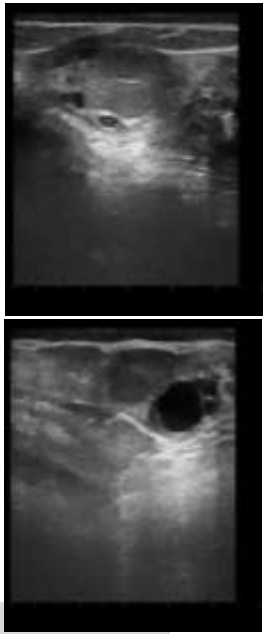


(Fonte: acervo pessoal)

Avaliação do corpo lúteo gestacional







Uso para diagnóstico precoce das fêmeas não-gestantes

(Pugliesi et al., 2014)

J. Dairy Sci. TBC:1–12
http://dx.doi.org/10.3168/jds.2013-6814

Color Doppler flow imaging for the early detection of nonpregnant cattle at 20 days after timed artificial insemination

L. G. B. Siqueira,* V. S. Areas,† A. M. Ghetti,‡ J. F. Fonseca,* M. P. Palhao,§ C. A. C. Fernandes,§ and J. H. M. Viana*[1]

Acurácia da Ultrassonografia Doppler no D.G. precoce

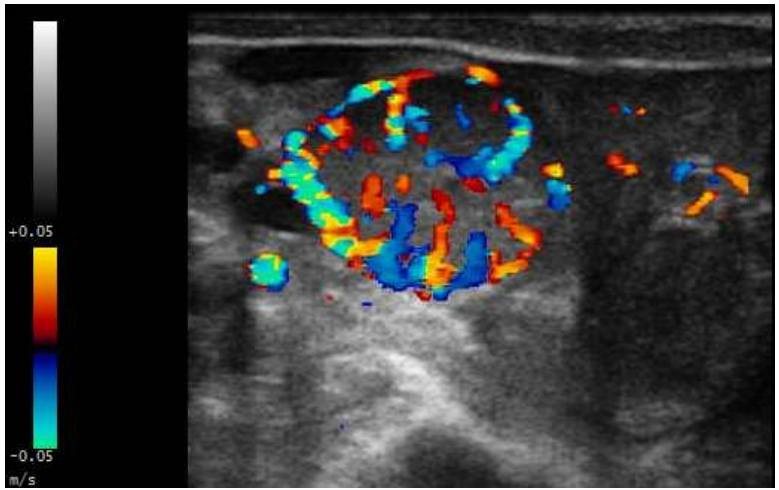
BIOLOGY OF REPRODUCTION (2014) 91(4):95, 1–12
Published online before print 10 September 2014.
DOI 10.1095/biolreprod.114.121525

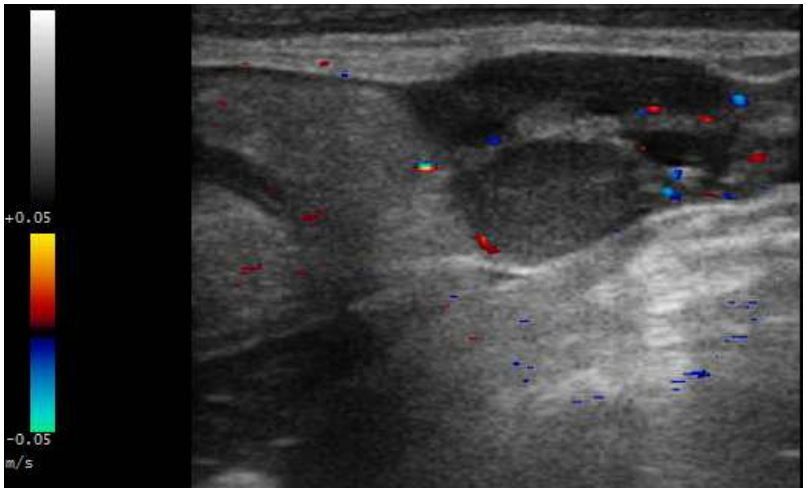
Conceptus-Induced Changes in the Gene Expression of Blood Immune Cells and the Ultrasound-Accessed Luteal Function in Beef Cattle: How Early Can We Detect Pregnancy?[1]

Guilherme Pugliesi,[2,3,4] Bruna T. Miagawa,[3] Yasmin N. Paiva,[3] Moana R. França,[3] Luciano A. Silva,[4] and Mario Binelli[3]

Gestante ou Não-gestante ???

É possivel detectar com alta aucurácia a gestação aos 20 dias pela ultrassonografia Doppler em bovinos???

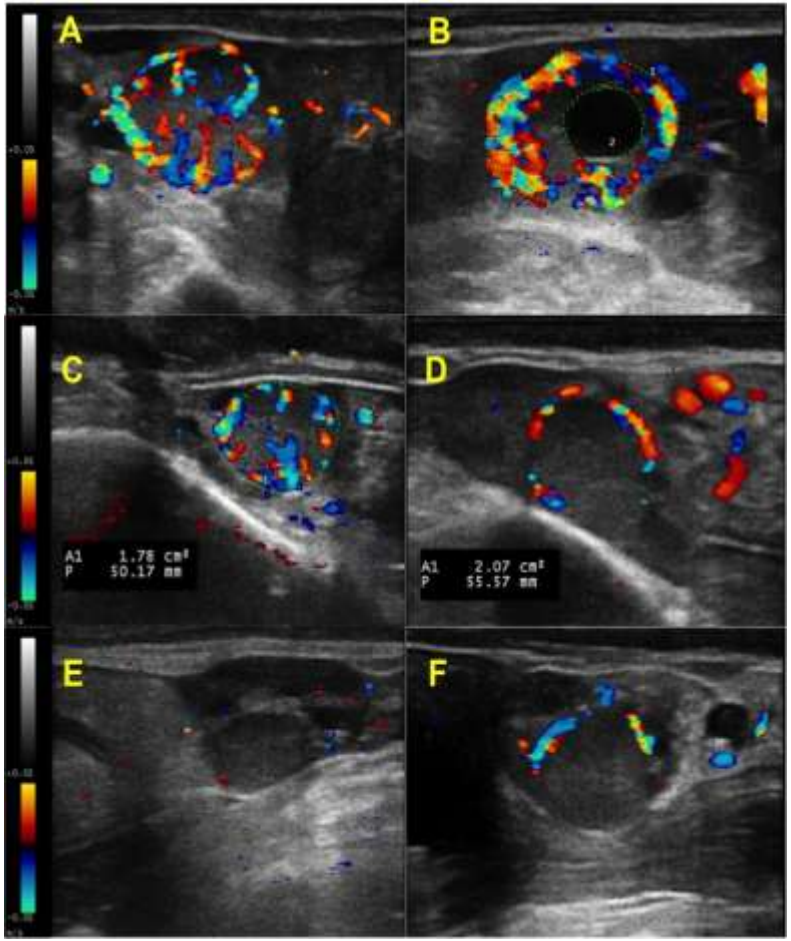


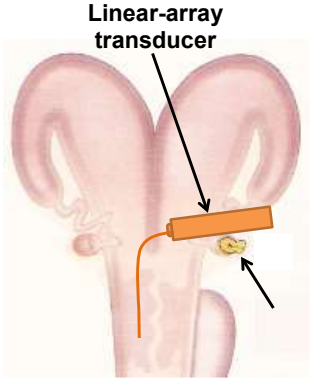


Dia 20 pós-IATF

(Fonte: acervo pessoal)

Doppler-US method – day 20 after TAI





Detection of luteolysis
(Non-pregnant females)

Criteria:
Blood perfusion ≤25%.

(Pugliesi et al., 2014)

Authors	Type/breed	Parity order	Type of service	Moment of gestation, d	Animals, n	Conception rate, %	Accuracy, %	False positive rate, %	False negative rate, %	PPV, %	NPV, %
Utt et a., 2009	Beef (Crossbreed)	Cows	TET	17 19 21	50	46	60 68.8 71.4	30.6 24.6 21	9.4 6.6 7.6	54.4 61.4 64.8	73.3 82.9 81.5
Siqueira et al., 2013										4.8 7.2	97.7 98
Pugliesi et al., 2014										0.8	100
Guimarães et al., 20										8.9	100
Scully et al., 2015[1]										6.6 9.5 0.8	70.3 88 87.8
										8.8	97.5
Pugliesi et al., 2018										0.4 0.5	100 100
Ataide Jr. Et al., 201										8.8	100
Andrade et al., 2019										7.3	100
Dalmaso Melo et al.										89 1.8	100 100
Wellert et al., 2020										9.4 75	100 100
Dubuc et al., 2020										52	98.1
Holton et al., 2022a										80 85	100 100
Holton et al., 2022b										86 90	100 100
Madoz et al., 2022										60	98.2
Ferraz et al., 2022										38 48	98 100

(Siqueira et al., 2013)

Accuracy: 75%
False-negative: 0.5%
False-positive: 24.5%

(Pugliesi et al., 2014)

Accuracy: 91%
False-negative: 0%
False-positive: 9%

Antecipação da Ressincronização

IATF

12-14 d

30 d

1-2 mg BE

Dispositivo P4

IATF

Ressinc pós-DG
(40 d)

22 d

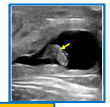
1-2 mg BE

Dispositivo P4

IATF

Ressinc antes-DG
(32 d)

18 d



1-2 mg BE

Dispositivo P4

IATF

Ressinc antes-DG
(28 d)

≤1 mg BE

Dispositivo P4

IATF

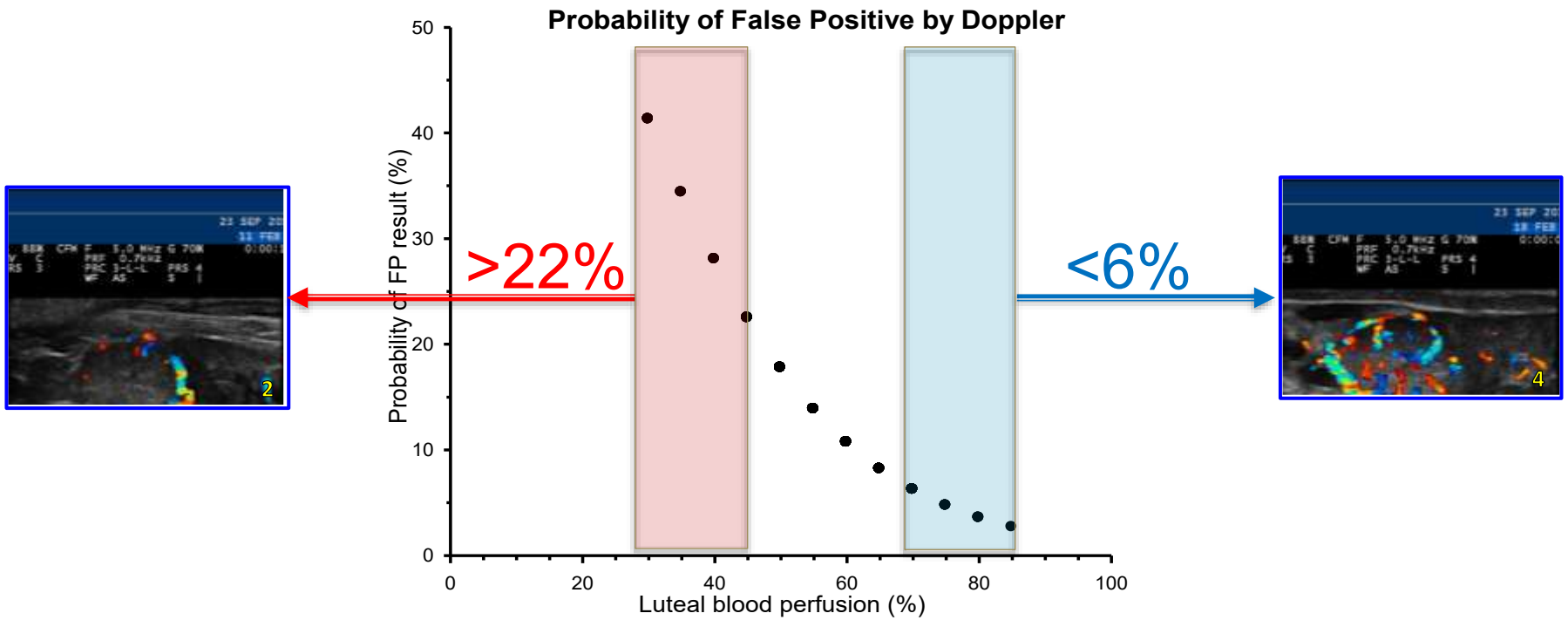
Ressinc antes-DG Doppler
(21-24 d)

Impactos da Ressinc com Doppler

- Aumento do número de nascimentos no início da estação de nascimento
- Melhora no peso final a desmama
- Maior proporção de novilhas púberes
- Menor custo/kg de bezerro desmamado

(Odeja-Rojas, 2021; 2022)

Relation of CL blood perfusion and FP results



Probability of false positive (FP) result (females identified with a functional CL on day 20 post-TAI by Doppler ultrasonography, but non-pregnant on day 30) according to the luteal blood perfusion at the of Doppler evaluation in beef cattle (n=159). Probability of FP = exp (-0.0591x + 1.4201)/1 + exp (-0.0591x + 1.4201); P =0.008.

(Pugliesi et al., 2023)

CL blood perfusion and Pregnancy Loss

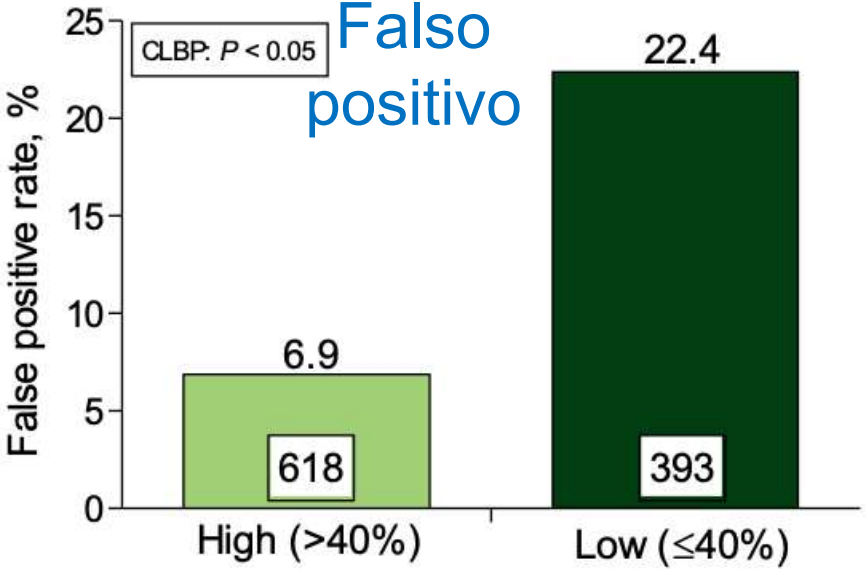
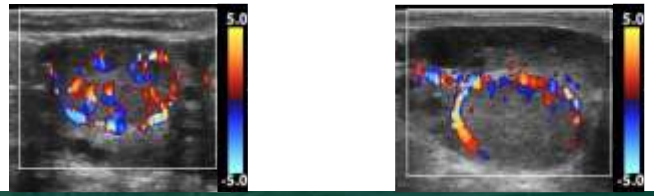


Figure 3. False positive rate (%) in beef females with high (>40%) or low (≤40%) corpus luteum blood perfusion (CLBP) on D22.



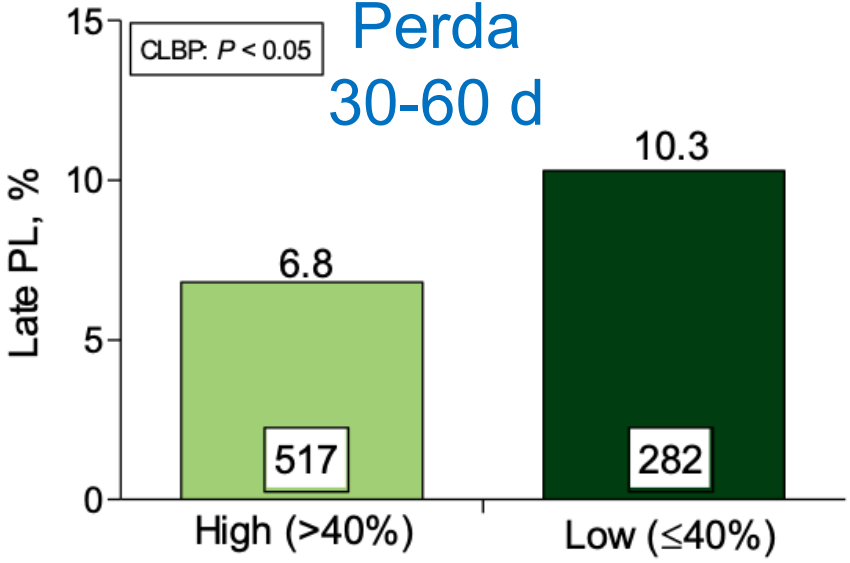
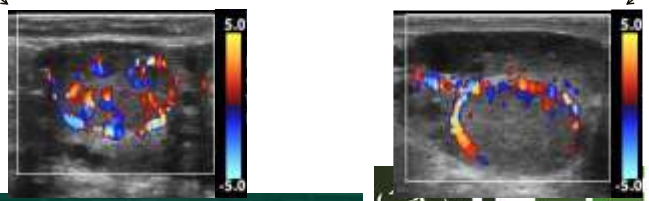
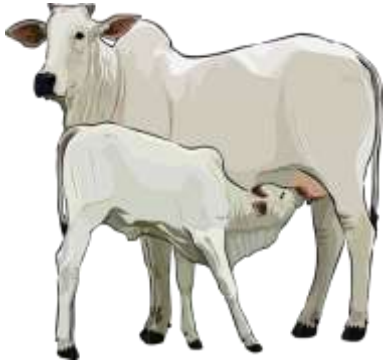


Figure 4. Late pregnancy loss (PD2 to PD3) in beef females with high (>40%) or low (≤40%) corpus luteum blood perfusion (CLBP) on D22.



CL blood perfusion and Pregnancy Loss

Heifers



Primiparous cows

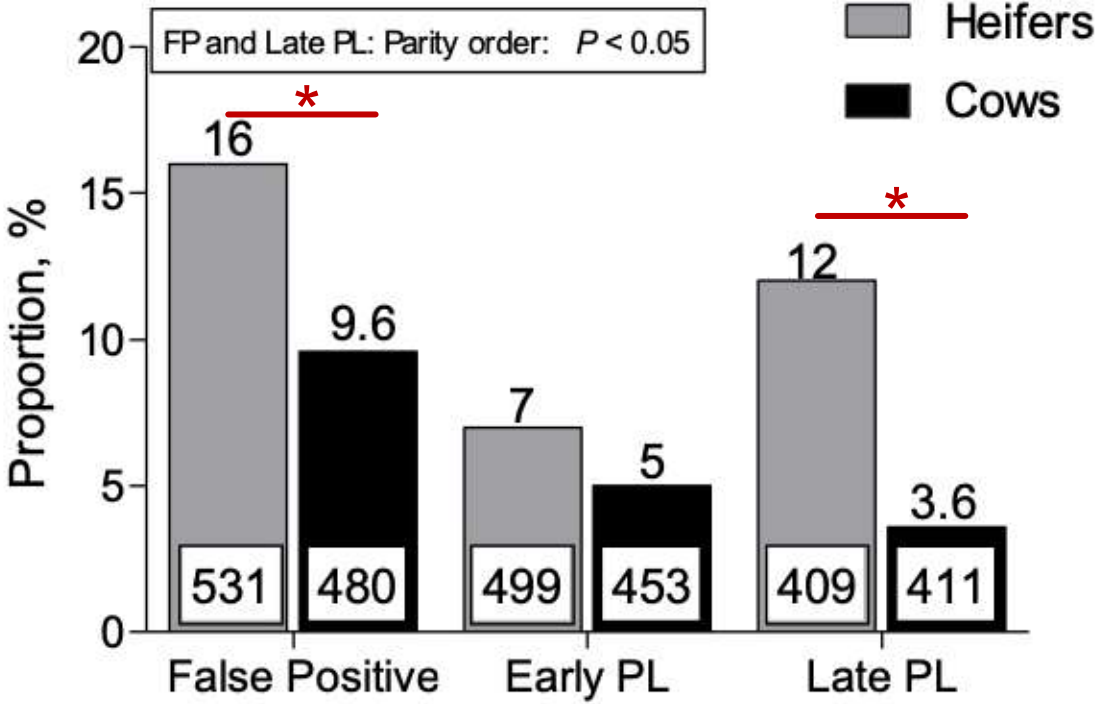


Figure 5. False positive rate (%), early (%; PD1 to PD2) and late pregnancy loss (%,;PD2 to PD3) between heifers and cows.

Quais fatores estão relacionados com o Falso +?

- Perda gestacional
- Avulação tardia no protocolo
- Luteólise tardia (leite vs. corte; novilhas vs. vacas)

Qual a proporção de cada fator na taxa de falso +?

Monitores de atividade (acelerômetros)

J. Dairy Sci. 98:8723–8731
http://dx.doi.org/10.3168/jds.2015-9645

Behavioral and physiological changes around estrus events identified using multiple automated monitoring technologies

K. A. Dolecheck,* W. J. Silvia,*[1] G. Heersche Jr.,* Y. M. Chang,† D. L. Ray,* A. E. Stone,* B. A. Wadsworth,* and J. M. Bewley*[2]
*Department of Animal and Food Sciences, University of Kentucky, Lexington 40546
†Research Support Office, Royal Veterinary College, University of London, London, NW1 0TU, United Kingdom

Acurácia em detectar o CIO (vazia)

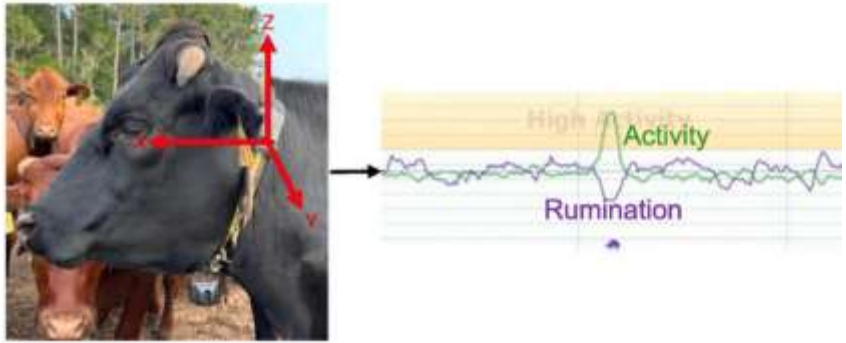
Table 3. Estrus detection capability[1] and 95% CI of different automated monitoring technologies[2] and machine-learning techniques (random forest, linear discriminant analysis, and neural network)[3]

Technique	Technology	Sensitivity	Specificity	Accuracy
Random forest	CowManager SensOor	100.00 (47.82–100.00)	98.57 (84.93–99.83)	98.62 (95.11–99.83)
	HR Tag	60.00 (14.66–94.73)	99.29 (96.08–99.98)	97.93 (94.07–99.57)
	IceQube	80.00 (28.36–99.49)	99.29 (96.08–99.98)	98.62 (95.11–99.83)
	Track a Cow	100.00 (47.82–100.00)	97.14 (92.85–99.22)	97.24 (93.09–99.24)
Linear discriminant analysis	CowManager SensOor	100.00 (47.82–100.00)	100.00 (97.40–100.00)	100.00 (47.82–100.00)
	HR Tag	100.00 (47.82–100.00)	97.86 (93.87–99.56)	97.93 (94.07–99.57)
	IceQube	100.00 (47.82–100.00)	97.86 (93.87–99.56)	97.93 (94.07–99.57)
	Track a Cow	100.00 (47.82–100.00)	96.43 (91.86–98.83)	96.55 (92.14–98.87)
Neural network	CowManager SensOor	100.00 (47.82–100.00)	98.57 (94.93–99.83)	98.62 (95.11–99.83)
	HR Tag	100.00 (47.82–100.00)	96.43 (91.86–98.83)	96.55 (92.14–98.87)
	IceQube	100.00 (47.82–100.00)	100.00 (97.40–100.00)	100.00 (97.49–100.00)
	Track a Cow	100.00 (47.82–100.00)	90.71 (84.64–94.96)	91.03 (85.16–95.14)

[1]Sensitivity = TP/(TP + FN); specificity = TN/(TN + FP); accuracy = (TP + TN)/(TP + TN + FP + FN); TP = true positive, TN = true negative, FP = false positive, and FN = false negative.

[2]CowManager SensOor (Agis Automatisering, Harmelen, the Netherlands); HR Tag (SCR Engineers Ltd., Netanya, Israel); IceQube (IceRobotics Ltd., Edinburgh, Scotland); and Track a Cow (Animart Inc., Beaver Dam, WI).

Monitores de atividade (acelerômetros)



Theriogenology

Original Research Article

Relationships between activity monitoring device data and ovarian, uterine, hormonal, and pregnancy variables in beef cows

Cecilia Constantino Rocha, Ana Beatriz Montevecchio, Alexandra Bennett, Abdul Waheed, Mackenzie Mazziotta, Tatiane S. Maia, McKenzie Lane-Jackson Haimon, Quino A. Hoorn, Masroor Sagheer, Camila J. Cuellar, Oscar Alejandro Ojeda-Rojas, Rebecca Lynn Krisher, Marcello Rubessa, Ky G. Pohler, Peter J. Hansen, Philipe Moriel, Ricardo C. Chebel, Mario Binelli

Table 1

Number of true positives, true negatives, false positives, false negatives diagnosis, and sensitivity, specificity and accuracy for determining cows that showed true estrus by accelerometer or ESTROTECT.

Variable	Accelerometer	ESTROTECT
Number of replicates	400	400
True positive	259	289
True negative	103	104
False positive	8	7
False negative	30	0
Sensitivity[a]	90 %	100 %
Specificity[b]	93 %	93 %
Accuracy[c]	91 %	98 %

Alta Acurácia em detectar o CIO (vazia)

Monitores de atividade associados a IA

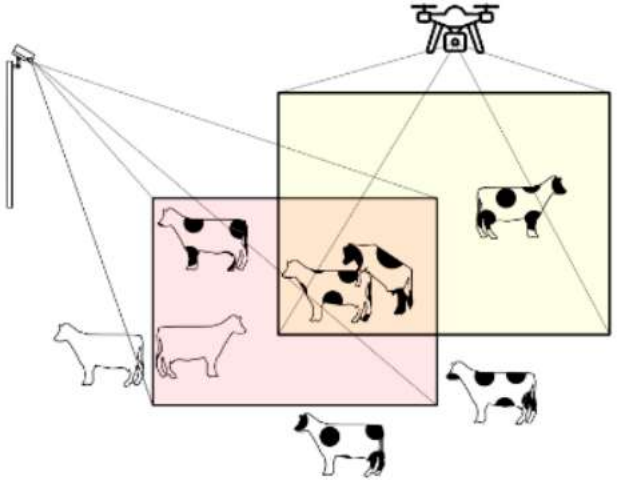
sensors

MDPI

Article

Estrus Detection and Dairy Cow Identification with Cascade Deep Learning for Augmented Reality-Ready Livestock Farming

İbrahim Arıkan [1], Tolga Ayav [1], Ahmet Çağdaş Seçkin [2] and Fatih Soygazi [2,*]



Monitores de atividade associados a IA

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MDPI

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Estrus Detection and Dairy Cow Identification with Cascade Deep Learning for Augmented Reality-Ready Livestock Farming

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Table 5. Comparison of machine learning-based methods in estrus detection and cow identification.

Reference	Sensor	Software	Estrus Detection Accuracy (%)	Cow Identification Accuracy (%)
[23]	IMU	Fuzzy logic model	98	NA
[27]	IMU	Deep learning	97	NA
[29]	IMU	NA	80	NA
[28]	Camera	Deep learning	94	NA
[45]	Camera	Detection of cow images with Deep learning (YOLOv5)	94.3	NA
[49]	Camera	Computer vision	90.9	NA
[50]	Camera	YOLOv3	82.1	NA
[51]	Camera and ear tag	CNN	NA	84
[52]	Camera	YOLO and faster R-CNN	NA	84.4
Proposed CNN model	Camera	Deep learning	98	NA
Proposed VGG-19 model	Camera	Deep learning	99	NA
Proposed YOLO model	Camera	Deep learning	98	95

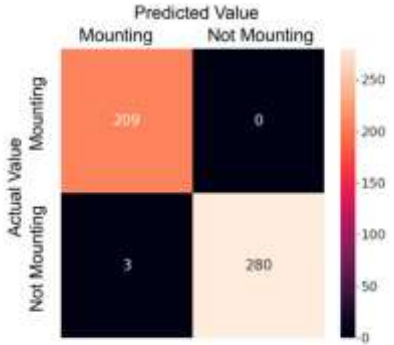


Figure 11. VGG-19 model's confusion matrix of the test dataset.

Limitantes:

- Vacas Anovulares
- Ovulação Silenciosa
- Luteólise tardia
- Perda embrionária

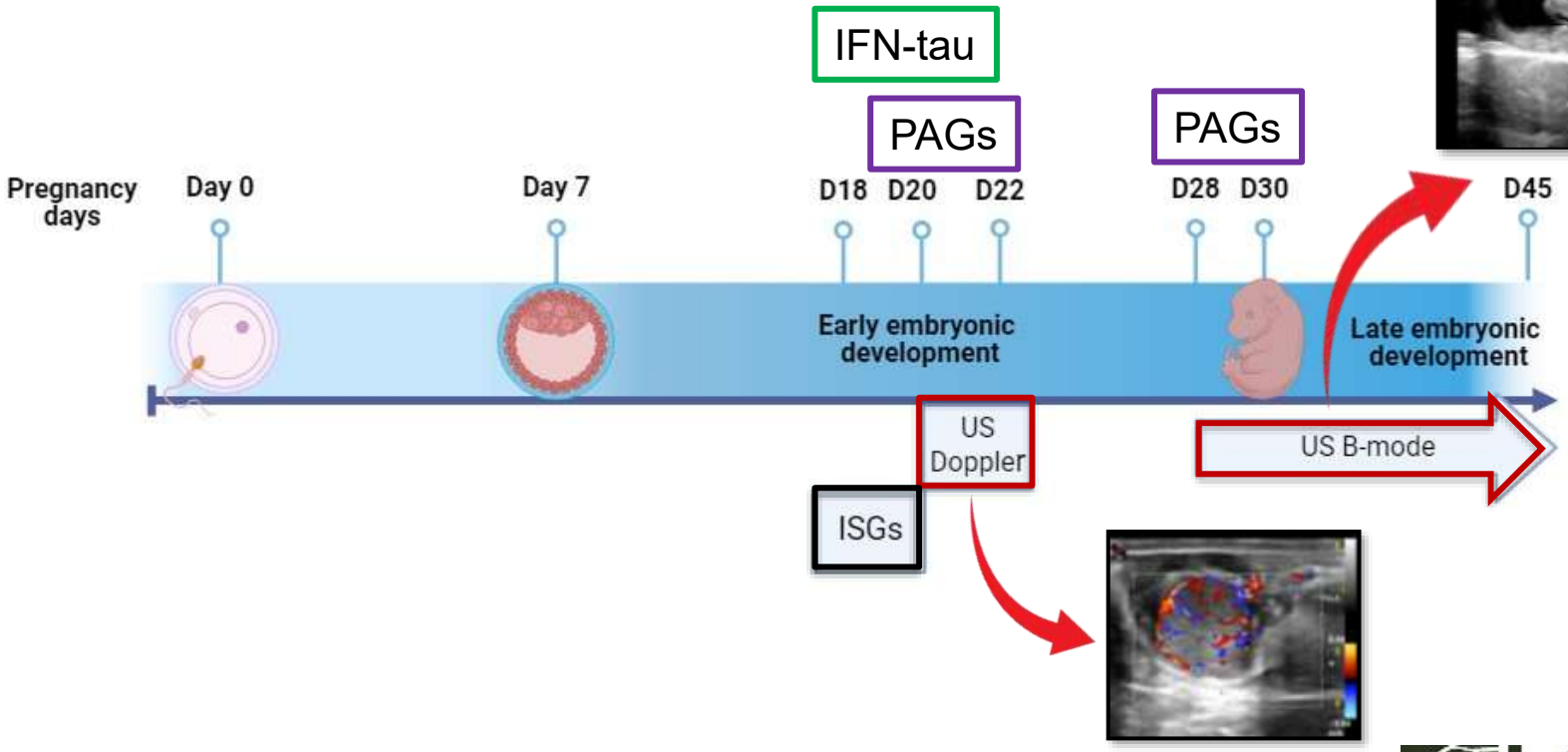
Tópicos

Marcador ou marcadores

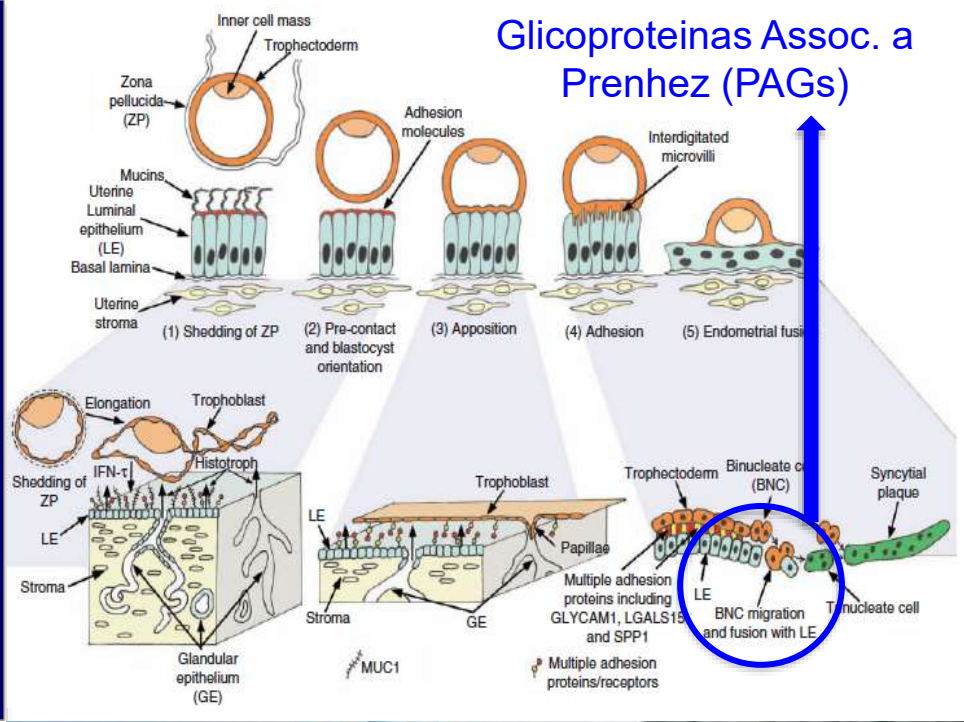
- Único marcador
  - Uso de candidatos conhecidos
  - Descoberta de novos candidatos

- Painel de marcadores ou assinaturas
  - Analíses ômicas
    - Transcriptoma
    - Metabolômica
    - Lipidômica
    - Proteômica
    - Etc.

Métodos de Diagnóstico de Gestação



Métodos Laboratoriais (Moleculares)



PAGs (Glicoproteínas associadas com a gestação)

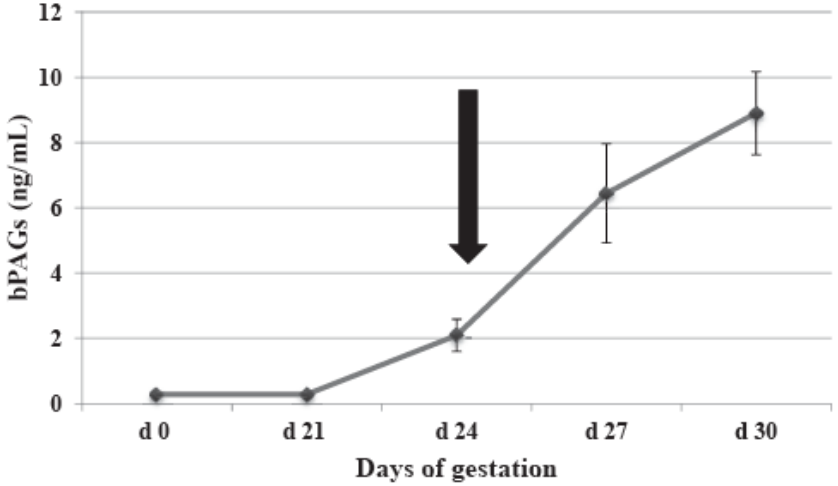


Fig. 1. Serum concentrations of bovine pregnancy-associated glycoproteins (bPAGs) in pregnant Nelore cows (mean ± SEM; n = 22) from Days 0 to 30 of gestation in experiment 1. First significant increase ($P < 0.0001$) in circulating bPAG concentrations occurred on Day 24 of gestation. Arrow head represents the first significant increase in circulating bPAG concentrations.

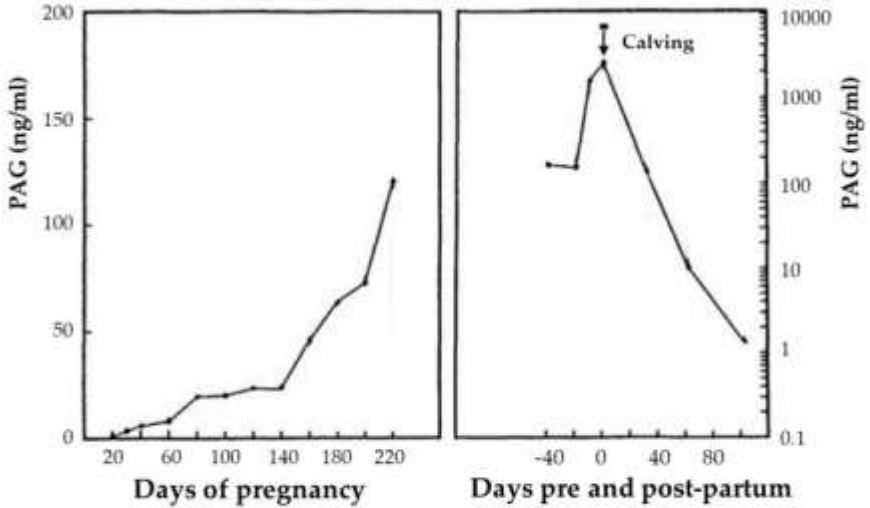


Figure 1. Pregnancy-associated glycoprotein (PAG) plasma profile of a cow during pregnancy and the post-partum period. Adapted from Zoli et al. [16].

(Pohler et al., 2016)

PAGs (Glicoproteínas associadas com a gestação)

- Bovinos: 22 genes de PAGs identificados
- Mensuração das concentrações
  - RIA e EIA (“Sandwich”)
  - Envio para laboratórios especializados (USA e Canadá)
  - Kits comerciais para Laboratórios
  - Kits para Campo

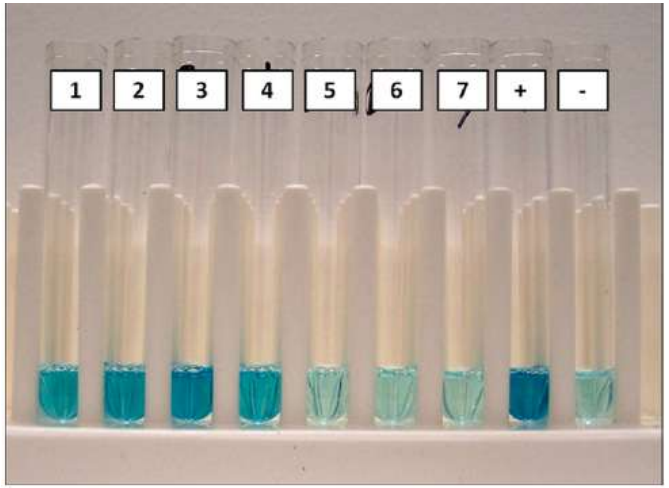


Fig. 2. Representative outcome of the rapid PAG ELISA on Day 25

AntelBio Bovine PAG ELISA... to identify open-cows

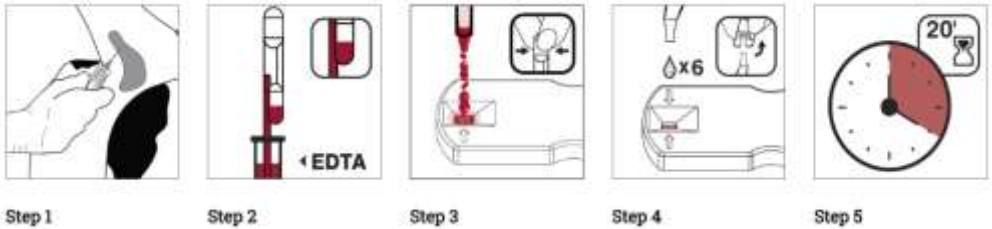
bioPRYN

CONCEPTION Animal Reproduction Technologies

IDEXX LABORATORIES

J.C. Green et al. / Theriogenology 75 (2011) 320–328

IDEXX LABORATORIES



Cow Pregnancy Test Kit

Uso do aumento de PAGs para indicar ligação embrionária

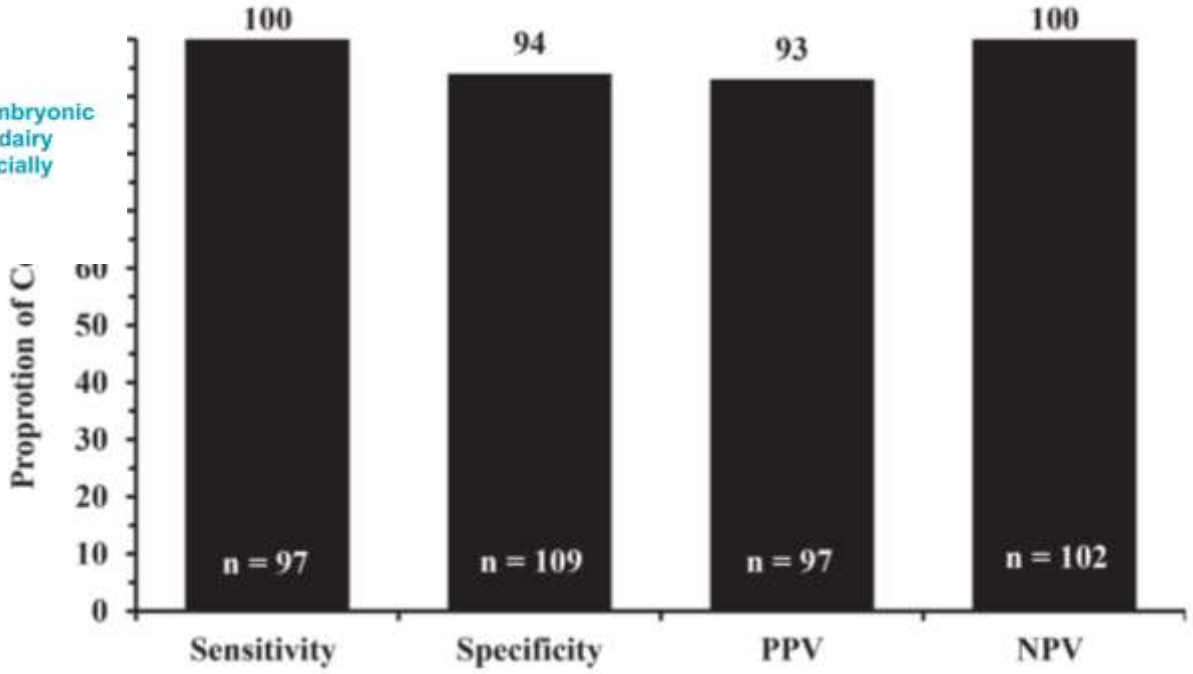
10% Increase in PSPB between 17 and 24 days

J. Dairy Sci. 102:7570–7575
https://doi.org/10.3168/jds.2018-15961

Short communication: **Blood samples before and after embryonic attachment accurately determine non-pregnant lactating dairy cows at 24 d post-artificial insemination using a commercially available assay for pregnancy-specific protein B**

E. L. Middleton and J. R. Pursley*
Department of Animal Science, Michigan State University, East Lansing 48824

Validating the 10% increase in PSPB – samples collected on D17 and 24 post-AI



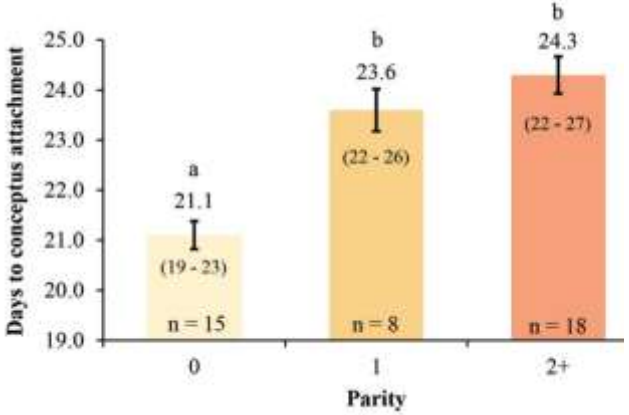
Middleton and Pursley, 2019

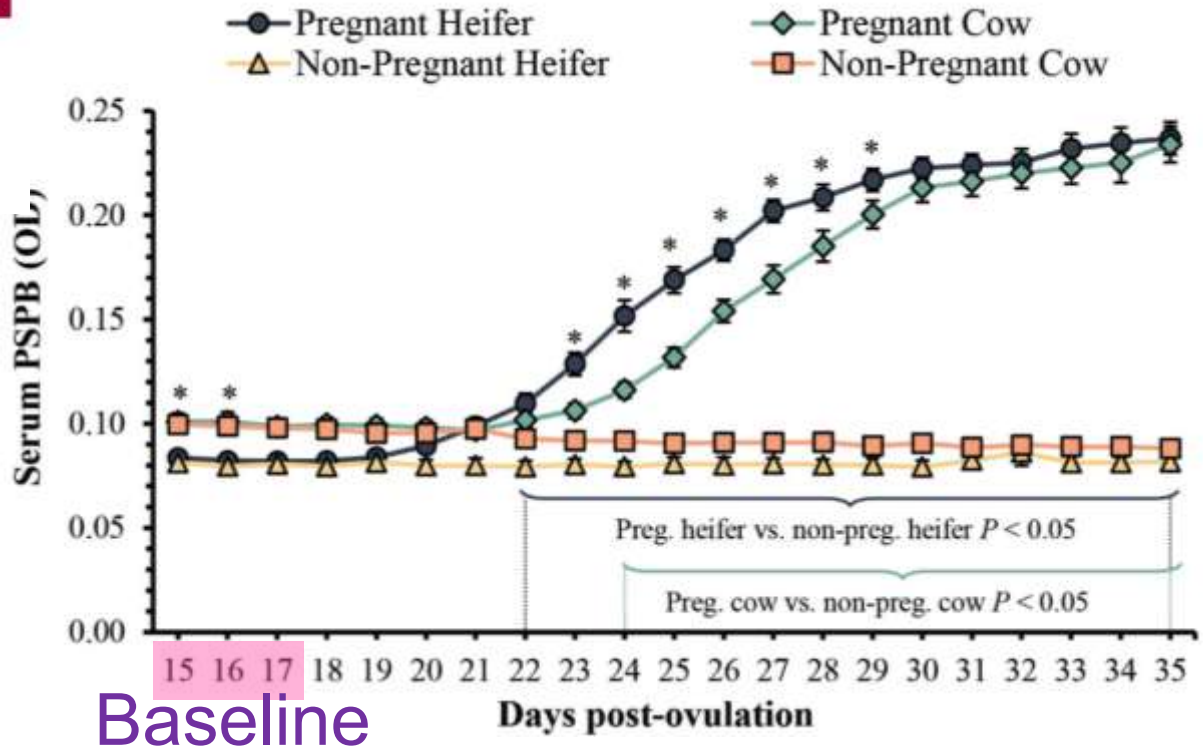
Determining time to increase in PSPB in heifers and multiparous dairy cows

JDS Communications®
2022; 3:291–295
https://doi.org/10.3168/jdsc.2021-0198
Short Communication
Physiology

Dairy heifers have an earlier increase in serum pregnancy-specific protein B compared with lactating dairy cows. Is this an indicator of earlier conceptus attachment?

E. L. Middleton, T. Minela, M. Aheame, H. Arnold, A. Santos, and J. R. Pursley*





Baseline

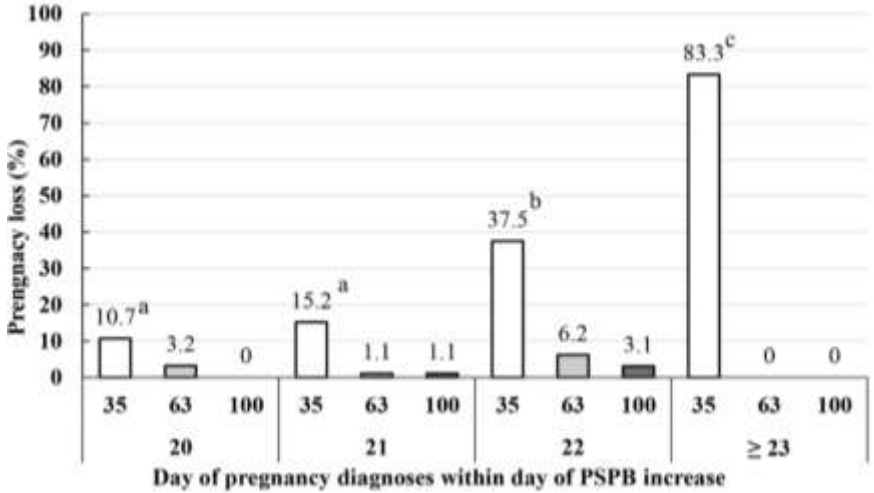
Middleton et al., 2022

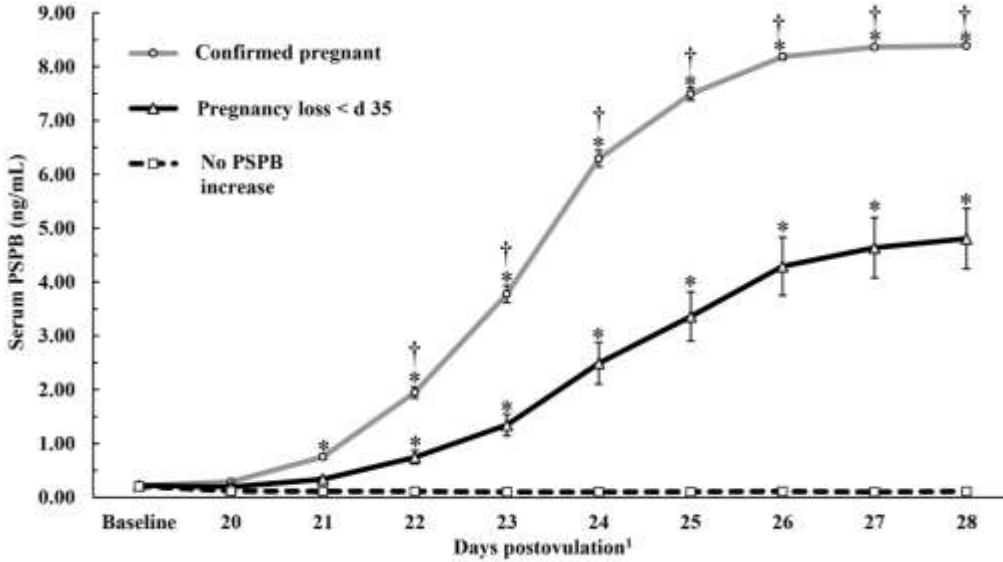
Determining the relationship between time of PSPB increase and subsequent pregnancy loss

J. Dairy Sci. 106:3734–3747
https://doi.org/10.3168/jds.2022-22553

Time to increase in pregnancy-specific protein B following artificial insemination is a direct determinant of subsequent pregnancy loss in lactating dairy cows

A. Santos,[1] T. Minela,[1] J. Branen,[2] and J. R. Pursley[1]*
[1]Department of Animal Science, Michigan State University, East Lansing 48824
[2]BioTracking Inc., Moscow, ID 83843





Santos et al., 2023

Genes estimulados por IFN-tau

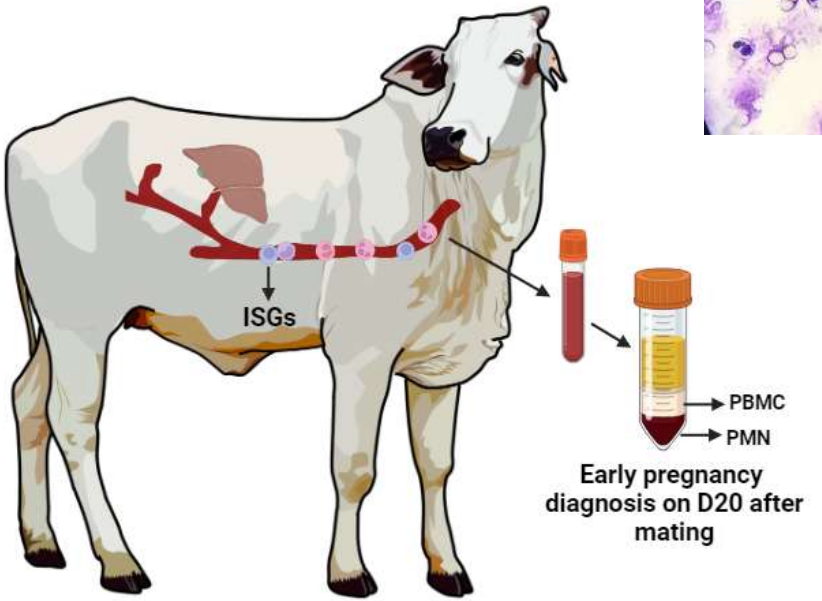
BIOLOGY OF REPRODUCTION (2014) **91**(4):95, 1–12
Published online before print 10 September 2014.
DOI 10.1095/biolreprod.114.121525

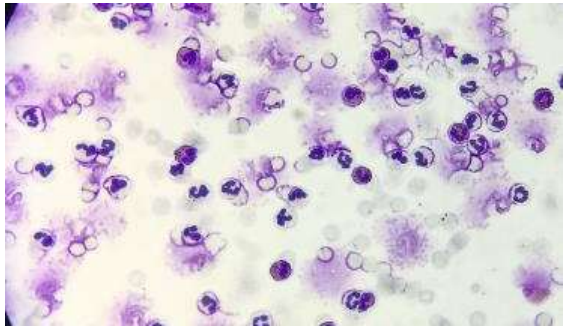
Conceptus-Induced Changes in the Gene Expression of Blood Immune Cells and the Ultrasound-Accessed Luteal Function in Beef Cattle: How Early Can We Detect Pregnancy?[1]

Guilherme Pugliesi,[2,3,4] Bruna T. Miagawa,[3] Yasmin N. Paiva,[3] Moana R. França,[3] Luciano A. Silva,[4] and Mario Binelli[3]

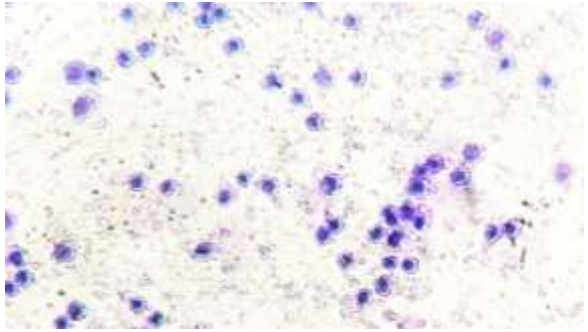
- Multiparous, non-lactating Nelore cows (n=27);
- PBMC isolation on days **12, 15, 18, 20, 22, 30, 45 and 60 post –TAI;**
- **Classic ISGs *(ISG15, OAS1, MX1 and MX2).***

Material and methods

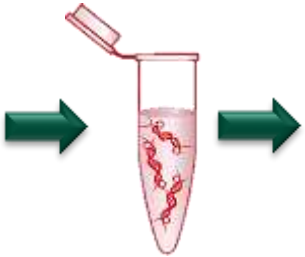




95% PMNs



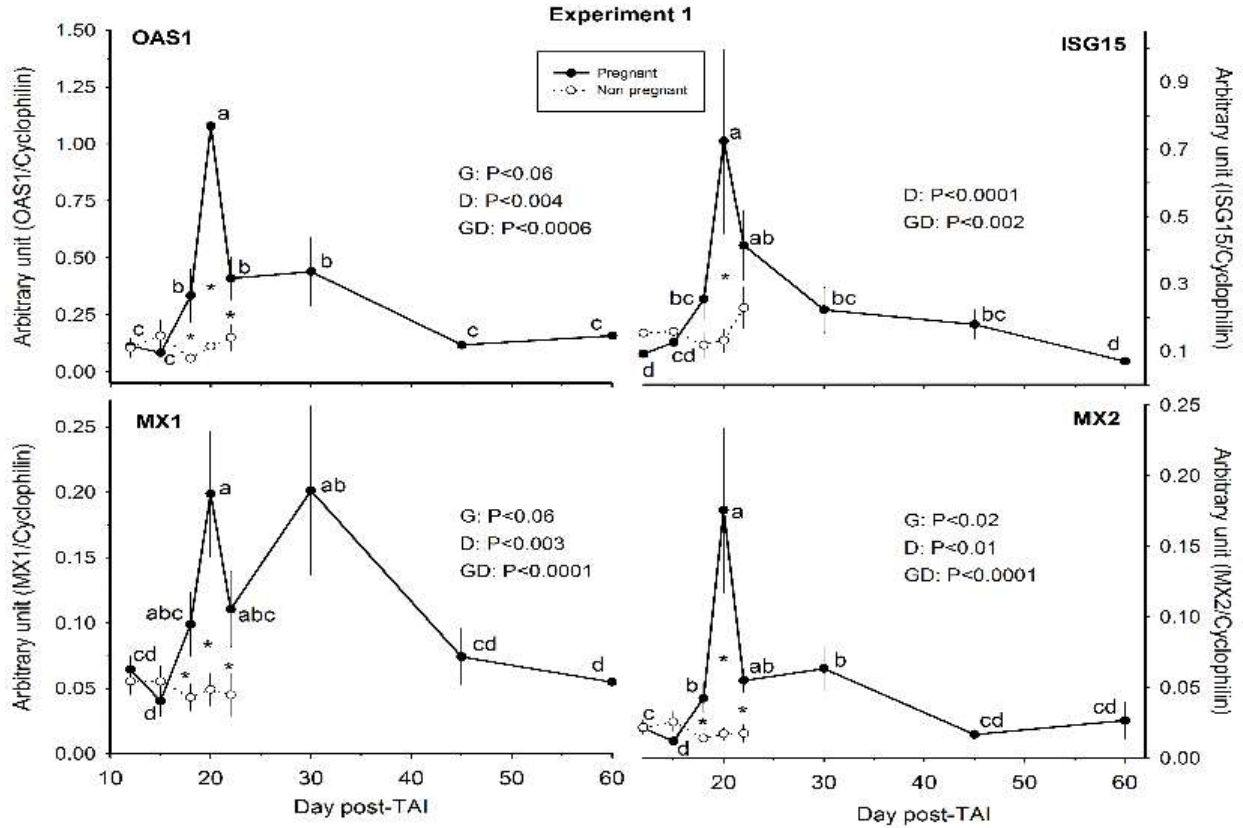
95% PBMCs



mRNA extraction

qPCR
Target-genes
(ISGs)

Perfil de ISGs em células imunes circulantes (PBMCs)



(Pugliesi et al., 2014)

Genes estimulados por IFN-tau

ISGs em PBMCs

TABLE 3. Experiment 2: number of TP, TN, FP, and FN diagnoses and sensitivity, specificity, PPV, NPV, and accuracy for determining pregnancy status on Day 20 post-TAI by Doppler-US or ISG-PBMC method.

	Doppler US[a]			ISG-PBMC[b]			
Endpoint	Only luteal area	Only luteal blood flow	Both	OAS-1	MX-2	Both	Doppler US + ISG-PBMC[c]
No. of cows	111	111	111	90	90	90	90
TP	41	41	42	24	26	22	22
TN	61	59	59	44	30	50	54
FP	8	10	10	13	27	7	3
FN	1	1	0	9	7	11	11
Sensitivity[d]	97.6%	97.6%	100%	72.7%	78.8%	66.7%	66.7%
Specificity[e]	88.4%	85.5%	85.5%	77.2%	52.6%	87.7%	94.7%
PPV[f]	83.7%	80.4%	80.8%	64.9%	49%	75.8%	88%
NPV[g]	98.4%	98.4%	100%	83%	81.1%	81.9%	83.1%
Accuracy[h]	92%	90.1%	91%	75.6%	62.2%	80%	84.4%

Genes estimulados por IFN-tau

Contents lists available at ScienceDirect

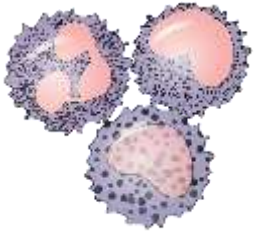
Theriogenology

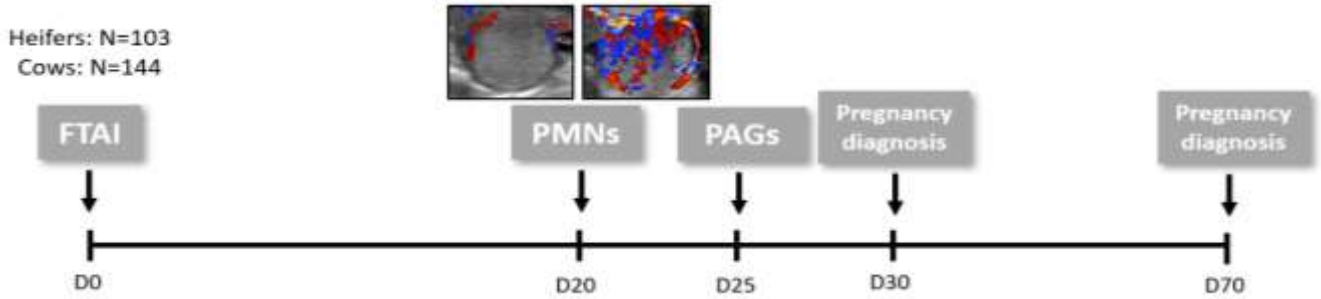
journal homepage: www.theriojournal.com

Applied use of interferon-tau stimulated genes expression in polymorphonuclear cells to detect pregnancy compared to other early predictors in beef cattle

Gabriela Dalmaso de Melo [a], Barbara Piffero Mello
Carlos Alberto Souto Godoy Filho [a], Cecilia Constan
Amanda Guimarães Silva [a], Sydney Taylor Reese [b], Ed Hoffmann Madureira [a],
Ky Garrett Pohler [b], Guilherme Pugliesi [a,*]

PMNs





Acurácia em vacas e novilhas

VETERINÁRIA USP

Número de resultados verdadeiro-positivo (TP), verdadeiro-negativo (TN), falso-positivo (FP) e falso-negativo (FN) e sensibilidade (SENS), especificidade (SPEC), Valor Preditivo Negativo (NPV), Valor Preditivo Positivo (PPV) e acurácia (ACCU) para determinação do status gestacional no dia 20 pós-IATF pelo Doppler-US, ISG15, OAS1 e P4 e no dia 25 pós-IATF pelas PAGs em novilhas e vacas.

Endpoint	Novilhas					Vacas				
	Doppler-US	*ISG15*	*OAS1*	P4	PAGs	Doppler-US	*ISG15*	*OAS1*	P4	PAGs
N	103	103	103	99	103	144	144	144	136	144
TP (N)	51	42	51	55	53	84	62	63	83	83
TN (N)	37	40	32	35	42	50	42	45	45	52
FP (N)	12	9	17	9	7	10	18	15	8	8
FN (N)	0	12	3	0	1	0	22	21	0	1
SENS (%)[a]	100	78	94	100	98	100	74	75	100	99
SPEC (%)[b]	75	82	65	80	86	83	70	75	85	87
PPV (%)[c]	81	82	75	86	88	89	78	81	91	91
NPV (%)[d]	100	77	91	100	98	100	66	68	100	98
ACCU (%)[e]	85	80	81	91	92	93	72	75	94	94

(Melo et al., 2020)

LFEM REPRODUÇÃO ANIMAL · FMVZ · USP

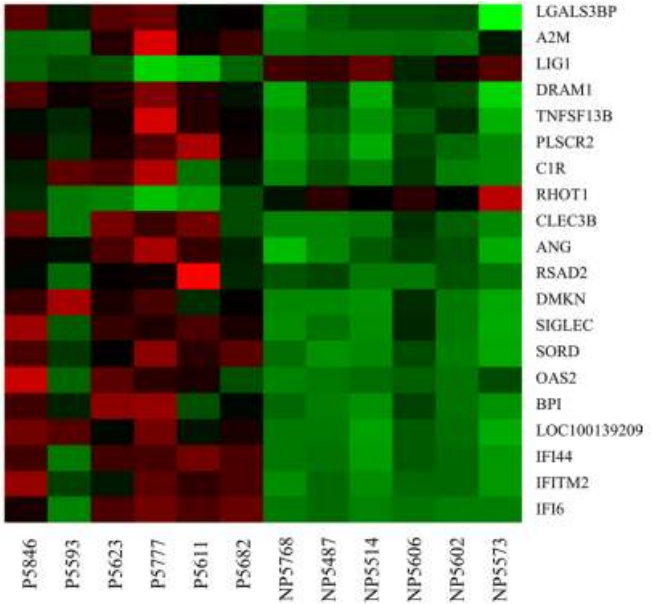
Genes estimulados por IFN-tau

SCIENTIFIC REPORTS
nature research

OPEN

Early pregnancy-induced transcripts in peripheral blood immune cells in *Bos indicus* heifers

Cecilia Constantino Rocha[1], Sônia Cristina da Silva Andrade[2], Gabriela Dalmaso de Melo[1], Igor Garcia Motta[1], Luiz Lehmann Coutinho[3], Angela Maria Gonella-Diaza[4], Mario Binelli[2] & Guilherme Pugliesi[1]



9 potencial biomarkers in PBMC (*IFI6, **RSAD2, IFI44**, IFITM2, TNFSF13B, LGALS3BP, CLEC3B, OAS2, LOC100139209)*

5 potencial biomarkers in PMN (*IFI6, **RSAD2, IFI44**, OAS2, LGALS3BP*).

scientific reports

OPEN

Conceptus signaling markers in immune cells enhance pregnancy prediction in beef cattle

Isabella Illa Feltrin[2], Gabriela Dalmazo Melo[2], Pedro Pisani Freitas[2], Karine Galhego Morelli[2], Maria Binelli[2], Claudia Maria Bertan Mendoza[1,2] & Guilherme Pugliesi[2]

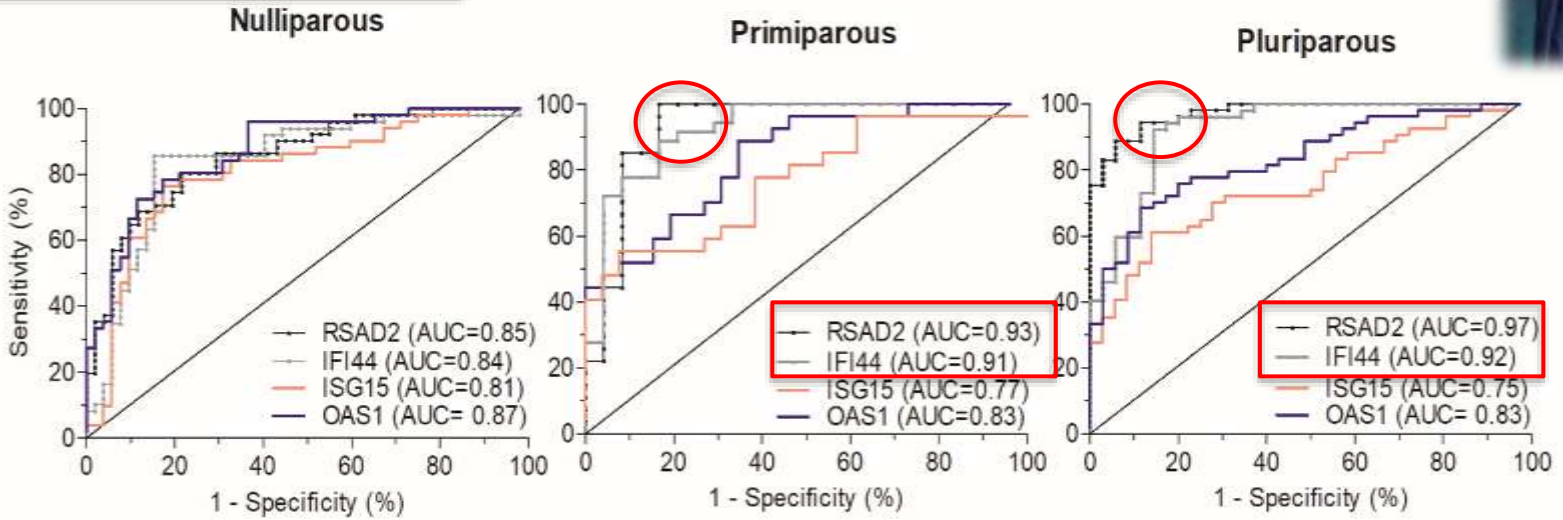


Figure 6. ROC (Receiver Operating Characteristic) curves of the classic (*ISG15* and *OAS1*) and non-classic (*RSAD2* and *IFI44*) ISGs on D20 post-TAI in nulliparous (N=103), primiparous (N=53) and pluriparous (N=91) bovine females. The horizontal and vertical axes represent false positive rate (1 - specificity) and sensitivity, respectively. Non-classic (*RSAD2* and *IFI44*) ISGs provided the most adequate prediction of pregnancy when compared to classic ISGs (*ISG15* and *OAS1*) in primiparous and pluriparous bovine females.

Aumento da sensibilidade usando 4 ISGs em PMNs

Table 3. Number of True-Positive (TP), True-Negative (TN), False-Positive (FP), False-Negative (FN), Sensitivity (SENS), Specificity (SPEC), Positive Predictive Value (PPV), Negative Predictive Value (NPV) and Accuracy (ACCU) for determining pregnancy status on D20 post-FTAI by *RSAD2*, *IFI44, ISG15* and *OAS1* in bovine females with a functional CL.

Endpoint	Nulliparous				Primiparous				Pluriparous			
	RSAD2	*IFI44*	*RSAD2/ IFI44*	*RSAD2/IFI44/ ISG15/OAS1*	*RSAD2*	*IFI44*	*RSAD2/ IFI44*	*RSAD2/IFI44/ ISG15/OAS1*	*RSAD2*	*IFI44*	*RSAD2/ IFI44*	*RSAD2/IFI44/ ISG15/OAS1*
n	100	100	100	100	50	50	50	50	83	83	83	83
VP *(n)*	39	42	44	48	27	23	27	27	45	46	48	48
VN *(n)*	47	47	46	43	22	22	22	21	32	30	30	28
FP *(n)*	4	4	5	8	1	1	1	2	1	3	3	5
FN *(n)*	10	7	5	1	0	4	0	0	5	4	2	1
SENS (%)	79.6	85.7	89.8	98.0	100.0	85.2	100.0	100.0	90.0	92.0	96.0	98.0
SPEC (%)	92.2	92.2	90.2	84.3	95.6	95.6	95.7	91.3	97.0	90.9	90.9	84.8
PPV (%)	90.7	91.3	89.8	85.7	96.4	95.8	96.4	93.1	97.8	93.9	94.1	90.7
NPV (%)	82.5	87.0	90.2	97.7	100.0	84.6	100.0	100.0	86.5	88.2	93.7	96.5
ACCU (%)	86.0	89.0	90.0	91.0	98.0	90.0	98.0	96.0	92.8	91.6	94.0	92.8

Marcadores: ↓ Falso Negativo

Uso associado dos ISGs com Doppler

Aumento da sensibilidade usando 4 ISGs em PMNs na fêmeas com CL ativo

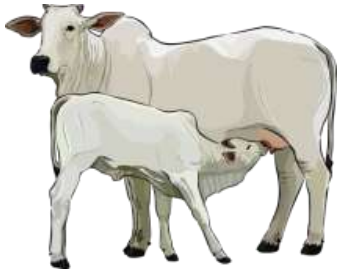
Table 4. Number of True-Positive (TP), True-Negative (TN), False-Positive (FP), False-Negative (FN), Sensitivity (SENS), Specificity (SPEC), Positive Predictive Value (PPV), Negative Predictive Value (NPV) and Accuracy (ACCU) for determining pregnancy status on D20 post-FTAI by *RSAD2, IFI44, ISG15* and *OAS1* in bovine females with a functional CL.

Genes	*ISG15*			*OAS1*		*RSAD2*	*RSAD2/IFI44/*
	OAS1	*RSAD2*	*IFI44*	*RSAD2*	*IFI44*	*IFI44*	*ISG15/OAS1*
n	233	233	233	233	233	233	233
TP *(n)*	108	115	118	122	123	120	124
TN *(n)*	92	95	95	95	95	98	92
FP *(n)*	15	12	12	12	12	9	15
FN *(n)*	18	11	8	4	3	6	2
SENS (%)	85.7	91.3	93.6	96.8	97.6	95.2	98.4
SPEC (%)	86.0	88.8	88.8	88.8	88.8	91.6	86.0
PPV (%)	87.8	90.5	90.8	91.0	91.1	93.0	89.2
NPV (%)	83.6	89.6	92.2	96.0	96.9	93.2	97.9
ACCU (%)	85.8	90.1	91.4	93.1	93.6	93.6	92.7

Acurácia dos ISGs usando células sanguíneas para DG Precoce

Feltrin et al., 2025. (PAINEL de ISG)

Nulliparous
Accuracy: 91%
FP: 14%
FN: 2%

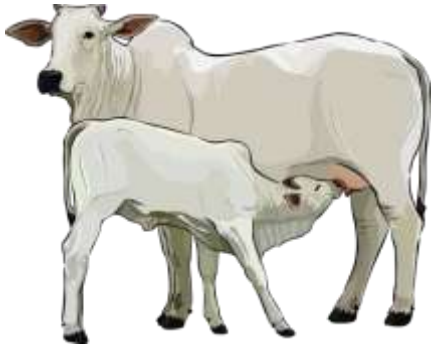


Primiparous:
Accuracy: 98%
FP: 3%
FN: 0%

Cows:
Accuracy 93%
FP: 9%
FN: 3%

Pugliesi et al., 2014; Dalmaso de Melo et al., 2020.

Heifers:
Accuracy: 90%
FP: 12%
FN: 6%

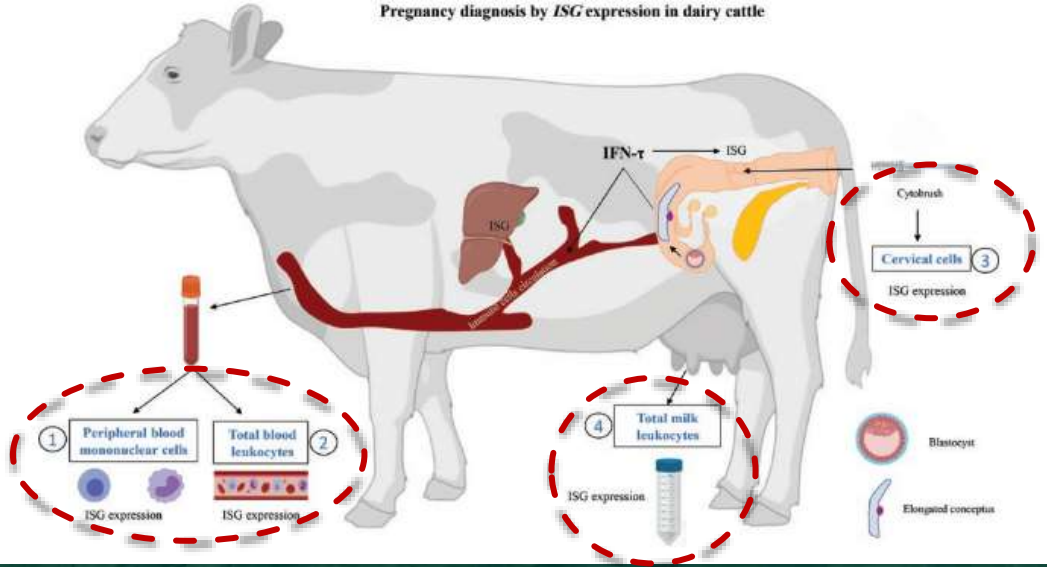


Cows:
Accuracy: 83-85 %
FP: 9-12%
FN: 16-25%

JDS Communications
2021; 2:153–158
https://doi.org/10.3168/jdsc.2020-0062
Short Communication
Physiology

Feasibility and accuracy of using different methods to detect pregnancy by conceptus-stimulated genes in dairy cattle

Priscila Assis Ferraz,[1] Carlos Alberto Souto Godoy Filho,[1] Cecilia Constantino Rocha,[2] Adomar Laurindo Neto,[1] Gabriela de Andrade Bruni,[1] Thais Sayuri Imura Oshiro,[1] Pietro Sampaio Baruselli,[1] Fabio Soares Lima,[3] and Guilherme Pugliesi[1]*



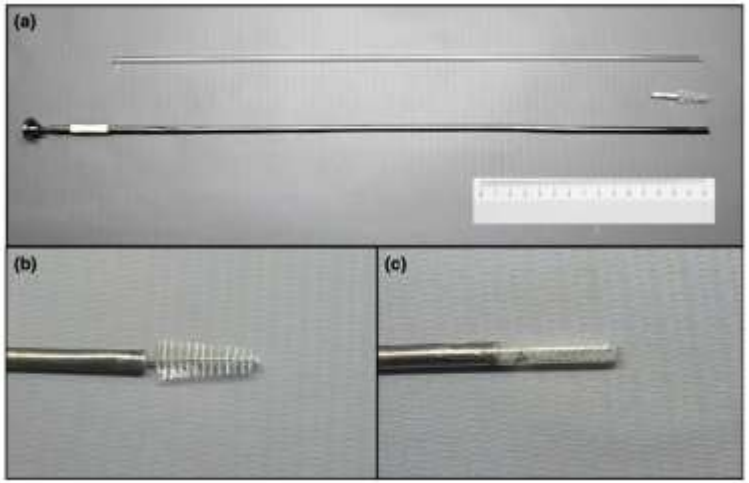
DOI: 10.1111/rda.13037

SHORT COMMUNICATION

WILEY

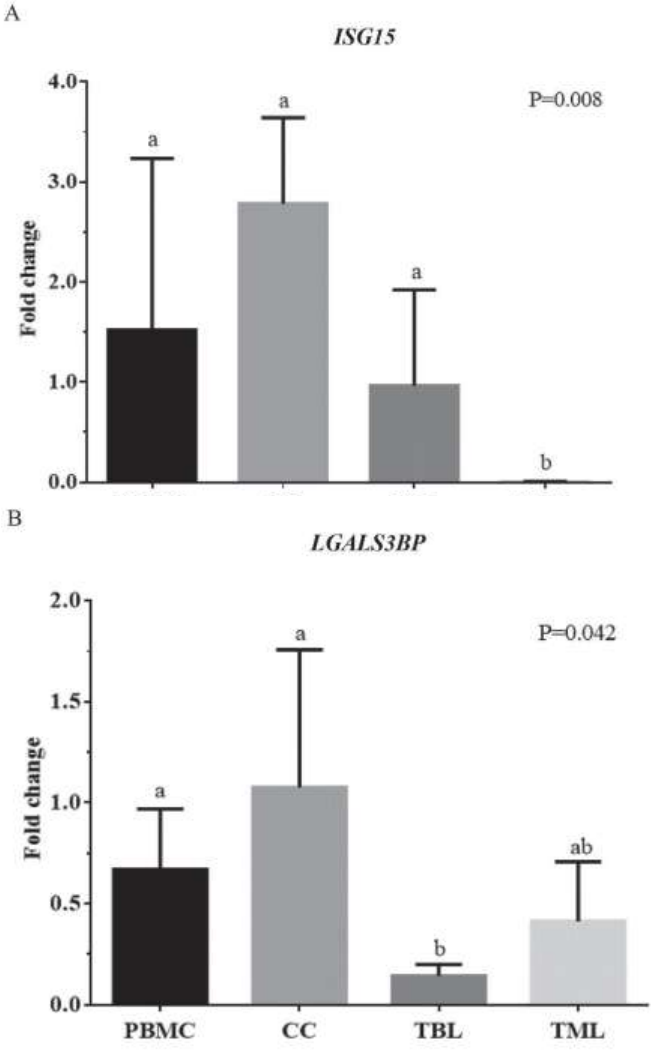
Cytobrush: A tool for sequential evaluation of gene expression in bovine endometrium

B Cardoso | ML Oliveira | G Pugliesi | EOS Batista | M Binelli

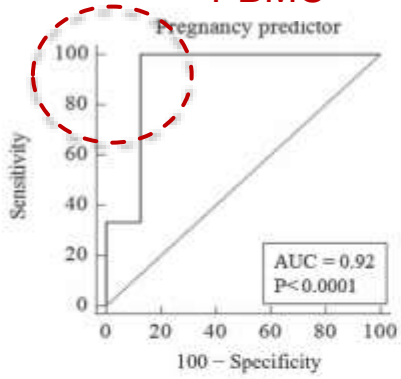


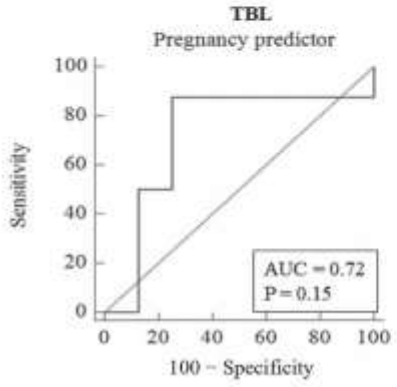
- Vacas (N=12) e novilhas (N=6) Holandesas lactantes;
- Amostras coletadas no **D20 pós-IATF.**

LFEM
REPRODUÇÃO ANIMAL · FMVZ · USP



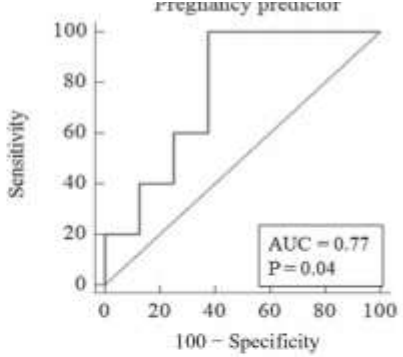
PBMC

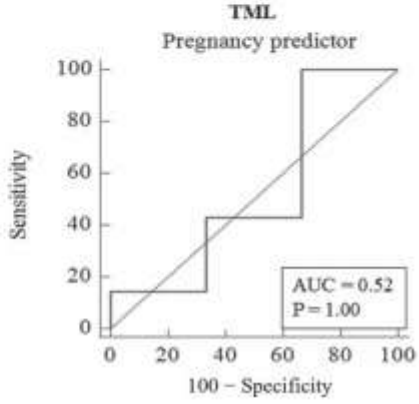




Leucócitos totais do leite

Células da Cérvix





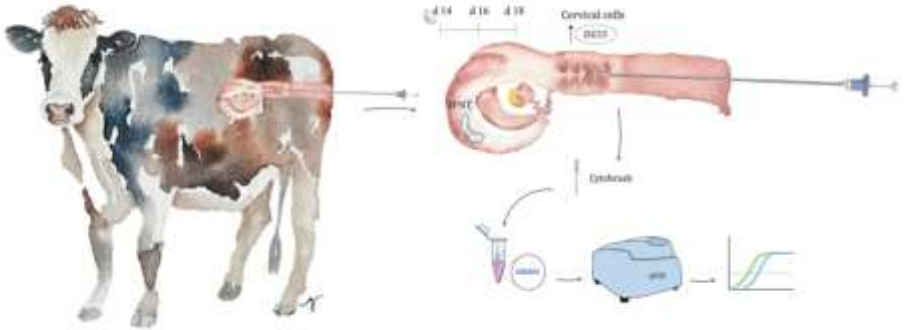
Leucócitos totais do sangue

JDS Communications®
2025; 6:165–170

https://doi.org/10.3168/jdsc.2024-0596
Short Communication
Physiology

Increased expression of interferon-stimulated gene 15 (*ISG15*) in cervical cells on day 14 of pregnancy in Holstein heifers

Graciana R. Mendina,[1]* Victoria de Brun,[2] Maria de Lourdes Adrien,[1] Victoria Pons,[1] Rodrigo Vivian Paradizo,[3] Jorge Gil,[1] Cecilia C. Rocha,[4] Mario Binelli,[4] and Ana Meikle[2]



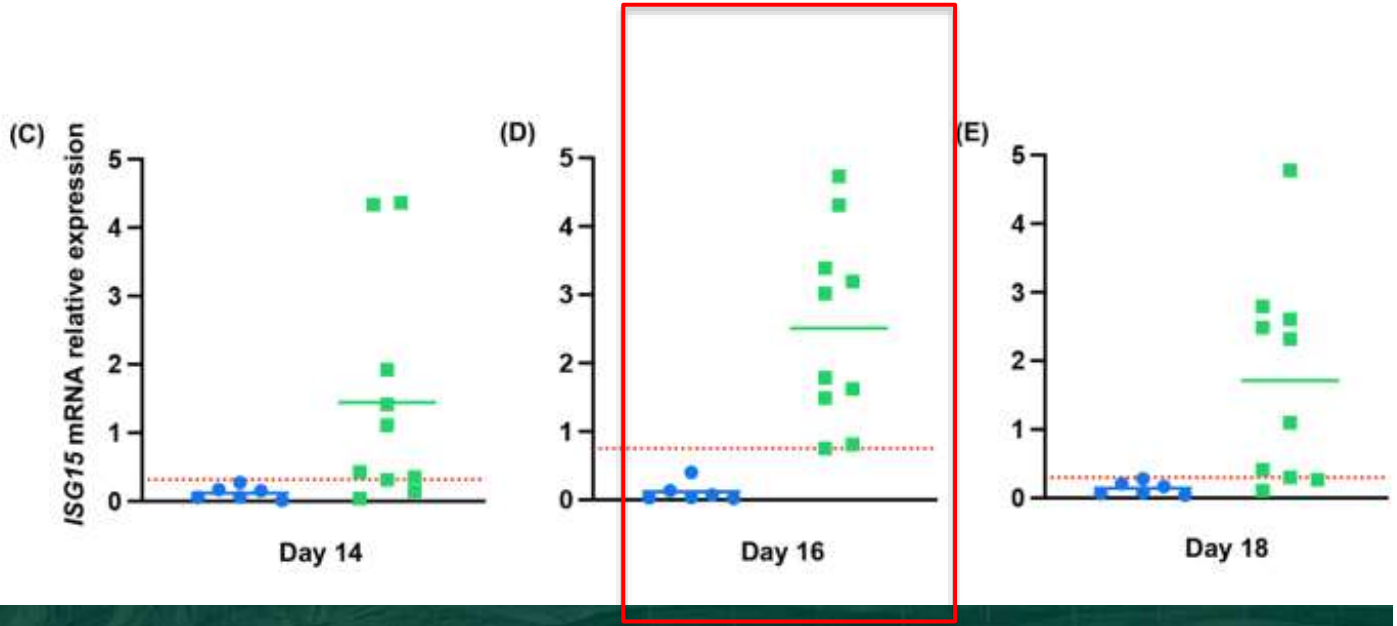


Table 1. Number of animals, true positive (TP), true negative (TN), false positive (FP), and false negative (FN) diagnoses, and sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), accuracy, and area under the curve (AUC) for determining pregnancy status on d 14, 16, and 18 post-AI by *ISG15* and on d 18 by *PGR* mRNA relative expression

	ISG15			*PGR*
Item	d 14	d 16	d 18	d 18
No. of animals	16	16	16	16
TP	8	10	8	10
TN	6	6	6	3
FP	0	0	0	3
FN	2	0	2	0
Sensitivity[1] (%)	80.0	100	80.0	100
Specificity[2] (%)	100	100	100	50.0
PPV[3] (%)	100	100	100	76.9
NPV[4] (%)	75.0	100	75.0	100
Accuracy[5] (%)	87.5	100	87.5	81.3
AUC (%)	86.0	100	93.3	73.3
P-value	0.0027	<0.0001	0.0009	0.0417

(Mendina et al., 2024)

Associação do uso de ISGs e PAGs para detector perda gestacional

Biology of Reproduction, 2024, **110**(3), 558–568
https://doi.org/10.1093/biolre/ioad164
Advance access publication date 11 December 2023
Research Article

Profiles of interferon-stimulated genes in multiple tissues and circulating pregnancy-associated glycoproteins and their association with pregnancy loss in dairy cows†

Rafael R. Domingues[1,2], Joao Paulo N. Andrade[1], Thiago O. Cunha[1], Guilherme Madureira[1], August S. Hoppman[1], Natalia N. Teixeira[1], Pedro L.J. Monteiro[1], Victor H. Gomez-Leon[1,3], Joao Paulo N. Martins[4] and Milo C. Wiltbank[1,2,*]

ISG ↓ ISG ↑ PAG ↓ Embrião

PAG ↓

ISG15 was determined in blood leukocyte on d19 and in the vagina and cervix on d17, d19, and d21

Pregnancy maintenance:
High ISG d17-21
Placenta attachment on d21
Luteal maintenance
Normal ISG15 on d17
Normal time of luteolysis d22
Lower ISG d21

Pregnancy loss d22-33 (24.6%):
High ISG d17-21
Delayed placenta attachment
Luteolysis or embryo death after d22

Uso de ISGs em células sanguíneas ainda com considerável ocorrência de Falso negativo

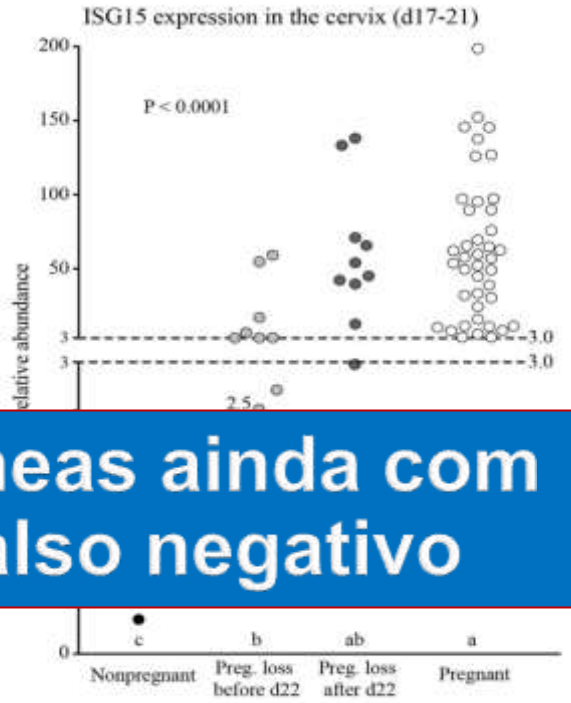


Figure 1. Mean expression of ISG15 in the cervix averaged for d17, d19 and d21 in cows that were not pregnant, pregnancy loss before d22,

Concentrações de IFN-tau

Biology of Reproduction, 2025, **112**(5), 981–995
https://doi.org/10.1093/biolre/ioaf066
Advance access publication date 28 March 2025
Research Article

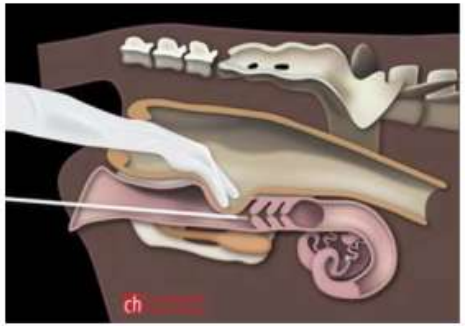
OXFORD

Early identification of bovine pregnancy status and embryonic mortality†

Jeanette V. Bishop[1,‡], Aydin Guzeloglu[1,‡], Tom Scheller[2], Joshua J. Docheff[3], Carolina L. Gonzalez-Berrios[1], Hana Van Campen[1], Terry M. Nett[1], Abigail L. Zezeski[4], Thomas W. Geary[4], William W. Thatcher[5] and Thomas R. Hansen[1,*]

Equine Swab

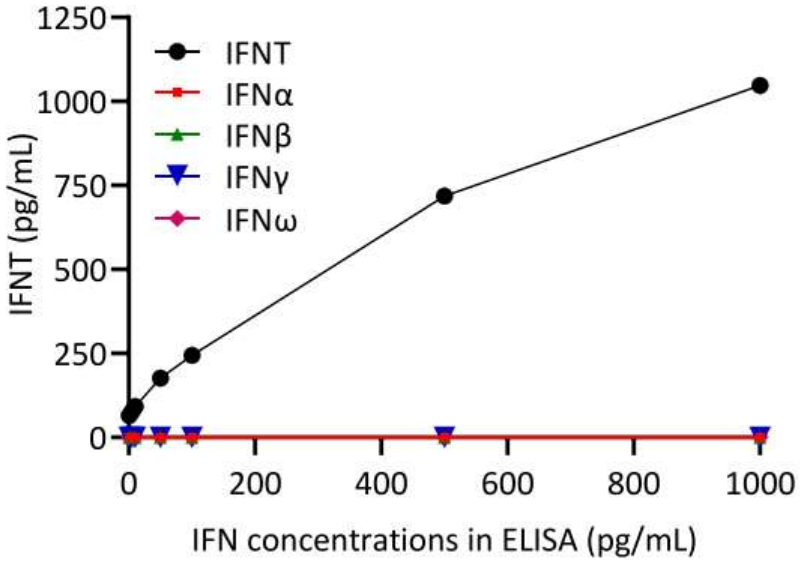
Transrectal-Guided Swab



Bovine Swab

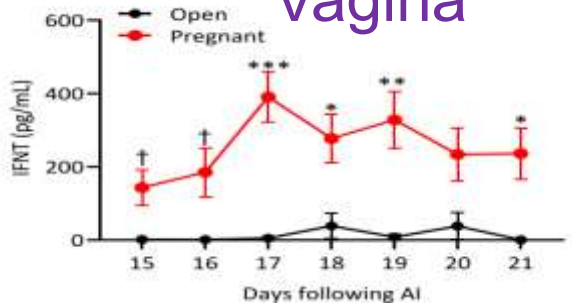
S I O A

A)



C)

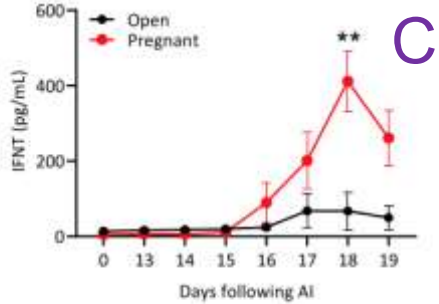
Vagina



	D15	D16	D17	D18	D19	D20	D21
Se	50	50	83	72	72	53	56
Sp	100	100	95	100	100	95	100
FP	0	0	5	0	0	5	0
FN	50	50	17	28	28	47	44

B)

Cervix



	DO	D13	D14	D15	D16	D17	D18	D19
Se	0	0	0	5	18	36	77	55
Sp	100	100	100	100	93	86	93	93
FP	0	0	0	0	7	14	7	7
FN	100	100	100	95	82	64	23	45

Table 2. Calculated parameters for open cow test (OCT) results based on pregnancy diagnosis by ultrasound in beef heifers and cows after insemination or embryo transfer in five different studies (USDA-ARS, MT, USA).

Endpoints	Definition	Heifers (ES, AI) (OCT Days 18–20) ($n = 102$) Value	Cows (ES, AI) (OCT Day 18) ($n = 135$) Value	Cows (ES, ET) (OCT Day 18) ($n = 126$) Value	Cows (BS, AI) (OCT Day16) ($n = 70$) Value	Cows (BS, AI) (OCT Day 18) ($n = 66$) Value
TP (n)	P by OCT and US	23	75	33	28	23
TN (n)	NP by OCT and US	66	47	80	36	39
FP (n)	P by OCT and NP by US	3	5	11	5	4
FP (%)	(FP/FP + TN)	4.4	9.7	12.1	12	9.3
FN (n)	NP by OCT and P by US	10	8	2	1	0
FN (%)	**(FN/FN + TP)**	**30.3**	**9.7**	**5.7**	**3.4**	**0**
ACC (%)	(TP + TN/n)	87.3	90.3	89.6	91.4	94
Se (%)	(TP/TP + FN)	69.6	90.3	94.3	96.6	100
Sp (%)	(TN/TN + FP)	95.6	90.3	87.9	87.8	90.7
PPV (%)	(TP/TP + FP)	88.4	93.7	75	84.8	85.2
NPV (%)	**(TN/TN + FN)**	**86.8**	**85.4**	**97.5**	**97.3**	**100**
EEM (%)	(FP/TP + FP + FN)	8	6	24.4	14.7	14.8

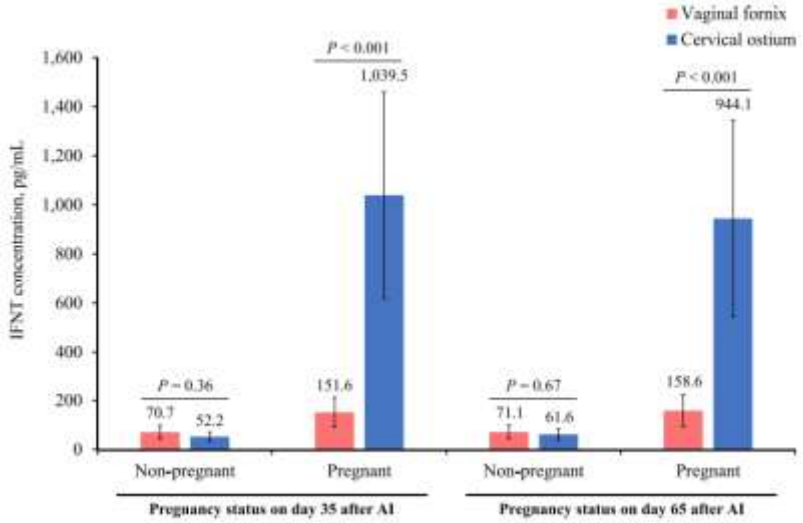
P, pregnant; NP, non-pregnant; TP, true positive; TN, true negative; FP, false positive; FN, false negative; ACC, accuracy; Sp, specificity; Se, sensitivity; PPV, positive predictive value; NPV, negative predictive value; EEM, estimated embryonic mortality; AI, artificial insemination; ES, equine swab device; BS, bovine swab device; US, ultrasound. The bold text and numbers represent the most important accuracy estimates for the open cow test.

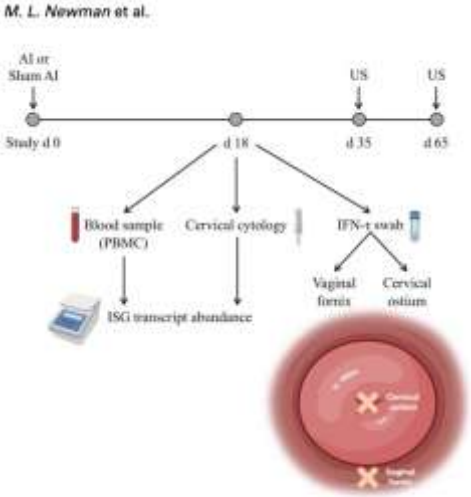
Biology of Reproduction, 2026, 114(3), 1045–1057
https://doi.org/10.1093/biolre/ioaf251
Advance access publication date 15 November 2025
Research Article

OXFORD

Interferon-tau concentration at the vaginal fornix and cervical ostium predicted early pregnancy outcomes in lactating dairy cows†

Madison Lauryl Newman[1], Victória Alice Bastos Primo[1], Maria Belen Ugarte Marin[1], Phillip Martins Gondim Peixoto[1], Tomás Delfin Gonzalez[2], Alexandra Bennett[3], Cecilia Constantino Rocha[4], Mário Binelli[5], Jeanette Victoria Bishop[6], Aydin Guzeloglu[6], Thomas Ross Hansen[6], William Watters Thatcher[5] and Rafael Sisconeto Bisinotto[1,*]





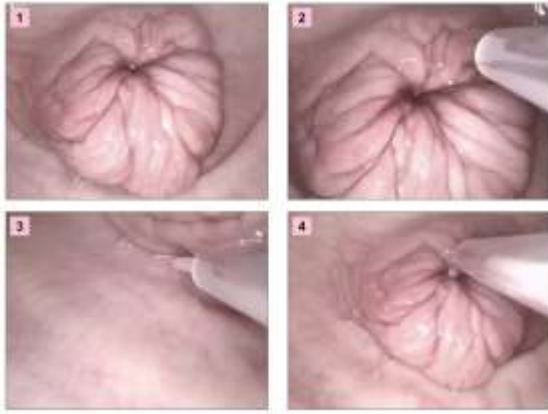


Figure 1. Diagram of study procedures. AI = artificial insemination; IFNT = interferon-tau; ISG = interferon-stimulated genes; PBMC = peripheral blood mononuclear cells; US = transrectal ultrasonography for pregnancy diagnosis.

Table 1. Test characteristics of early pregnancy diagnosis based on interferon-tau (IFNT) on day 18 after artificial insemination (AI) compared with pregnancy diagnosis based on transrectal ultrasonography (US) on days 35 and 65 after AI (n = 238)

	US day 35 after AI		US day 65 after AI	
Parameter[2]	Value	95% CI[1]	Value	95% CI[1]
Sensitivity	0.84	0.77 to 0.91	0.84	0.76 to 0.91
Specificity	0.84	0.78 to 0.90	0.82	0.76 to 0.88
PPV	0.81	0.73 to 0.88	0.77	0.69 to 0.85
NPV	0.87	0.81 to 0.93	0.88	0.82 to 0.93
Accuracy	0.84	0.79 to 0.89	0.83	0.78 to 0.88

[1]95% confidence interval. [2]Sensitivity ($\frac{TP}{TP+FN}$), specificity ($\frac{TN}{TN+FP}$), negative predictive value (NPV; $\frac{TN}{TN+FN}$); positive predictive value (PPV; $\frac{TP}{TP+FP}$), accuracy ($\frac{TP+TN}{TP+FP+TN+FN}$).

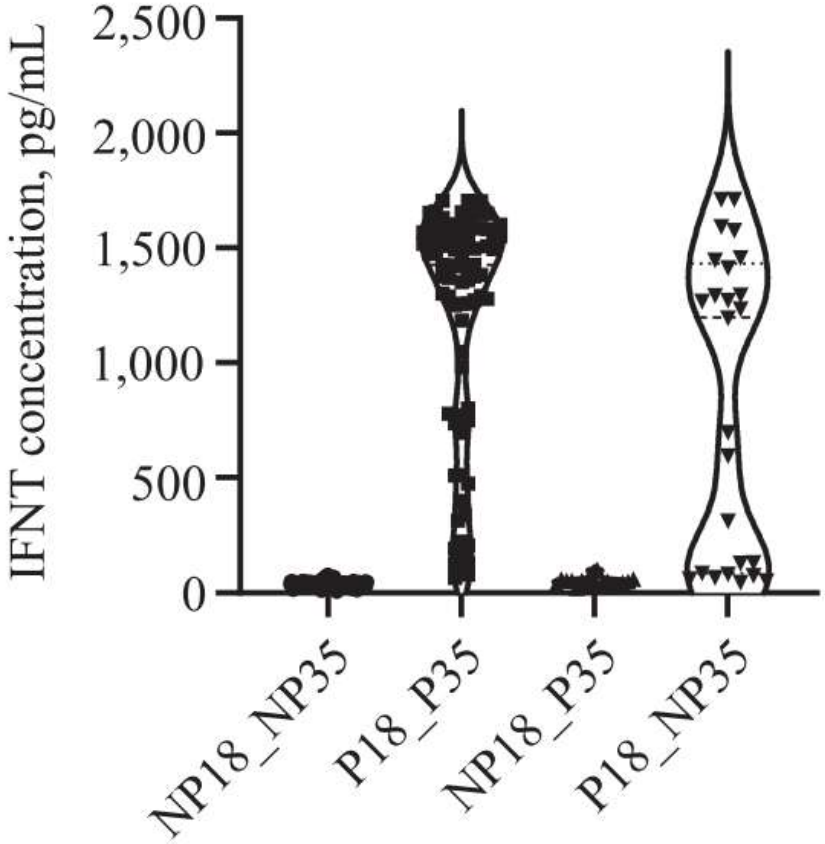


Figure 4. Violin plot depicting interferon-tau (IFNT) concentration in cervical swabs according to pregnancy category (n = 238):

Imprecisão na Predição do Status Gestacional

Falso-Positivo

- Mortalidade embrionária precoce;
- Indução de ISGs por outros estímulos (infecções virais).

Falso-Negativo

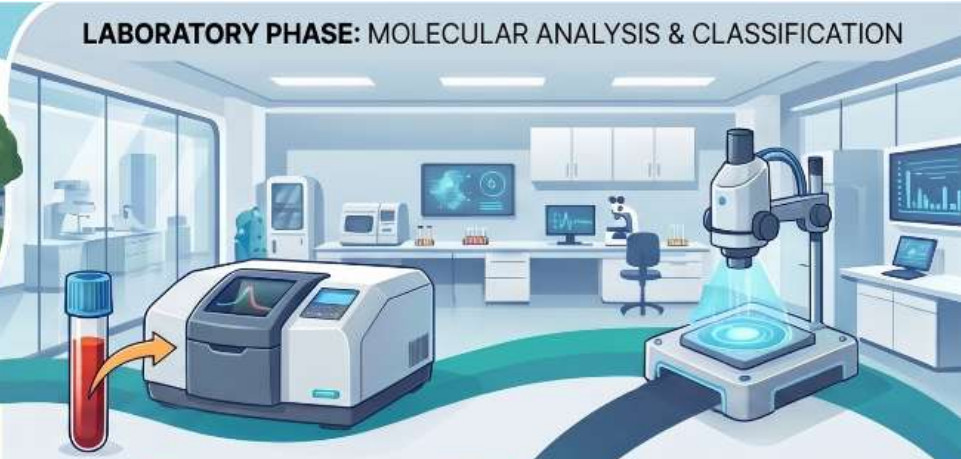
- IFN-τ não sinalizando o suficiente para estimular a expressão de ISGs
- Ineficácia da técnica de amostragem

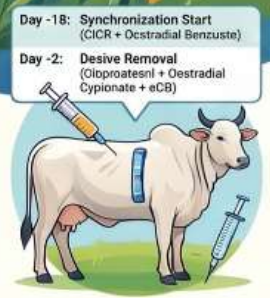
Perspectivas futuras

VETERINÁRIA USP

FIELD PHASE: SYNCHRONIZATION & SAMPLE COLLECTION

LABORATORY PHASE: MOLECULAR ANALYSIS & CLASSIFICATION





Step 1: Hormonal Synchronization (D-10 to D-2)

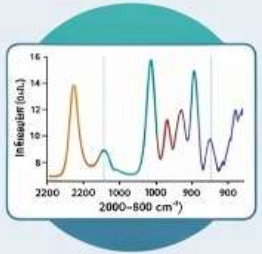
Females received progesterone (CIDR) and oestradiol treatments to synchronize ovulation before insemination.

Step 2: Fixed-Time Artificial Insemination (D0)

Eighty Nellore females were inseminated with frozen-thawed semen from a single bull.

Step 3: Diagnosis & Serum Collection (D30)

Pregnancy was confirmed via ultrasound, and blood was collected for lab-based spectral analysis.



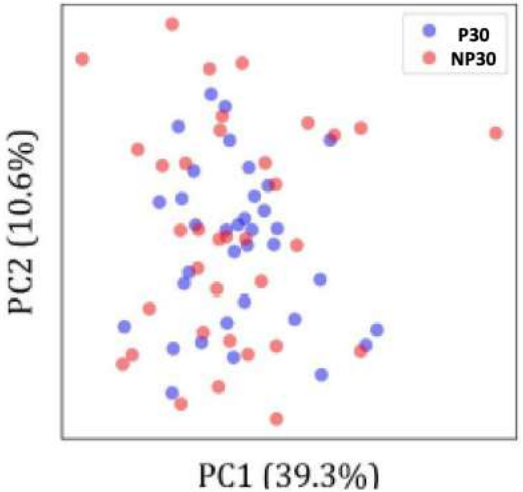
FTIR Molecular Fingerprinting

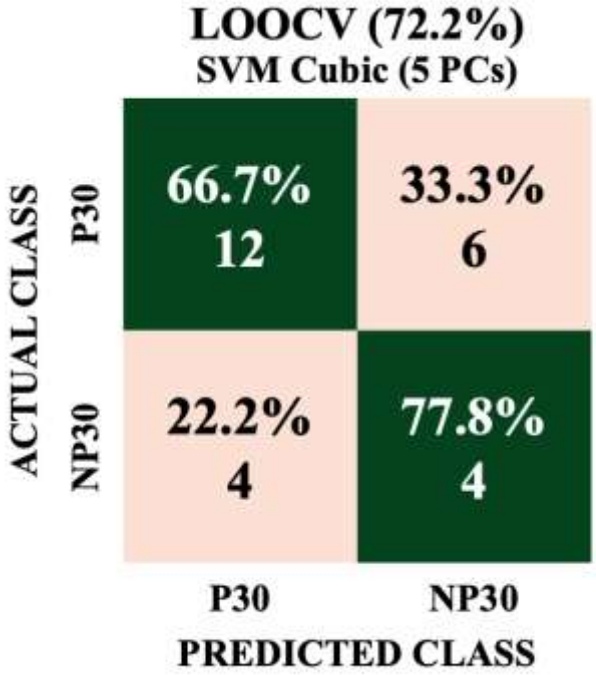
Serum was analyzed via infrared spectroscopy (2000–900 cm^{-1}) to identify protein and lipid changes.

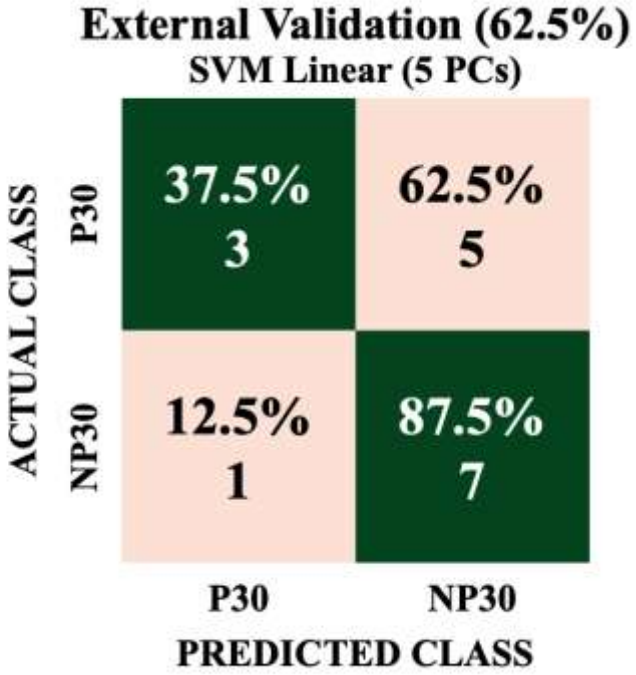
Machine Learning Classification

Spectral data was processed using Support Vector Machines (SVM) with cubic kernel functions.

Espectroscopia







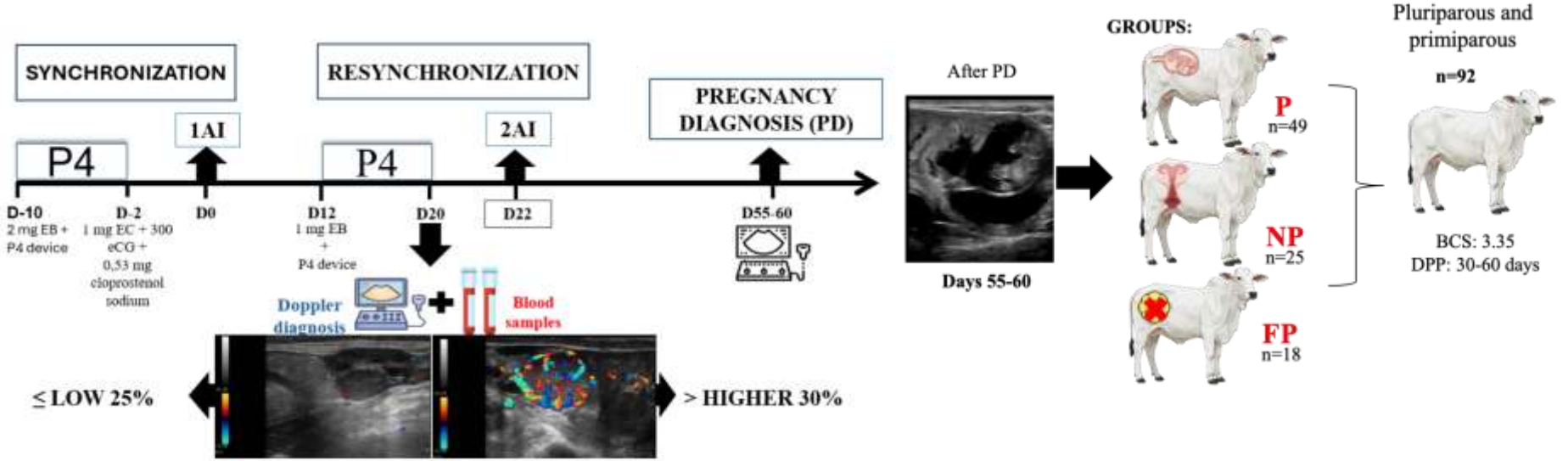
(Reis, 2024)

Perspectivas futuras

Investigation of the metabolomic profile of Nelore cows for anticipation of pregnancy diagnosis

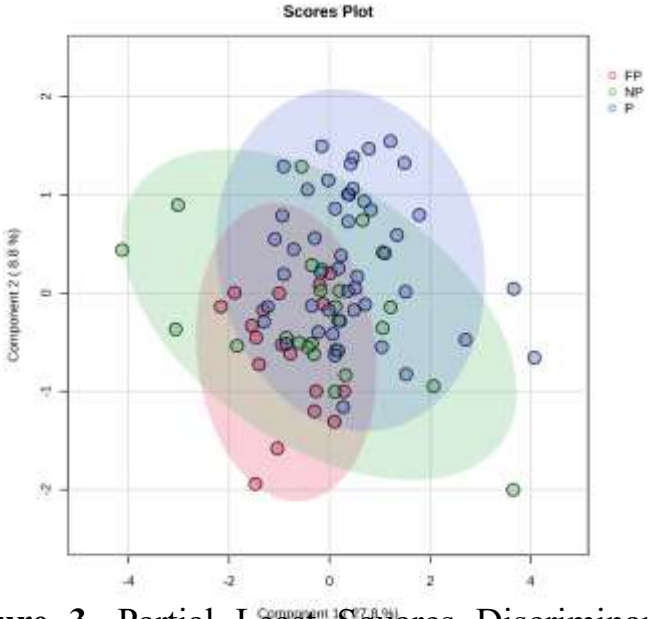
Ana Laura dos Santos Munhoz Gôngora[1], Samuel Souza Volpe[2], Vinicius Laerte Silva Herreira[1], Eduardo Solano Pina Santos[1], Lauro César Ferreira Beltrão[1], Maria Angélica dos Santos[1], Fernanda Maria Marins Ocampos[3], Luiz Alberto Conalgo[3], Amanda Guimarães Silva[2], Isabella Rio Feltrin[2], Mario Binelli[4], Guilherme Pugliesi[2], Nara Regina Brandão Cônsolo[1]

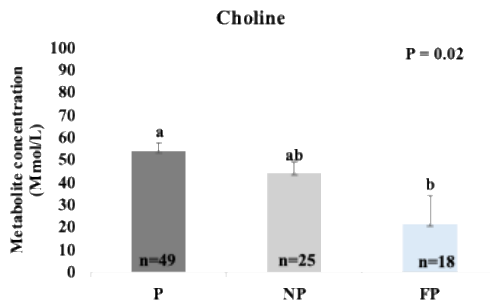
- **Metabolômica no soro**



Perspectivas futuras

- **Metabolômica no soro**





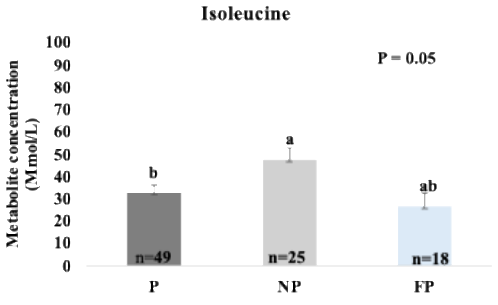
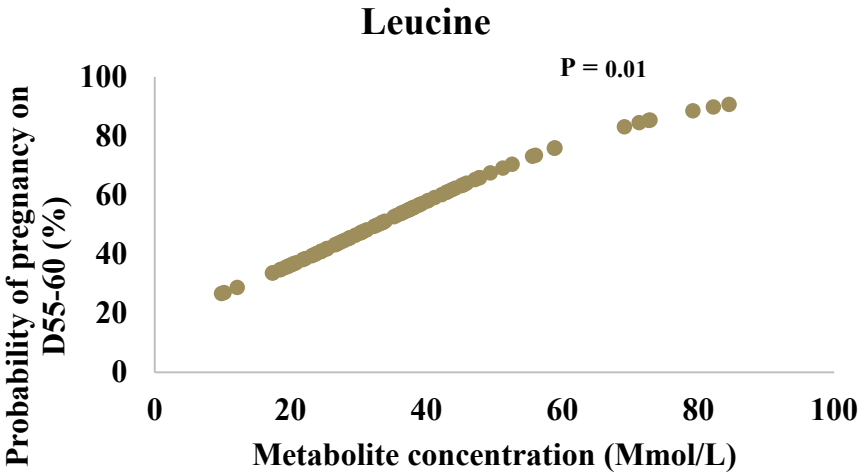


Figure 3. Partial Least Squares Discriminant Analysis (PLS-DA) of serum metabolites treatments. FP: false-positive; P: pregnant; NP: non-pregnant.

Metabolômica no soro



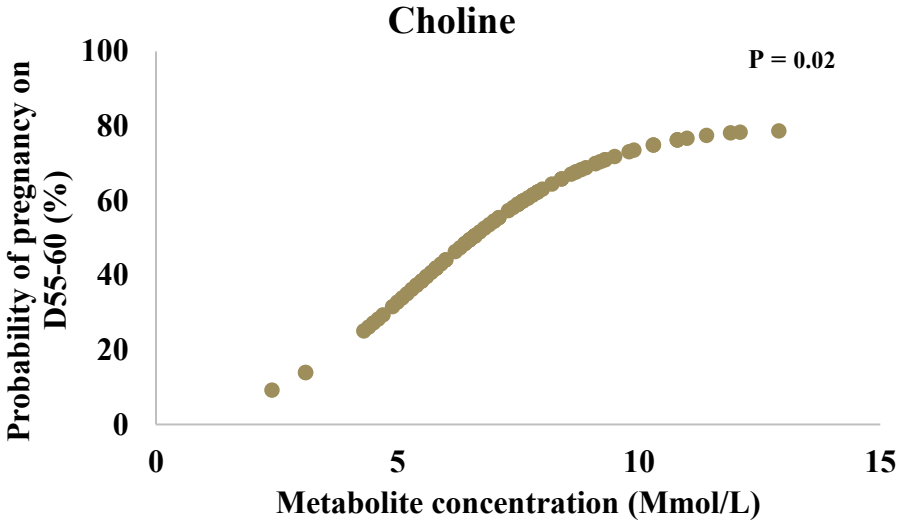
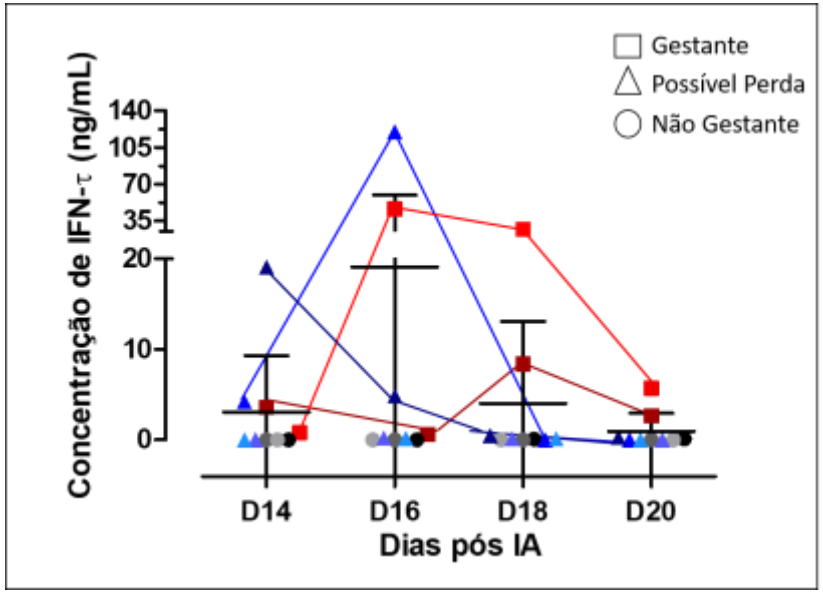
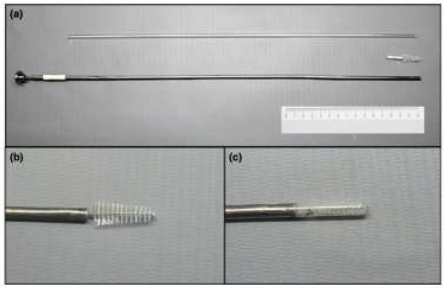


Figure 9. Probability of being pregnant at confirmatory diagnosis (D55–60) based on the concentration of significant metabolites.

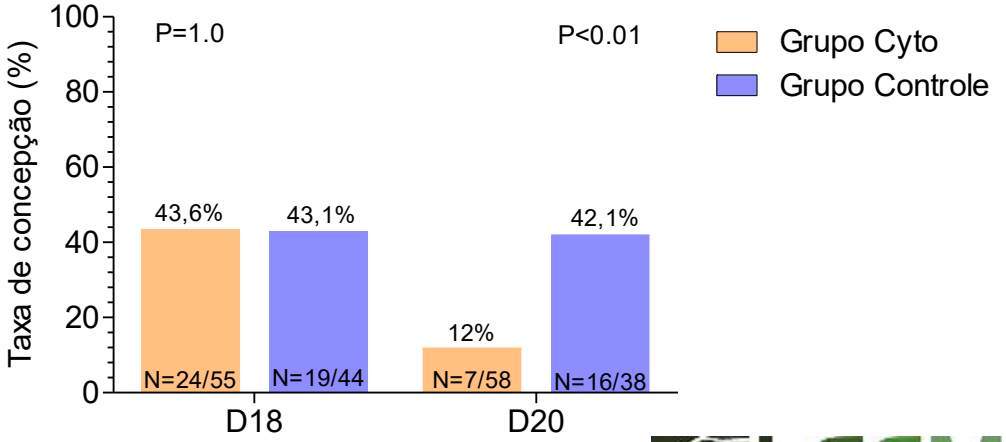
Perspectivas futuras

- Mensuração de IFN-tau no útero





Fêmeas Inseminadas DG 60



Dados não publicados

Dispositivos de Respiração ("Bafômetro para Vacas")

VETERINÁRIA USP

CompreRural
PORTAL DE CONTEÚDO RURAL

HOME PECUÁRIA DE CORTE PECUÁRIA LEITEIRA AGRICULTURA CAVALOS ARTIGOS MAIS LIDAS COLUNISTAS DIREITO NO AGRO

Home > Artigos > "Bafômetro para vacas" com tecnologia da NASA detecta prenhez em segundos

"Bafômetro para vacas" com tecnologia da NASA detecta prenhez em segundos

Escrito por Compre Rural Notícias
19 de setembro de 2025 - 15h01 Atualizado em 19 de setembro de 2025 - 15h01

MILKPOINT

NOTÍCIAS & MERCADO | PREÇOS & PRODUÇÃO | COLUNAS | MILKPLAY | ARTIGOS | EVENTOS | TO

Início > Giro de Notícias

Pecuária adota inovação inspirada pela NASA no rebanho

O "nariz eletrônico" da Agscent realiza diagnósticos rápidos e seguros via hálito bovino, abrindo espaço para maior eficiência e sustentabilidade no agro.

Publicado por: MilkPoint
Publicado em: 25/09/2025 - 2 minutos de leitura

Dispositivos de Respiração ("Bafômetro para Vacas")

- **"Breathomics"** → Análise do Metaboloma do Hálito
- Mudanças metabólicas alteram a assinatura química de **Compostos Orgânicos Voláteis (VOCs)** na circulação sanguínea.
- Troca gasosa entre pulmão e sangue periférico: VOCs alterados são excretados continuamente por meio da respiração do animal.
- Detecção por nano sensores (NASA)

https://www.youtube.com/watch?v=lwQIlqGf7uE

Dispositivos de Respiração ("Bafômetro para Vacas")

mla
MEAT & LIVESTOCK AUSTRALIA

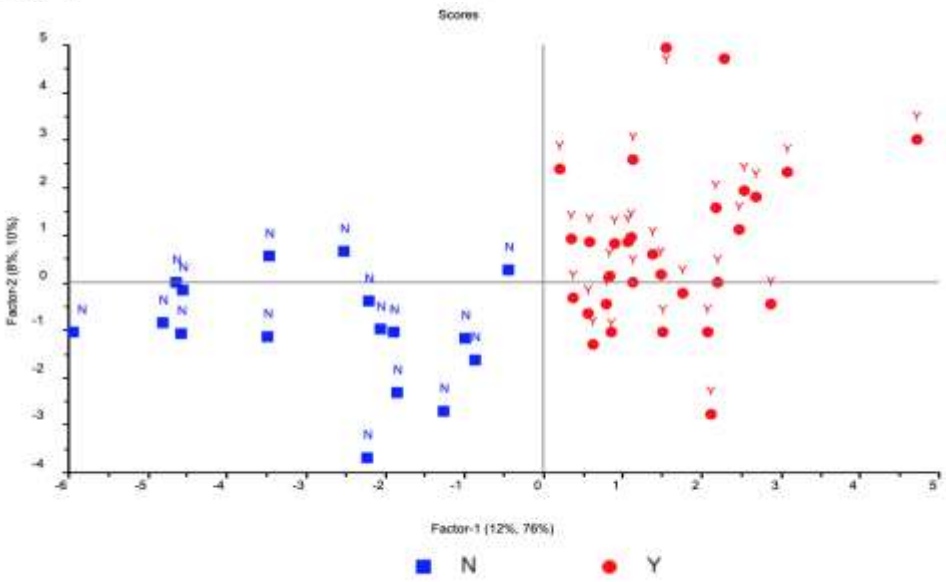
Final report

Agscent Cow Breath Sampling: pregnancy diagnosis proof of concept

Project code: B.AWW.0007

Prepared by: Dr Bronwyn Darlington
Agscent Pty Ltd

Date published: 4 May 2021



Validated model differentiating pregnant/empty cows at day 40 (100%)

Dispositivos de Respiração ("Bafômetro para Vacas")

VETERINÁRIA USP

An official website of the United States government

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breath; pregnancy diagnosis; cattle

Artigos

A qualquer momento
Desde 2026
Desde 2025
Desde 2022
Período específico...

Artigos adicionados no ano passado, classificados por data

Sua pesquisa - **breath; pregnancy diagnosis; cattle** - não encontrou nenhum artigo correspondente.

Sugestões:

Available online at www.sciencedirect.com
ScienceDirect
journal homepage: www.elsevier.com/locate/issn/15375110

Research Note

Automatic detection of oestrus cows via breath sampling with an electronic nose: A pilot study

Francis E.P. Sanderink [a], Jan Willem Gerritsen [b], Peter W.G. Groot Koerkamp [a,], Simon van Mourik [a,*]*

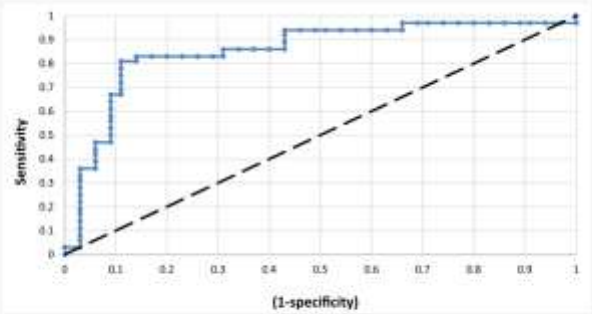


Fig. 3 – ROC curve relating sensitivity (true positives) and 1-specificity (1- true negative) under varying threshold values. The dashed diagonal line represents no predictive value. The AUC is 0.86.

LFEM REPRODUÇÃO ANIMAL · FMVZ · USP

Dispositivos de Respiração ("Bafômetro para Vacas")

Promessa:

- US$ 10 mil
- A partir de 18 dias pós-IA
- 30 segundos

Realidade:

- Sem comprovação científica
- Só relatório técnico de prova de conceito publicado

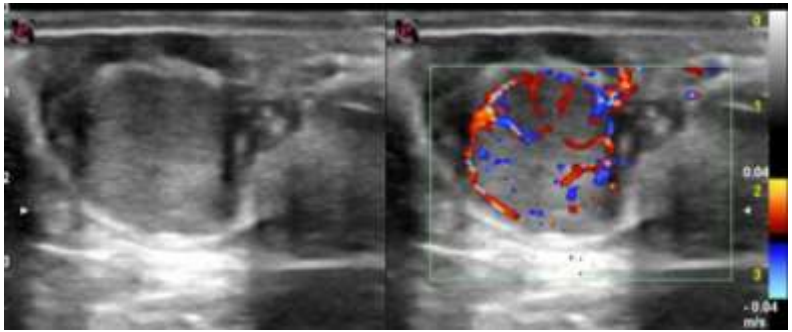
Limitantes:

- Validar em diferentes condições
- Disponibilidade do equipamento

Tópicos

- Métodos de Diagnóstico de Gestação Convencionais
- Ferramentas para Antecipar a Detecção do Status Gestacional
- Marcadores Gestacionais e Potenciais Métodos
- Considerações Finais

A campo (em tempo real):
US Modo B e Doppler



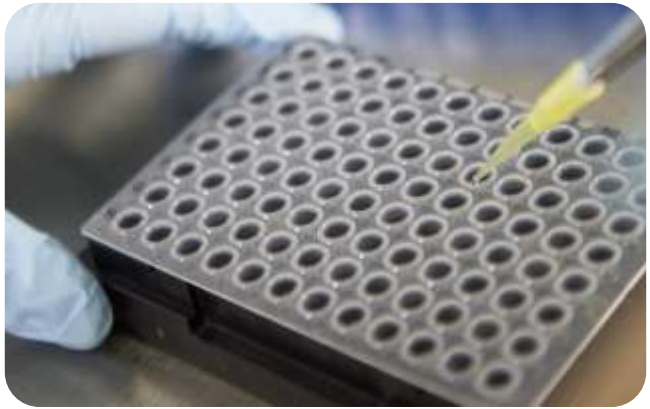
Laboratório (moleculares):

PAGs

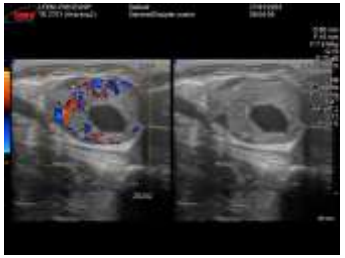
Genes estimulados por IFN-tau (ISGs)

IFN-tau

Novas moléculas ou Assinatura (fingerprint)



Considerações Finais:



- Ferramentas a campo
- Ultrassonografia Doppler (realidade a campo)
  - Antecipa detecção da prenhez em programas em Tempo Fixo
  - Ferramenta que permite com alta acurácia identificar as fêmeas não-gestantes com 20-22 pós-inseminação
  - Limitações
    - Veterinários especializados
    - Equipamentos regulados
    - Interpretação → Inteligência Artificial

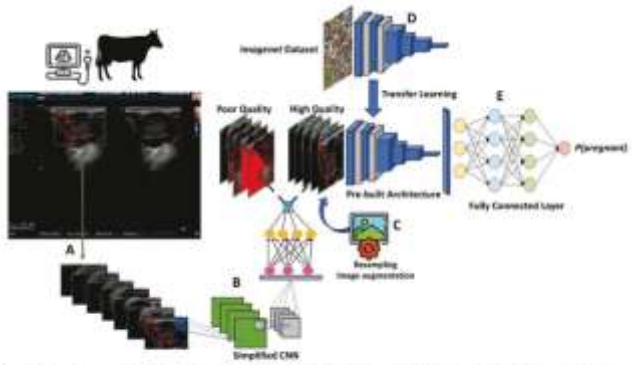
Machine learning e Doppler

Journal of Animal Science, 2025, **103**, skaf188
https://doi.org/10.1093/jas/skaf188
Advance access publication 13 May 2025
Technology in Animal Science

Computer vision analysis of luteal color Doppler ultrasonography for early and automated pregnancy diagnosis in *Bos taurus* beef cows

Lucas Melo Gonçalves,[†] Pedro Levy Piza Fontes,[†,‡] and Anderson Antonio Carvalho Alves[†,‡,§]

[†]Department of Animal and Dairy Science, University of Georgia, Athens, GA, 30602, USA
[‡]Institute for Integrative Precision Agriculture – University of Georgia, Athens, GA 30602, USA
[§]Corresponding author: alvesand@uga.edu



Tropical Animal Health and Production (2026) 58:162
https://doi.org/10.1007/s11250-026-04964-4

REGULAR ARTICLES

Prediction of gestational status nineteen days after artificial insemination using color ultrasonography and machine learning strategies in beef heifers

Pablo Sebastián Reineri[1,2] · Sergio Daniel Roldán Bernhard[1] · Santiago Alberto Principi[3] · Juan Florencio Aller[4]

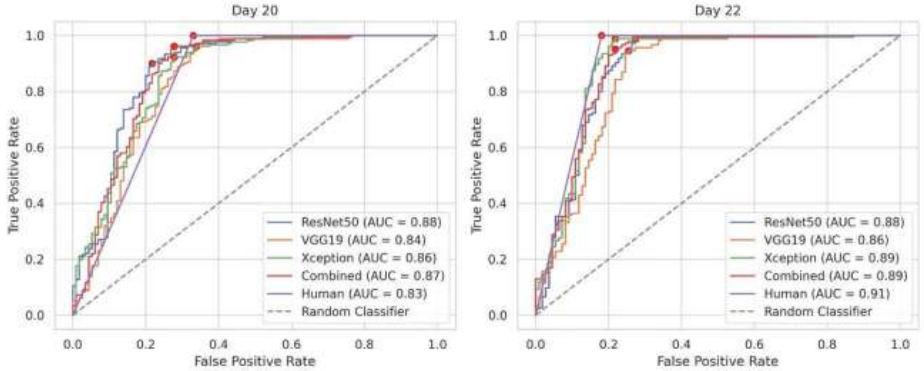


Figure 3. Receiver Operating Characteristic (ROC) curves and area under the curve (AUC) for pregnancy classification in beef cows, comparing human evaluation with different convolutional neural network (CNN) architectures. The pregnancy assessments were based on Doppler ultrasound data collected 20 and 22 d after fixed-time artificial insemination. Circles on the ROC curves indicate the optimal balance between sensitivity and specificity, determined using Youden's Index.

Ainda sem acurácia superior ao veterinário treinado

Machine learning e Doppler

imv TECHNOLOGIES

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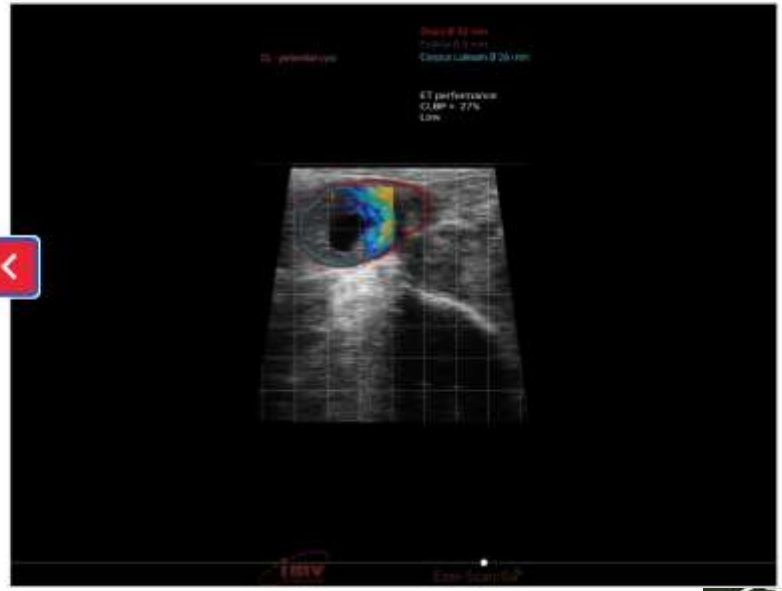

Perspectivas Futuras

Mais pesquisas usando IFN-t, PAGs e ISGs como biomarcadores de prenhez;

Utilização de metodologias mais rápidas e sensíveis (PCR digital);

Associação de técnicas moleculares com Ultrassonográficas.

Cuidado com as notícias...

Agradecimentos

Pesquisadores, empresas e fazendas parceiras

PPGRA
Programa de Pós Graduação em Reprodução Animal

LFEM

@lfem_usp

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Deixa um like pra gente hehe

Contato: gpugliesi@usp.br