



## Ultrasonographic evaluation of thyroid glands and comparative hormonal analysis of domestic cats and neotropical wild felids

[Avaliação ultrassonográfica de glândulas tireoide e análises comparativas hormonais de felídeos domésticos e selvagens neotropicais]

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### ABSTRACT

This study aimed to determine the morphological and metric of the thyroid gland, and Total T4 and Free T4 hormonal values among domestic and wild felids without thyroid diseases. Thirty-three felids without thyroid diseases were evaluated, being 13 felids, one *Panthera onca*, three *Pumas concolor*, three small wild cats, three *Pumas yagouaroundi*, two *Leopardus pardalis* and one *Leopardus wiedii*, and 20 domestic felines. The animals were submitted to ultrasonography of the thyroid gland and to hormonal serum dosage of Total T4 and Free T4 by the technique of chemiluminescence. Subsequently, they were divided into groups according to weight, sex, and age. The mean volume of thyroid lobe was 0.11cm<sup>3</sup> for domestic cats, 0.18cm<sup>3</sup> for the mixed wild feline group (*Leopardus pardalis*, *Leopardus tigrinus*, *Leopardus wiedii* and *Pumas yagouaroundi*) and 1.57cm<sup>3</sup> for the jaguar group (*Panthera onca* e *Pumas concolor*). The mean Total T4 and Free T4 were 2.55µg/dL and 1.23ng/dL for domestic cats, 1.46µg/dL and 1.89ng/dL for the mixed feline group and 0.68µg/dL and 0.82ng/dL for the jaguar group, respectively. Animals over 10 years old presented higher Free T4 values.

Keywords: cats, wild, leopardus, thyroid, ultrasound

### RESUMO

O objetivo deste estudo foi determinar a morfologia e a métrica da glândula tireoide e os valores hormonais de T4 total e T4 livre entre felinos domésticos e selvagens sem doenças da tireoide. Foram avaliados 33 felinos sem doenças da tireoide, sendo 13 felinos, uma *Panthera onca*, três *Pumas concolor*, três pequenos gatos selvagens, três *Pumas yagouaroundi*, dois *Leopardus pardalis* e um *Leopardus wiedii*, e 20 felinos domésticos. Os animais foram submetidos à ultrassonografia da glândula tireoide e à dosagem sérica hormonal de T4 total e T4 livre pela técnica de quimioluminescência. Em seguida, foram divididos em grupos de acordo com peso, sexo e idade. O volume médio do lobo da tireoide foi de 0,11cm<sup>3</sup> para gatos domésticos, 0,18cm<sup>3</sup> para o grupo misto de felinos selvagens (*Leopardus pardalis*, *Leopardus tigrinus*, *Leopardus wiedii* e *Pumas yagouaroundi*) e 1,57 cm<sup>3</sup> para o grupo de onças-pintadas (*Panthera onca* e *Pumas concolor*). A média de T4 total e T4 livre foi de 2,55µg/dL e 1,23ng/dL para gatos domésticos, 1,46µg/dL e 1,89ng/dL para o grupo de felinos mistos e 0,68µg/dL e 0,82ng/dL para o grupo da onça-pintada, respectivamente. Os animais com mais de 10 anos de idade apresentaram valores mais altos de T4 livre.

Palavras-chave: felinos, selvagens, leopardus, tireoide, ultrassom

### INTRODUCTION

Hyperthyroidism is the most common endocrinopathy among felines and it is estimated that near 10% of senior cats shall be affected by it (Peterson, 2020). Thyroid neoplasia is frequently observed among senile cats, having more commonly the diagnosis of adenomas in

cats of average age of 12.4 years and of carcinomas in cats of average age of 15.8 years. In non-domestic felines the age at the diagnosis of thyroid neoplasia was similar to domestic cats (15.9 years), (Pope *et al.*, 2017). Ultrasonography is a screening examination, and it must be approached more routinely for the diagnosis of thyroid diseases (Kahalya *et al.*, 2018), and it is more sensitive than the palpation

together with fine needle aspiration (FNA) guided by ultrasound, may be useful for diagnostic conclusion (Ribeiro Filho *et al.*, 2015). No reports of ultrasonographic evaluation of the thyroid in wild cats were found.

## MATERIALS AND METHODS

This study was submitted to the Ethics Committee of the State University of Maringá, Brazil [comitê de ética da Universidade Estadual de Maringá], filed under CEUA nº 4859190121 (ID 002903).

Thirty-three animals, 13 wild felids from the zoo of Cascavel, Paraná, Brazil, one *Panthera*, three *Pumas concolor*, three *Leopardus tigrinus*, three *Pumas yagouaroundi*, two *Leopardus pardalis*, one *Leopardus wiedii* and 20 domestic felines from the clinical routine of veterinary clinics from the city of Paranavaí, state of Paraná, Brazil, which were ceded by their guardians for this study.

The clinical history, body score and Total T4 and Free T4 hormonal dosage were obtained from each feline, in addition to an ultrasonography of the thyroid gland, and based on these data, the animals were classified as animals without thyroid diseases.

For the conduction of the ultrasonographic examinations, the anesthetized animals were positioned in dorsal recumbency with the neck

extended (Woods *et al.*, 2018). In wild felids, it was not allowed the trichotomy of the cervical region for the conduction of the thyroid ultrasonographic examination due to the animal public exposure at the zoo. Whereas the domestic cats had the ventral region of the neck trichotomized. Ultrasound gel was applied on every animal upon ultrasonographic examination.

The ultrasonographic equipment used was of the brand Chison, models 3 vet Expert and Ebit50, ultrasound of the cervical region was performed by a board eligible veterinary radiologist (L.T.A). The image was obtained by means of two multifrequency transducers. The micro-convex transducer was regulated with the frequency of 6.5- 8 mega-hertz and the linear, with 10 mega-hertz, and the two lobes of the thyroid were assessed (Penninck, 2015). The transducers were placed in the cranioventral portion of the neck, immediately caudal to the larynx, in the transverse position, where it could visualize the carotid artery, thyroid and trachea, and measure width and height (TL Trans and TR Trans for the width of the right and left lobe, respectively, and TL and TR for height of the left and right lobe, respectively). Following, by rotating the transducer 90 degrees, at the longitudinal position, the thyroid length was measured (named as TL long the left lobe length and TR long the right lobe). All measures were given in centimeters. The following ultrasound images of wild animals were obtained:

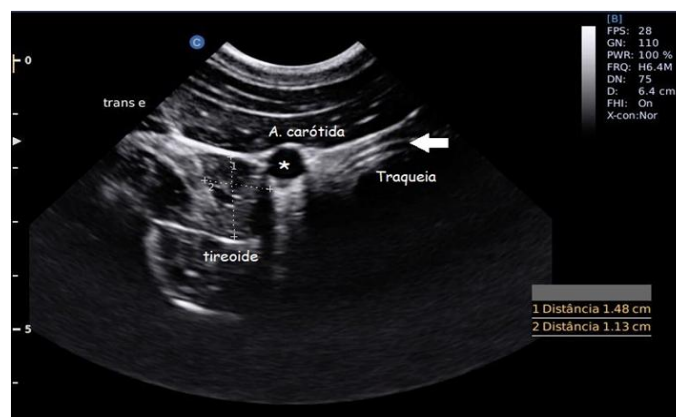


Figure 1. Personal file. Cross-sectional ultrasound image of the left lobe of the normal thyroid of a *Panthera onca*. Note the definition of the tracheal ring (arrow) and carotid artery in cross-section (\*). Latero-dorsally to the artery, the thyroid can be seen in cross-section (measurement lines) slightly hyperechogenic compared to adjacent tissues, with a well-defined, homogeneous shape, without evidence of nodules.

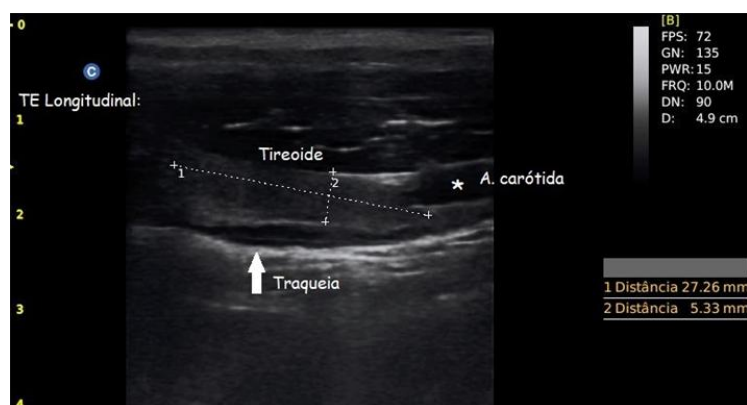


Figure 2. Personal file. Longitudinal image of the left lobe of the normal thyroid of a *Pumas concolor*. Note the definition of the tracheal ring (arrow) and carotid artery in longitudinal section (\*). Ventral to the trachea, the thyroid can be seen in a longitudinal section (measurement lines), slightly hyperechogenic compared to adjacent tissues, with a well-defined and regular shape, homogeneous, without evidence of nodules.

The blood collection through the jugular vein was performed after the ultrasonographic examinations of the thyroid, to avoid anatomic changes due to the puncture. The samples were packaged in tubes for biochemical examinations and there were obtained the results of Total T4 and Free T4 of the same blood sample through the technique of chemiluminescence from 30 animals. The hematological exam of three animals was excluded for reasons of hemolysis or insufficient volume.

The obtained data were submitted to the software SAS (2002) to verify the normality of residue and homogeneity of variances by PROC UNIVARIATE. The animals' weight was used as covariable within the statistical model.

The data were analyzed, by PROC MIXED according to the following model:

$$Y_{ijk} = \mu + E_i + I_j + S_k + E_i I_j + E_i S_k + S_k I_j + E_i I_j S_k + e_{ijk}$$

where:  $Y_{ij}$  = dependent variable,  $\mu$  = general mean,  $E_i$  = effect of species ( $i=1$  to 2);  $I_j$  = random effect of age ( $j=1$  to 3);  $S_k$  = fixed effect of sex ( $k=1$  to 2);  $E_i I_j$  = effect of interaction;  $E_i S_k$  = effect of interaction;  $S_k I_j$  = effect of interaction;  $E_i I_j S_k$  = effect of interaction. The freedom degrees were corrected by  $DDFM = kr$ . The obtained data were submitted to analysis of variance by the command PROC MIXED do SAS, version 9.0, being adopted the significance level of 5%. The interactions were assessed by the command PDIFF slice of PROC MIXED.

Due to different weight magnitudes, the animals of this study were regrouped into groups of different weights among the wild ones, above and below 20 kilos, the domestic group remained the same, with domestic cats, the jaguar group contains one *Panthera onca* and three *Pumas concolor* and the mixed wild feline group contains three *Leopardus tigrinus*, three *Pumas yagouaroundi*, one *Leopardus wiedii* and two *Leopardus pardalis*.

The ANOVA and Tukey post-hoc tests were used for the comparison of means, in addition to the Pearson correlation test to identify a possible

relation between the size of the thyroid gland and the Total T4 and Free T4 factors. To this end, transverse, longitudinal and height measures of each thyroid gland were considered to achieve the volume calculation of the ellipsoid of the gland, given by  $\pi/6(\text{transverse} * \text{longitudinal} * \text{height})$  (Wisner *et al.*, 1994).

## RESULTS

The felines were firstly divided into two groups, wild x domestic and afterwards subdivided again into jaguars x domestic x mixed wild, represented by Table 1 and Table 2, respectively.

Table 1. Summary of significant values, separated by statistical tests (Anova, Tukey, T-paired and Pearson) and tested variables (right and left thyroids, Total T4 and Free T4 hormonal values, weight, sex, and age) in different groups: wild X domestic and jaguars x domestic x mixed wild (Paraná, Brazil, 2022)

Procedure	Tested variables	Test Results				p-value			
		Domestic		Wild					
		Female	Male	Female	Male				
PROC MIXED	TL Long x Sex	1.285	1.514	1.05	1.523	0.0240			
	TL Long x Species*Sex	1.285 <sup>b</sup>	1.514 <sup>a</sup>	1.105 <sup>c</sup>	1.523 <sup>a</sup>	0.0250			
	TR Long x Species*Sex	1.277 <sup>b</sup>	1.437 <sup>ab</sup>	1.160 <sup>c</sup>	1.715 <sup>a</sup>	0.0040			
	TR Transv x Sex	0.442	0.511	0.483	0.669	0.0480			
	TR x Sex	0.433	0.453	0.352	0.565	0.0170			
	Total T4 x Species	2.64	2.45	1.44	1.08	0.0030			
	Free T4 x Species	1.09	1.12	2.41	1.37	0.0420			
PROC MIXED	TL x Age	Domestic			Wild				
		0 to 5 years	5 to 10 years	Over 10 years	0 to 5 years	5 to 10 years	Over 10 years		
		0.388	0.397	0.44	0.347	0.686	0.43	0.0770	
		TR Transv x Species	0.386	0.42	0.656	0.59	0.778	0.537	0.0320
		TR Transv x Species*Age	0.386 <sup>d</sup>	0.420 <sup>c</sup>	0.656 <sup>a</sup>	0.590 <sup>b</sup>	0.778 <sup>a</sup>	0.537 <sup>b</sup>	0.0250
Total T4 x Species	2.88	2.42	2.3	1.68	0.36	1.57	0.0020		
PROC MIXED	TL Long x Sex	Female			Male				
		0 to 5 years	5 to 10 years	Over 10 years	0 to 5 years	5 to 10 years	Over 10 years		
		1.152	1.280	1.156	1.410	1.782	1.424	0.0480	
		TL Transv x Sex*Age	0.392 <sup>e</sup>	0.452 <sup>d</sup>	0.669 <sup>b</sup>	0.513 <sup>c</sup>	0.720 <sup>a</sup>	0.449 <sup>d</sup>	0.0460
		TR x Sex	0.44	0.429	0.297	0.426	0.588	0.563	0.0470
Total T4 x Sex*Age	2.93 <sup>a</sup>	2.43 <sup>a</sup>	1.29 <sup>c</sup>	2.17 <sup>b</sup>	0.75 <sup>d</sup>	2.32 <sup>b</sup>	0.0460		
Free T4 x Age	1.03	1.18	2.74	1.26	0.92	1.59	0.0380		

Equal letters on the same line do not differ among themselves, and different letters on the same line differ among themselves statistically ( $p < 0.05$ ). TLlong (thyroid left lobe length); TLTransv (thyroid left lobe width); TL (thyroid left lobe height); TRlong (thyroid right lobe length); TRTransv (thyroid right lobe width); TR (thyroid right lobe height); Total T4 (Total Thyroxine); Free T4 (Free Thyroxine); SEM (Standard Error Mean).

From the statistical tools, the summary of the significant comparisons among the groups was structured in Table 1.

In the first field of results of Table 1, when observed the factor “sex”, it is found significant difference in the TL Longitudinal values ( $p$ -value=0.024), TR Transversal ( $p$ -value=0.048) and TR ( $p$ -value=0.017), where males, regardless the species, present greater measures. However, when observing the interaction between species and sex, just TL Longitudinal ( $p$ -value=0.025) and TR Longitudinal ( $p$ -value=0.004) presented significant differences.

To the TL Longitudinal interaction, domestic females presented greater TL longitudinal measures (1.285) compared to wild females (1.105). In addition, males presented greater measures than females, regardless the species. And when we assessed the TR Longitudinal interaction, domestic females and males presented greater measures (1.277) and (1.437) respectively, compared to wild female (1.160). Whereas the wild males present the greatest measure (1.715) and significant differences compared to females, regardless the species.

Concerning hormonal values, domestic cats presented higher Total T4 and lower Free T4 than wild felines regardless the sex.

In the second field of Table 1, the TL measures were significantly ( $p\text{-value} = 0.07$ ) greater in wild animals aged 5 to 10 years, compared to the domestic ones.

There was interaction between species and age, variable TR Transverse pointed out significant difference to an  $\alpha = 5\%$  ( $p\text{-value} = 0.025$ ).

As to the interaction between species and age of the TR Transverse, it may be considered equal the means for domestic animals over 10 years old (0.656) and for wild animals aging from 5 to 10 years (0.778). The same way, it is estimated to be equal the means for wild animals aging from 0 to 5 years (0.590) and wild animals over 10 years old (0.537). The domestic animal from 5 to 10 years of age presents mean of 0.420 and this is not considered equal to any other level of interaction. The same occurs to the mean of the domestic animal aging from 0 to 5 years, which presents the lowest mean of all levels (0.386). Within the age ranges of the domestic species, no mean is considered equal to another, at a level  $\alpha=5\%$  of significance.

Regarding the hormonal values, the Total T4 ( $p\text{-value} = 0.002$ ) means presented higher values for the domestic species.

In the third field of Table 1, there are the results of the comparisons between the animals' sexes and age ranges, in which sex denoted to be significant considering an  $\alpha=5\%$  in the TL Longitudinal ( $p\text{-value} = 0.048$ ) and TR ( $p\text{-value} = 0.047$ ) variables, with mean for males presenting superior values to females in both cases.

When the age of the animals is observed, significant  $p\text{-value}$  to an  $\alpha = 5\%$  is observed only for Free T4 ( $p\text{-value} = 0.038$ ), which verifies that the mean of such variable in animals over 10 years old presents to be considerably superior to the other age ranges. Furthermore, when there is the interaction between sex and age, it presented significant differences to an  $\alpha=5\%$  for TL Transverse ( $p\text{-value} = 0.046$ ) and for Total T4 ( $p\text{-value} = 0.046$ ).

As to the interaction between sex and age of TL Transverse, it is verified that the greatest mean belongs to males from 5 to 10 years of age, although virtually all means differ among themselves, with the exception of females raring 5 to 10 years (0.452) and of males over 10 years old (0.449) that can be considered equal.

And to the interaction between sex and age for Total T4, it points out equality of means between females aging 0 to 5 years and 5 to 10 years, having also the levels which hold the highest means of Total T4 (2.93 and 2.43, respectively). It is also pointed out the equality of the means between males aging from 5 to 10 years (2.17) and over 10 years old (2.32). Except for the equalities above, all other means differ among themselves, in which no female mean is considered equal to the males, and the females over 10 years old mean (1.29) is statistically lower than females aging from 0 to 10 years (2.93 and 2.43), as well as the mean of males aging from 5 to 10 years (0.75) is statistically lower than of males aging from 0 to 5 years (2.17) and over 10 years old (2.32).

To obtain correlations between the thyroid gland sizes and hormonal levels, the measurement in centimeters of each gland was transformed into volume. They were divided into jaguar, wild feline and domestic cat groups, and such correlation was assessed in each group.

In the first field of results of Table 2, when observed the results of the Total T4 variable, in which there is significant difference to an  $\alpha = 5\%$  among the Jaguar x Mixed Domestic and Wild x Domestic groups, however there is no statistical difference between Mixed Wild and Jaguars.

In the second field of results of Table 2, by the Pearson correlation tests, it was not found positive correlation of  $\rho=0.64$  at an  $\alpha=10\%$  significance level just between the volume of the left thyroid and Free T4 in the mixed wild animals, that is, when the volume of the left thyroid increases, there is positive impact of  $\rho^2=41.29\%$  on the Free T4 indexes.

Tab. 2. Summary Table of significant values, separated by statistical tests, tested variables (measurements of right and left thyroids, Total T4 and Free T4 hormonal values, weight, sex and age) in different groups: jaguars x domestics x mixed wild

Tests	Tested variables	Test Results			p-value
		Diff	Sum Sq	Mean Sq	
Paired T	Total T4 (Jaguar-Domestic)	-1.87	3,24	0.49	0.00624
Paired T	Total T4 (Mixed Wild-Domestic)	1.09	2.15	0.04	0.04125
		Correlation	T-statistic		
Correlation	Left Thyroid x Free (Mixed Wild)	0.64	2.05		0.08575

The mean volume of the normal thyroid lobe was of 1.57cm<sup>3</sup> for jaguars, 0.18cm<sup>3</sup> for mixed wild and 0.11cm<sup>3</sup> for domestic cats.

For a greater understanding, following there is Table 3 which presents the means and standard deviation of the hormonal values (Total T4 and Free T4), in the group of domestic cat, jaguar and mixed wild species.

Table 3: Means and standard deviation of Total T4 (ug/dL) and Free T4 (ng/dL) hormonal values per macro species (domestic cats, jaguars, and mixed wild felines)

Species	n	Total T4		Free T4	
		Mean ± Standard Deviation	Amplitude	Mean ± Standard Deviation	Amplitude
Domestic	20	2.55 ± 1.06	1.1 – 4.5	1.23 ± 0.43	0.79 – 2.55
Jaguar	4	0.68 ± 0.65	0.05 – 1.60	0.82 ± 0.22	0.55 – 1.05
Mixed Wild	9	1.46 ± 0.96	0.30 – 2.70	1.89 ± 1.68	0.6 – 5.90

### DISCUSSION

The mean volume of the normal thyroid lobe obtained was of 1.57cm<sup>3</sup> for jaguars, 0.18cm<sup>3</sup> for mixed wild and 0.11cm<sup>3</sup> for domestic cats, 29% higher in domestic felines when compared to the study by Wisner *et al.* (1994), with mean of 0.085cm<sup>3</sup>.

Another formula can also be used to calculate the thyroid gland volume, described by Drost *et al.* (2006) and Shiel and Mooney (2007), using the formula (*length x height x width*), however the formula by Wisner *et al.* (1994) was maintained, due to its similarity when compared to the mathematical formula of the sphere (Volume = 43πr<sup>3</sup>).

Moreira *et al.* (2017), obtained mean ultrasonographic measurements of the thyroid glands of healthy domestic felines of 1.96 centimeters of length, 0.49 centimeter of width and 0.508 centimeter of height, measuring the same way as it was carried out in this study, in

which presented a difference of 40% shorter when compared to the length mean (1.17cm), 11% shorter to the width mean (0.44cm) e 21% shorter to the height mean (0.4cm) in the domestic felines of this study. Shiel and Mooney (2007) obtained grater measures for the length and shorter for width and height, with values of 2.04cm; 0.25cm; 0.32cm, respectively, further stating that the measure may vary according to the sonographer. A study on thyroid glands of healthy felines by computed tomography obtained length, width and height of 1.65cm, 0.20cm, 0.431cm (Drost *et al.*, 2006), being height the only mean measure similar to the obtained in this study. Lastly, Stocco *et al.* (2021) determined measures in cadavers for the right lobe of 1.939cm length, 0.536 cm width of the cranial pole, 0.367cm width of the caudal pole and 0.13cm height. Whereas for the left lobe, 2.029cm, 0.485cm, 0.388cm, 0.164cm, respectively, being still similar measurements to the ones previously mentioned, differing mainly to height, with measures 67.5% and 59% lesser when compared to this study.

For mixed wild felines, the means were of 1.28cm length, 0.56cm width and 0.41cm height and to jaguars 3cm, 0.88cm and 0.76cm, respectively.

In hyperthyroid cats, Shiel and Mooney (2007) determined measurements of 21.1mmX 6.7mmX 6.8mm of length, width and height, however hyperthyroid animals were not evaluated in this study.

Besides the measurements, the format and echotexture were evaluated. The thyroid lobes had ellipsoid, regular, homogeneous shapes, without nodules or cysts. Junginger *et al.* (2015) diagnosed thyroid neoplasia in wild animals that did not evidence thyrotoxicosis, such as hypertrophic cardiomyopathy or weight loss. An eventual increase of the thyroid gland or echography alterations of the morphology, as the shape, surface regularity, homogeneity and echotexture can be easily visualized through ultrasonography and aid for the diagnosis of thyroid neoplasia (Penninck, 2015), although no echography alteration could be diagnosed in the evaluated animals.

Junginger *et al.* (2015), states that there was a significant increase of thyroid neoplasia when observing the increase in age. However, it was not identified any correlation between age and size in the glands assessed in this study.

The high concentration of circulating thyroid hormones continues to be a marker of the diagnosis of hyperthyroidism (Shiel and Mooney, 2007). The evaluated animals did not present concentrations above the reference values and, due to the clinical conditions, they were characterized as animals without thyroid alterations.

The measuring of Free T4 through dialysis was considered significantly superior when compared to the Total T4 and T3 dosage for the diagnosis of mild hyperthyroidism, however it must not be assessed in an isolated way for euthyroid animals may present increased Free T4 in cases of bearing concomitant diseases (Peterson *et al.*, 2001). To exclude hyperthyroidism, besides the clinical history, body score and thyroid ultrasonography, it was conducted the serum dosage of the two hormones (Total T4 and Free

T4) in all evaluated animals, which were found within the reference values for domestic felines.

Hope and Deem (2006) did not describe cases of endocrine diseases in the evaluated animals, as well as in the animals of this study. Thyroid hyperplasia and neoplasia are observed by the increase in age of domestic (Peterson, 2012) and wild (Pope *et al.*, 2017) cats, although there were not Total T4 and Free T4 levels above the reference considered normal for felines in this study, the animals of the group over 10 years old presented higher values of Free T4. Highlighting the importance previously stated by Faria *et al.* (2013), over the evaluation in animals over 7 years old, even without clinical signals of hyperthyroidism, other concomitant diseases that may emerge due to the increased lifespan.

The Total T4 values in domestic cats were significantly higher in domestic cats in relation to wild felines, as well as observed by Rodini *et al.* (2007) and these data may corroborate with the suspicion by Peterson (2012) in which denotes potential environmental and eating habit factors may cause hormonal interferences and suggest predisposition to hyperthyroidism. In domestic cats, the Total T4 mean values were 2.55µg/dL, within the expected hormonal values for euthyroid domestic felines reported by Nelson and Couto (2015), Bastos (2014) and Vieira *et al.* (2010), with reference values from 2.5 to 3.5µg/dL; 1.44 to 2.63µg/dL and 0.75 to 3.5µg/dL respectively. The Free T4 mean values through the technique of chemiluminescence for domestic felines was of 1.23ng/dL, for mixed wild felines was of 1.89 ng/dL and for jaguars was of 0.82ng/dL, all within the references used by Peterson, Melián and Nichols (2001), with value up to 2.6ng/dL for healthy domestic cats. In contrast, the Free T4 mean value for the mixed wild feline group was 20% above the average determined by Jordan *et al.* (2021) when compared to the domestic feline studied by him, through the technique of automatic immunoassay (PILVF4-2, 2017-03-06), in the device by the brand *Siemens Healthcare*, with maximum value of 1.57ng/dL.

Rodini *et al.* (2007) determined Total T4 normal values through the technique of radioimmunoassay in animals compatible to the ones of this study, the *Panthera onca* (0.56ng/ml), *Pumas concolor* (0.67ng/ml),

*Leopardus pardalis* (0.48ng/ml), *Leopardus tigrinus* (0.43ng/ml), *Leopardus wiedii* (0.48 ng/ml) and *Pumas yagouaroundi* (0.7ng/ml). The Total T4 means obtained through the technique of chemiluminescence of the same species were 0.6ug/dL; 0.71ug/dL; 1.14ug/dL; 1.86 ug/dL; 0.9ug/dL and 1.45ug/dL, respectively. When subdivided into subgroups of macrospecies (jaguars, mixed felines and domestic cats) there were obtained means of 0.68ug/dL, 1.46ug/dL and 2.55ug/dL, respectively.

### CONCLUSION

Based on the results obtained in the present study, it is concluded that:

The volume of the thyroid gland was greater in the jaguar group, followed by the wild mixed felines and lastly the domestic cat group.

The wild mixed feline group obtained higher Total T4 and Free T4 mean values when compared to the jaguar group, however they did not differ statistically.

Domestic cats present higher Total T4 and lower Free T4 values when compared to the wild animals evaluated.

Animals over 10 years old present higher Free T4 values when compared to animals under 10 years old.

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