Published by

Archives of Veterinary Science

Echocardiographic reference intervals for end-diastolic and end-systolic left ventricle volumes obtained by Simpson's method of discs in healthy showjumping and polo Argentinian Saddlebred horses

http://dx.doi.org/10.5380/avs.v29i4.96569

Jeff M. Perez
Chiara Alessi
Carlos E. Giraldo
Enrica Zucca
Gerhard Wess
Sergio E. Linares-Villalba

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS VETERINÁRIAS-UFPR
50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023
UFPR
UNIVERSIDADE FEDERAL DO PARANÁ

ARTICLES

Archives of Veterinary Science

https://www.ufpr.br/

Echocardiographic reference intervals for end-diastolic and end-systolic left ventricle volumes obtained by Simpson's method of discs in healthy showjumping and polo Argentinian Saddlebred horses

Submitted: *15/08/2024*
Accepted: *01/12/2024*

Jeff M. Perez[1], Chiara Alessi[2], Carlos E. Giraldo[2], Enrica Zucca[3], Gerhard Wess[4], Sergio E. Linares-Villalba[2]

[1] *Vet Point Veterinary Care Center, Cardiology and Surgery Service, Al Waab Street, Doha, Qatar. ORCID: https://orcid.org/0000-0001-7735-1739*
[2] *Department of Animal Health, Universidad de Caldas, 170004, Manizales, Colombia. ORCID: https://orcid.org/0000-0001-9333-2650*
[2] *Department of Animal Health, Universidad de Caldas, 170004, Manizales, Colombia. ORCID: https://orcid.org/0000-0001-8050-0512*
[2] *Department of Animal Health, Universidad de Caldas, 170004, Manizales, Colombia. ORCID: https://orcid.org/0000-0003-3645-0647*
[3] *Equine Sports Medicine Lab (ESM-Lab), Department of Health, Animal Science and Food Safety, Università degli Studi di Milano, Via Celoria 10, 20133, Milano, Italy. ORCID: https://orcid.org/0000-0003-0494-1329*
[4] *Clinic of Small Animal Medicine, Ludwig-Maximilians-Universität München, 80539, Munich, Germ... 6634-8072*

Author for correspondence:

Jeff M. Perez

jeff.mp@outlook.com

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS VETERINÁRIAS-UFPR

50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ

ABSTRACT

The left ventricle volume quantification is a critical component of standard echocardiography. Therefore, this study aimed to establish breed-specific echocardiographic reference intervals for end-diastolic and end-systolic volumes using Simpson's method of discs (SMOD) in healthy showjumping and polo Argentinian Saddlebred horses.

ABSTRACT

The central 90% reference limit was calculated, and its confidence and reference intervals were reported with 90% confidentiality. A comparison was performed between cardiac SMOD-derived and Teichholz-derived volumes and between males and females.

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS VETERINÁRIAS-UFPR

50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ

ABSTRACT

A total of 117 horses (43 females and 77 males) weighing 445–690 kg (521 ± 56 kg) with similar training were selected to create the reference intervals. SMOD-derived end-diastolic volume indexed (EDVI) was 1.32 ml/kg, RI from 1.26 to 1.37 ml, and SMOD-derived end-systolic volume indexed (ESVI) was 0.47 ml/kg, RI from 0.43 to 0.50 ml.

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS VETERINÁRIAS-UFPR

50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ

ABSTRACT

There was a significant difference between EDVI SMOD-derived and EDVI Teichholz-derived volumes ($p < 0.001$, $d = 1.14$). In addition, ESVI SMOD-derived volumes differed from Teichholz-derived volumes ($p < 0.05$, $r = 0.33$). EDVI was statistically similar between males and females ($p = 0.721$). ESVI was statistically similar between males and females ($p = 0.122$).

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS VETERINÁRIAS-UFPR

50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ

ABSTRACT

In conclusion, it is feasible and reproducible to obtain SMOD-derived volumes in horses as in humans and dogs with standard views modifications and reference intervals are reported for clinical and research purposes, especially when accurate quantification of ventricular volumes and ejection fraction are needed.

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS VETERINÁRIAS-UFPR

50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ

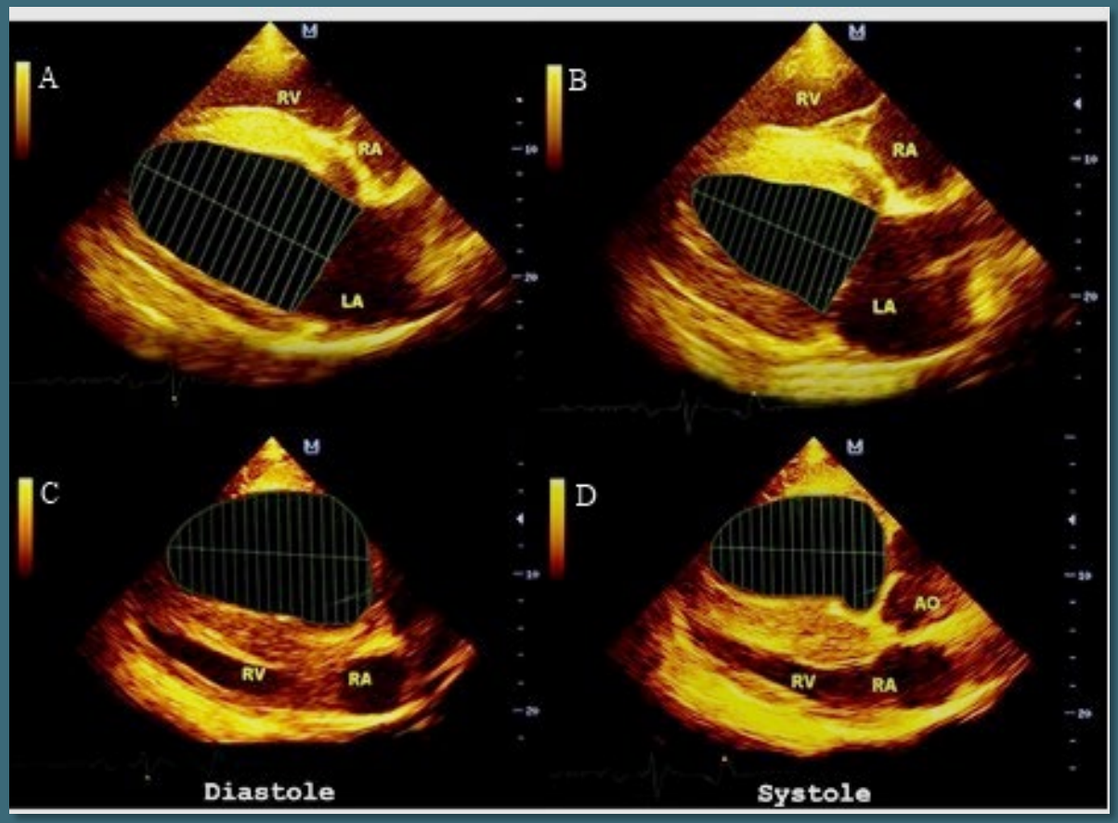
ABSTRACT

Keywords: Horses, cardiac volumes, echocardiography, left ventricle, reference intervals.

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS VETERINÁRIAS-UFPR

50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ



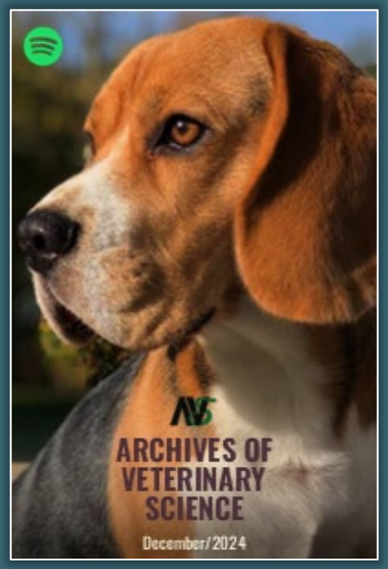


Figure 1 – Simpson's method of disc measurement performed on a standard 2-D right parasternal long-axis view of the left atrium and ventricle in diastole (A) and systole (B), and from the 2-D left parasternal long-axis view in diastole (C) and systole (D). A.O.: aorta; LA: left atrium; LV: left ventricle; R.A.: right atrium; R.V.: right ventricle.

$$\sqrt{\frac{(Measure1 - Measure2)^2}{2}}$$

The absolute intra- and inter-observer variability was calculated using the following formula:

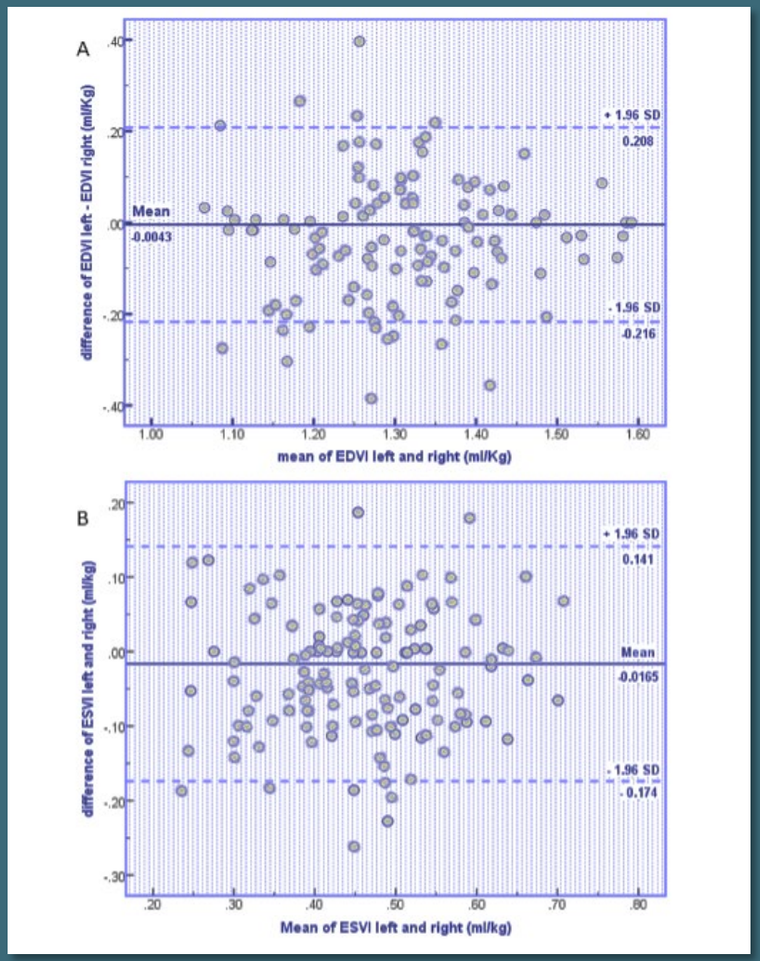
$$\frac{\sqrt{\frac{(Measure1 - Measure2)^2}{2}}}{\frac{(Measure1 + Measure2)}{2}}$$

The relative intra- and inter-observer variability was calculated using the following formula:

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS VETERINÁRIAS-UFPR

50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ



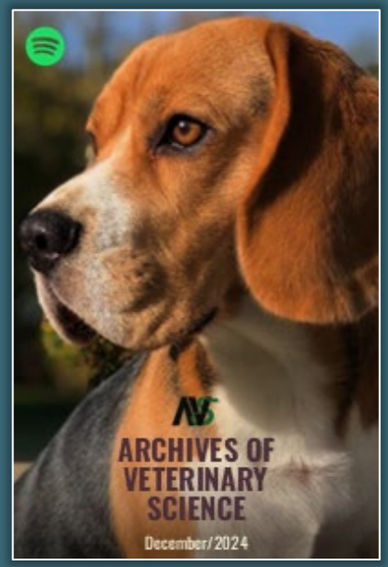


Figure 2 – The Bland-Altman plot for SMOD-derived volumes indexed to the B.W. between measurements of EDVI (A) and ESVI (B) obtained from the right parasternal. EDVI right: end-diastolic volume index to body weight (B.W.) in right and left parasternal views; EDVI left end-diastolic volume indexed to B.W. in left parasternal view; ESVI right: end-systolic volume indexed to B.W. in right parasternal view; ESVI left end-systolic volume indexed to B.W. in the left parasternal view.

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS VETERINÁRIAS-UFPR

50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ

CONCLUSION

In conclusion, this study demonstrated that obtaining SMOD-derived volumes is both feasible and reproducible in horses, with breed-specific reference intervals provided. The end-diastolic and end-systolic volumes derived from SMOD measurements in Showjumping and Polo Argentinian Saddlebred horses represent the first data of this kind for these breeds and this information is valuable for both clinical and research applications. Notably, effect size was reported alongside the variables, which is important for designing and interpreting future research and meta-analysis in this field.

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS VETERINÁRIAS-UFPR

50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ

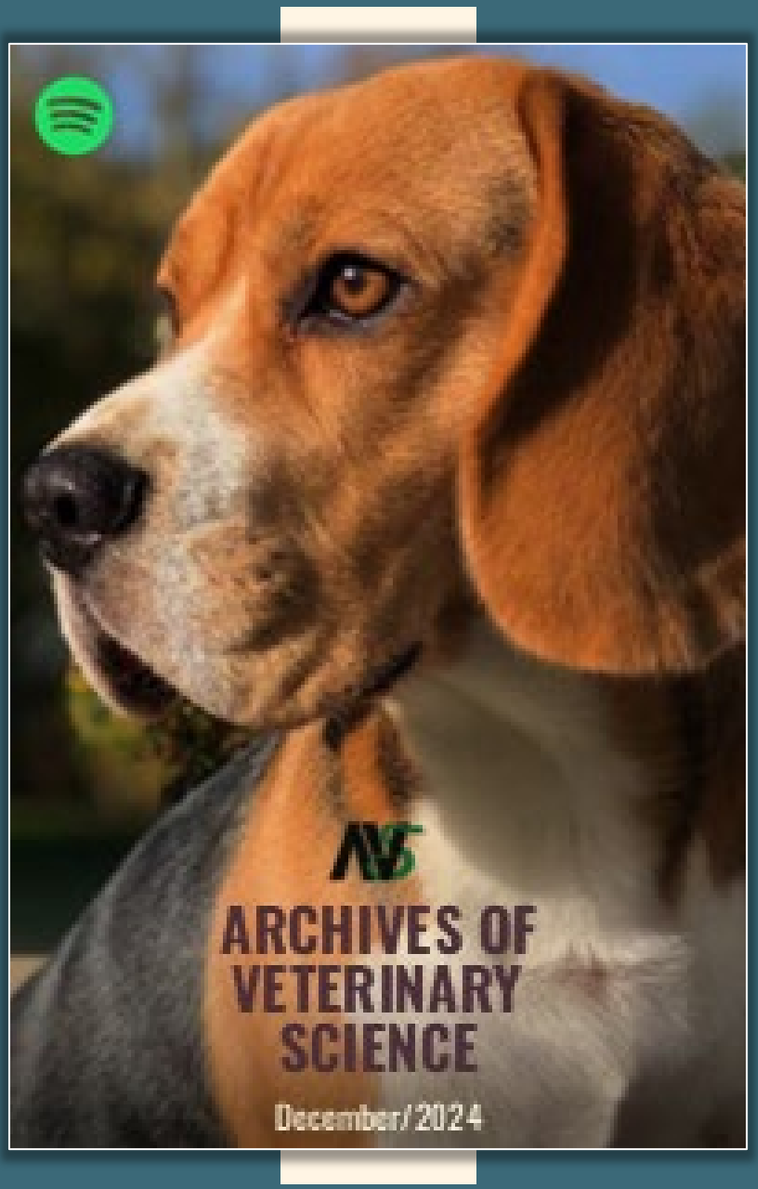
CONCLUSION

Consequently, studying the relationship between left ventricle volumes and athletic performance, as well as the effects of various training regimens and sports on cardiac volumes, would benefit from these data, improving our understanding of cardiovascular health in athletic horses. Finally, SMOD-derived volumes are a simple, non-invasive echocardiographic measure that can be used before more advanced imaging techniques, such as real-time three-dimensional echocardiography or ECG-gated multidetector computed tomography angiography are available in equine cardiology.

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS VETERINÁRIAS-UFPR

50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ



https://doi.org/10.5380/avs.v29i4

PPGCV
PROGRAMA DE PÓS-GRADUAÇÃO
EM CIÊNCIAS VETERINÁRIAS-UFPR

50 anos
Setor de Ciências Agrárias
Universidade Federal do Paraná
1973 - 2023

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ