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Heart Rate of Reticulated Pythons (*Malayopython reticulatus*) from Bali based on Its Body Length

(DETAK JANTUNG ULAR SANCA BATIK (Malayopython reticulatus) BERDASARKAN PANJANG TUBUH DI BALI)

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ABSTRACT

This study was aimed to determine the correlation between heart rate and body length of reticulated python (*Malayopython reticulatus*) from the island of Bali. The study offers data of the *M. reticulatus* heart rate value to exotic animal veterinary practitioner. Fifteen clinically healthy snakes, consists of 9 females and 6 males were used in this study. Heart rate was measured twice a day during day and night using a fetal Doppler (BF-500 eBestman®, China) and body length using a measurement tape. Heart rate was analyzed with independent *t*-test to time collection and correlation to body length. Results show that heart rate mean value at day and night of the *M. reticulatus* from the island of Bali was each 65.68±14.093 bpm and 64.53±13.637 bpm. Heart rate value of wild-caught snakes is higher (67.90±15.290 bpm) than captive-bred snakes (60.92±10.039 bpm). Total length (TL), snout-vent length (SVL), and snout-heart length (SHL) mean value of *M. reticulatus* from the island of Bali was each 168.6±90.67 cm, 149.53±82.77 cm, and 38.7±19.28 cm. Correlation between heart rate and total length has higher R-value (R = 0.802), and followed by snout-heart length (R = 0.800) and snout-vent length (R = 0.792). Statistically, it could be concluded that heart rate during day and night time shows no significant difference, heart rate value based on how it is kept is significantly different, and heart rate was negatively correlated to body length.

Keywords: body length; heart rate; *Malayopython reticulatus*

ABSTRAK

Penelitian ini bertujuan untuk menentukan korelasi antara detak jantung dan panjang tubuh ular sanca batik (*Malayopython reticulatus*) dari Pulau Bali sehingga tersedianya data untuk praktisi dokter hewan eksotik. Sebanyak 15 ular yang secara klinis sehat terdiri atas 9 betina dan 6 jantan digunakan dalam penelitian ini. Detak jantung diukur dua kali sehari pada siang dan malam hari menggunakan *fetal* Doppler (BF-500 eBestman®, China) dan panjang tubuh diukur menggunakan pita ukur. Detak jantung dianalisa dengan uji *independent t-test* terhadap waktu pengambilan dan korelasi terhadap panjang tubuh. Hasil menunjukkan bahwa rata-rata detak jantung *M. reticulatus* pada siang dan malam hari masing-masing 65,68±14,093 bpm dan 64,53±13,637 bpm. Detak jantung ular *wild-caught* lebih cepat (67,90±15,290 bpm) dibandingkan ular *captive-bred* (60,92±10,039 bpm). Rata-rata panjang total (TL), panjang *snout-vent* (SVL), dan panjang *snout-heart* (SHL) *M. reticulatus* masing-masing adalah 168,6±90,67 cm, 149,53±82,77 cm, dan 38,7±19,28 cm. Korelasi antara detak jantung dan panjang total memiliki nilai R lebih tinggi (R=0,802), dan diikuti dengan panjang *snout-heart* (R=0,800) dan panjang *snout-vent* (R=0,792). Kesimpulannya, secara statistik, detak jantung pada siang dan malam hari tidak memiliki perbedaan yang signifikan, detak jantung berdasarkan asalnya memiliki perbedaan yang signifikan, dan detak jantung berkorelasi secara negatif terhadap panjang tubuh.

Kata-kata kunci: detak jantung; *Malayopython reticulatus*; panjang tubuh

INTRODUCTION

Pythons are common snakes kept as pets among reptile keepers (Raharjo *et al.,* 2008; Pees *et al*., 2010). Being a native snake in Indonesia, a wide range of captive breeding program of the *Malayopython reticulatus* is held across the nation. *Malayopython reticulatus* is the longest species among the serpents (Ruchira, 2017). *Malayopython reticulatus* are still being heavily exploited due to the high demand of its skin for fashion commodities or captured alive to be sold as a pet (Hanifa *et al*., 2016).

Serpents in general have three-chambered heart cavity (Kik and Mitchell, 2005; Bogan, 2017). Auscultation is part of the physical examination. Auscultation in small sized snakes can be difficult due to the girth of the snake. Fetal Doppler is one of instruments to be used in the auscultation of snakes during the clinical examination.

Variation of heart rate (HR) in snakes were influenced by many factors, such as digestive process (Enok *et al*., 2013), activity (Wang *et al*., 2001), pregnancy (Birchard *et al*., 1984), temperature (Kik and Mitchell, 2005), and body size (Gillooly *et al*., 2001). There is no study regarding HR in *M. reticulatus* from the island of Bali, neither a record of the correlation between the body length and HR in this particular snake. Therefore, a study to determine the HR and its correlation with the body length is needed. This study offers data of the *M. reticulatus* HR value to exotic veterinary practitioner.

RESEARCH METHODS

Fifteen clinically healthy *M. reticulatus* from the island of Bali (9 females and 6 males) were used in this study. Each python was assigned and marked as RT01 to RT15. All snakes were restrained using a snake hook and handled by two or three assistants. A lubricated snake probe was used to determine the gender of all the pythons.

Pythons that are used in this research were captive-bred, wild caught (WC) kept in captivity, or house-call-rescued, which were soon to be relocated. The snakes were kept in individual containers. All snakes used in this study were kept without any feeding for about 10 days before the data collection. Water was provided *ad libitum*.

Measurements such as total length (TL), snout-heart length (SHL), and snout-vent length (SVL) were taken with a measurement tape. TL, SHL, and SVL were measured by placing the measurement tape from the tip of the snout at the rostrum until approximately the apex of the heart, vent, and tail-tip. All measured length data were recorded two days before data collection.

The position of the heart was either visualized or manually palpated and marked using a sticker tape or marker ink. Heart rate data was measured by a fetal Doppler (BF-500 eBestman®, China). Snakes were manually restrained until they were relaxed. A fetal Doppler was applied together with acoustic gel to measure HR for a minute using a stopwatch. Data was collected at 12 – 3 pm for daytime (temperature at 31.3 ± 1.6ºC and humidity 65.7 ± 3.7%) HR collection and 9 pm – 1 am for night data collection (temperature at 28.9 ± 2.3ºC and humidity 88.3 ± 2.6%) HR collection. The temperature and humidity were measured by a thermo-hygrometer (Indoor Max-min Thermometer Hygrometer #TH-328, X&Y Auto Equipment Co., Ltd., China). Heart rate collection was done for a minute and repeated five times.

Heart rates were descriptively calculated and compared between day and night with independent *t*-test. The method was also used to compare heart rate between wild-caught and captive-bred snakes. The correlation between body length and heart rate were statistically calculated for determining the significance (P), R-value, and formulation. The level of significance used in these study was 5% ($P<0.05$). Software SPSS version 22 (IBM® Company, USA) was used to analyze the data.

RESULTS AND DISCUSSION

Heart rate data collection of day and night is presented in Table 1. Heart rate was measured in beats per minute (bpm) scale. Based on the data of Table 1, heart rate mean value in day and night time of *M. reticulatus* were 65.68±14.093 bpm and 64.53±13.637 bpm. A two-factor measure with HR and time yielded $F = 0.434$ and $P = 0.613$. There was no significant difference ($P>0.05$) in HR between day and night time. Wild-caught snakes have higher heart rate (67.90±15.290 bpm) than captive-bred (60.92±10.039 bpm) and it shows significant difference ($p<0.05$).

Data collection of TL, SVL, and SHL of *M. reticulatus* is served in Table 2. The TL, SVL, and SHL were measured in centimeter (cm) scale. Based on the data from Table 2, mean value of *M. reticulatus* were 168.6±90.67 cm for TL, 149.53±82.77 cm for SVL, and 38.7±19.28 cm for SHL. TL and SVL results show that snake number RT03, 08, 09, 10, 11, and 12 were under 100 cm.

Correlation between total length and HR

Table 1. Heart rate data in day and night time of *M. reticulatus* from the island of Bali

Snake No./ Sex	Daytime (Mean±SD) (bpm)	Night Time (Mean±SD) (bpm)
RT01/M/WC	49.00±1.000	46.60±3.050
RT02/F/WC	57.60±2.702	53.60±1.517
RT03/M/CB	51.00±0.707	56.40±5.459
RT04/F/WC	68.20±1.483	65.20±0.837
RT05/F/CB	62.80±1.789	66.20±2.387
RT06/M/CB	59.40±0.894	62.00±1.000
RT07/F/CB	67.20±1.643	64.80±2.775
RT08/F/CB	77.60±1.140	73.20±3.421
RT09/F/WC	83.00±0.707	84.80±2.950
RT10/M/WC	85.60±2.074	82.00±3.082
RT11/F/WC	82.60±2.702	81.60±2.881
RT12/F/WC	88.00±1.225	83.00±2.000
RT13/M/WC	54.60±1.517	52.40±2.074
RT14/F/WC	51.80±0.837	52.60±1.140
RT15/M/CB	46.80±0.837	43.60±0.894
Mean	65.68±14.093[a]	64.53±13.637[a]

Note: M: male; F: female; WC: wild-caught; CB: captive-bred; bpm=beat per minute; different superscript in the mean row shows a significant difference ($p<0.05$).

Table 2. Total length, snout-vent length, and snout-heart length data of *M. reticulatus* from the island of Bali

Snake No./ Sex	TotalLength (TL) (cm)	Snout-Vent Length (SVL) (cm)	Snout-Heart Length (SHL) (cm)
RT01/M/WC	239	203	53
RT02/F/WC	265	232	64
RT03/M/CB	85	74	21
RT04/F/WC	160	139	34
RT05/F/CB	189	161	52
RT06/M/CB	137	118	33
RT07/F/CB	123	111	33
RT08/F/CB	82	72	18
RT09/F/WC	88	80	20
RT10/M/WC	83	73	21
RT11/F/WC	87	77	21
RT12/F/WC	81	71	18
RT13/M/WC	314	297	65
RT14/F/WC	300	275	65
RT15/M/CB	296	260	62.5
Mean	168.60±90.672	149.53±82.769	38.70±19.282

Note: M: male; F: female; WC: wild-caught; CB: captive-bred

was significantly negative correlated (R = 0.802 and P = 0.000) (Figure 1), likewise the snout-heart length (R = 0.800 and P = 0.000) (Figure 2) and snout-vent length (R = 0.792 and P = 0.000) (Figure 3). Formula of each regression between total length (x) and HR (y) are y = 170.301 – 21.080 ln (TL), snout-heart length (x) and HR (y) were y = 142.794 – 21.990 ln (SHL), and snout-vent length (x) and HR (y) are y = 165.243 – 20.580 ln (SVL).

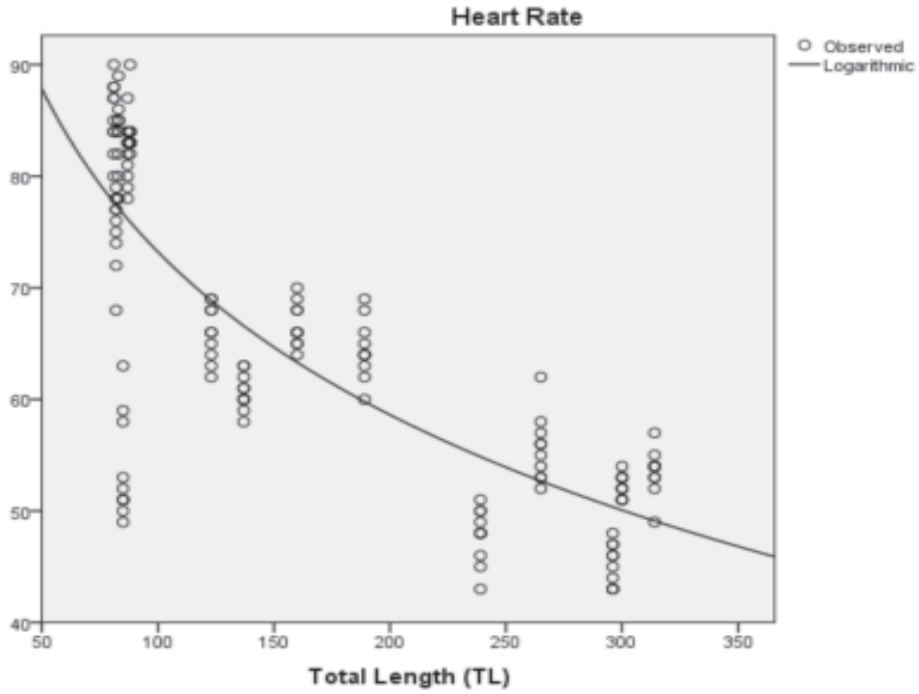

Figure 1. Graph relation of total length to heart rate of *M. reticulatus* from Bali

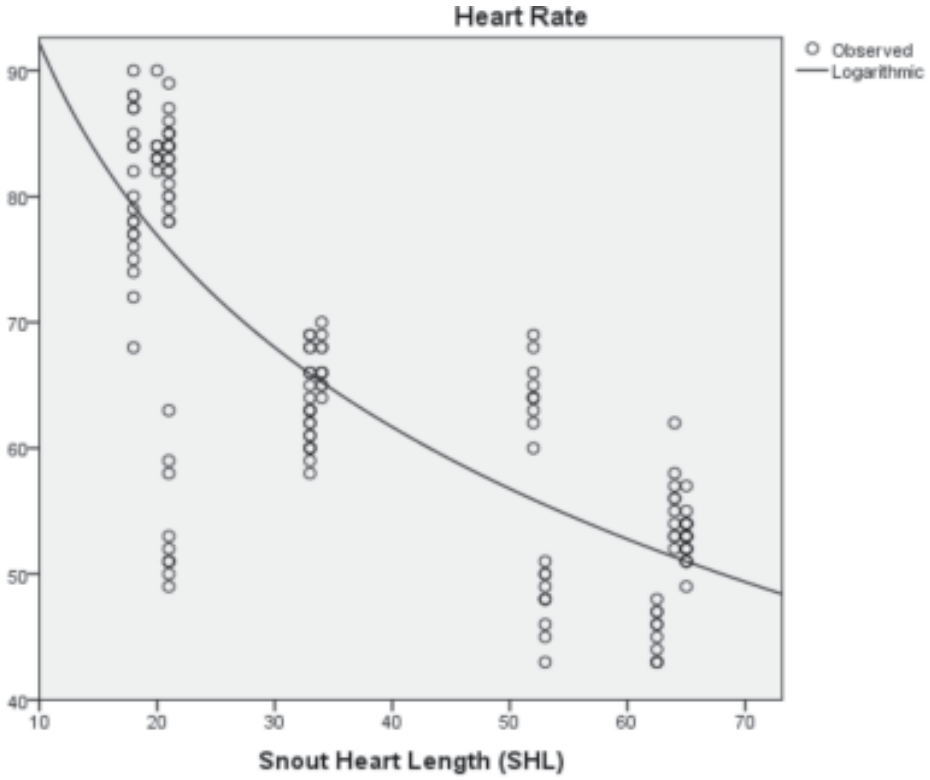

Figure 2. Graph relation of snout-heart length to heart rate of *M. reticulatus* from Bali

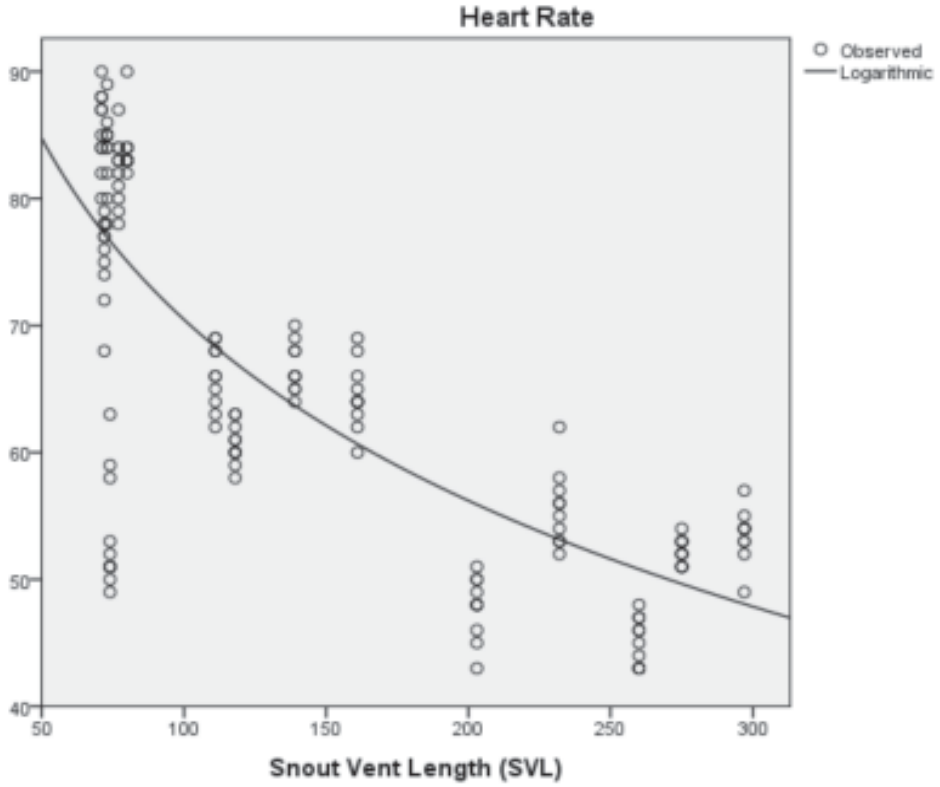

Figure 3. Graph relation of snout-vent length to heart rate of the *M. reticulatus* from Bali

Results shows that HR of *M. reticulatus* has higher HR value than *Boa constrictor* (58.8±6.7 bpm) (Rodrigues *et al*., 2015) and *Python molurus* (56.9±1.4 bpm) (Secor *et al*., 2000). Forced activity by manually restraining the snakes would affect the HR of the snake (Wang *et al*., 2001; Wang *et al*., 2003; Zaar *et al*., 2007). This could be also due to the snakes getting into the basal condition within a short period of time. A difference of species may also influence the HR between *B. constrictor* (Rodrigues *et al*., 2015), *P. molurus* (Secor *et al*., 2000), and *M. reticulatus*. The study by Rodrigues *et al*., (2015) differs due to a trivial difference of the temperature and humidity in keeping the snakes. The temperature and humidity was higher in our study because of the tropical climate. Contrary to the results, Kik and Mitchell (2005) showed that temperature contributes to variation in HR. Difference results may be due to insignificant comparable temperature during day and night time to HR in this study.

Length difference of each snake in this study is probably influenced by age factor and/or feeding factor for captive snakes, which was not recorded in this study. Due to these factors, some snakes might be in a growing phase. There are variations of the body length in this study. Higher variation of body length shows diversities on the physiological or body metabolism.

Higher heart rate in wild-caught snakes in this study might be due to stress factor (Lillywhite *et al.*, 1999; Cabanac and Bernieri, 2000).Wild-caught snakes have less physical contact with humans. Therefore, handling and restraining may have led to stress among the wild-caught snakes. Stinner and Ely (1993) mentioned this as handling stress.

R-value presents how much body length is influencing the variety of HR. The closer the R-value to 1.000, the higher the influence to the HR of the snakes. R-values shows longer snakes have lower HR. Correlation between heart rate and total length has higher R-value (R = 0.802), and followed by snout-heart length (R = 0.800) and snout-vent length (R = 0.792). This study also shows higher R-value than the study of Rodrigues *et al*. (2015) (R = 0.519). Regression formulas show that the longer the body length of *M. reticulatus* is, the lower the HR is.

The result of this study corroborates with the study of Rodrigues *et al*. (2015) for *B. constrictor*, which had negative correlation

results between HR and body length. Results demonstrated that metabolic-related measurements are good parameters of HR (Rodrigues *et al*., 2015). Body size of animals is known negatively correlated with metabolic rates (Gillooly *et al*., 2001). In this study, snakes were fasted to control the metabolism process of the HR (Enok *et al*., 2013). Digestion in snakes increases HR (Wang *et al*., 2001; Enok *et al*., 2012). Metabolic rates do have an influence on HR and other physiological responses (Rodrigues *et al*., 2015). The study also reported that larger snakes have slower metabolic rate (Lillywhite *et al*., 1999).

CONCLUSION

In conclusion, HR value of restrained *M. reticulatus* from the island of Bali was 65.68±14.093 bpm in daytime (temperature at 31.3 ± 1.6ºC and humidity 65.7 ± 3.7%) and 64.53±13.637 bpm in night time (temperature at 28.9 ± 2.3ºC and humidity 88.3 ± 2.6%). There was no significant difference between HR value and time collection. HR value in wild-caught snakes is higher than captive-bred snakes and it is significantly different. The HR of the *M. reticulatus* is negatively correlated with body length.

SUGGESTION

Further study needs more size samples and within the same age range of the snakes to gain more valid data.

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