

PHYSIOLOGICAL VALUES OF ELECTROCARDIOGRAM, HEART RATE, RESPIRATION RATE AND BODY TEMPERATURE OF *Dugong dugon*

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ABSTRACT

Dugong dugon is sea mammal which listed as endangered and protected species. Lack of reports according to the physiological values of the animal causes a specific problem for veterinarian when they have to observe and diagnose this mammal. Study on the physiological values of electrocardiography (ECG), heart rate, respiration rate, and body temperature was carried out in PT. SeaWorld-Jakarta-Indonesia on a *Dugong dugon* using recorder of *Patient Monitor*. Some important parameters such as heart rate, respiration rate, body temperature, and ECG (P-wave, QRS-complex, PR-interval, QT-interval, and MEA) was measured. This study showed that physiological values of heart rate, respiration rate, body temperature were respectively (45.73 ± 4.10) beat/minute, (10.11 ± 3.44) inspiration/minute, and $(31,42 \pm 0,41)$ °C. Physiological values of ECG-waves revealed that there were no significant changes among Lead I and Lead II, otherwise it showed isoelectric (0 mv) of ECG-waves values on Lead III. ECG-waves values of Lead II such as P-wave duration and voltage were $(0,05 \pm 0,02)$ second and $(0,03 \pm 0,01)$ mv, R-waves voltage was $(0,07 \pm 0,02)$ mv and duration of QRS-complex was $(0,06 \pm 0,01)$ second, PR-interval and QT-interval were $(0,26 \pm 0,01)$ second and $(0,21 \pm 0,11)$ second, MEA value was +90° up to -135° to the right side, and regularly rhythm. Physiological values of *Dugong dugon* show the specific characters compared with physiological values of dogs, it might be caused by ecological, anatomical and thickness of thorax wall in both animals are relatively different.

Keywords : *Dugong dugon*, electrocardiogram, cardiopulmonary, body temperature

INTRODUCTION

Dugongs are sea mammal or aquatic herbivores and feed on the phanerogamous seagrasses of the families Potamogetonaceae and Hydrocharitaceae. Also reported to occasionally eat algae, and crabs have been found in the stomachs of dugongs. Geographic Range are found discontinuously in coastal waters of east Africa from the Red Sea to northernmost South, northeastern Indian, along the Malay peninsula, around the northern coast of Australia to New Guinea and many of the island groups of the South Pacific. Range was greater in the past. Conservation status of Dugongs are listed as endangered under the Endangered Species Act of the U.S.A. and as vulnerable by the IUCN (International Union for the Conservation of Nature). All populations are in CITES Appendix I except the Australian populations, which are in Appendix II [1].

Now days, the existence and population of *Dugong dugon* extremely decline, due to its biological living only has a maximum rate of population increasing on 5 % per year. Besides, various factors could be involved conducting to the causes of its mortality and population declining such as, human activities in costal area, and also infectious and non-infectious diseases occurred (<http://www.gbrmpa.gov.au/>, 22 June 2006).

Studies according to the kind of diseases emerging and technical veterinary diagnostic of this Dugongs are still scare, meanwhile existence and population of the animal have to be conserved as an attempt to maintain population and decrease the death rate of the animal. Veterinarian should have a responsibility to initiate the various studies regarding to the health status of this animal in groups or individually related to the sea complex ecosystem. Observation of the health status of the animal individually has to be considered on the still lack of physiological values references existing up to now, which are very important to help veterinarian for diagnostic purposes. Therefore studies related to the physiological values establishment assessed by non-invasive method of the *Dugong dugon* are needed. The objective of study is to know the physiological values of electrocardiogram, heart rate, respiration rate, and body temperature of the *Dugong dugon* in PT. SeaWorld-Jakarta-Indonesia.

MATERIALS AND METHODS

Physiological examination on the electrocardiogram, heart rate, respiration rate, and body temperature of a male *Dugong dugon*, approximately 9 years old, was carried out in PT. SeaWorld-Jakarta-Indonesia using *patient monitor*, Welch Allyn, 621E. The average of sea water pool environment status as a habitat (ecosystem) of the Dugong were dissolved O₂ by (7,1 ± 0,4) ppm, temperature by (28,7 ± 0,7) °C, acidity by (pH 7,7 ± 0,1), and salinity by (31,6 ± 1,2) ppt. Average body weight of the mammal was 96 kg, which fed every day with seagrass of *Syringodium isoetifolium* approximately 8 kg. The calculation of the nutrient contains from proximate analysis of the dried seagrass could be presented in Table 1.

Using the equipment, the observation of the all parameters was recorded in a dorsal recumbent position when the sea water pool removed before. In the position, Thorax-ventral area was dried with tissue paper first, and then placed electrode each for certain position as a frontal leads. Besides, placement of temperature indicator in right axillaries position was conducted to measure body temperature. Thought the monitor recording from all parameters could be seen. Recording of the ECG (Lead I, II, dan III), respiration rate, and body temperature could be printed in the specific ECG-paper. The analysis of the recording result was conducted on the duration (seconds) and voltages (mv) from P wave, QRS complex wave, PR interval, QT interval, and *mean electricity axis* (MEA). The observation repeated for 15 times every week in the morning (7.30-8.30). The physiological examination methods are presented in the Figure 1 bellows.

Table 1. Nutrient contains of *Syringodium isoetifolium*

Nutrient Contains	Values
Water (%)	81,83 ± 3,17
Crude Lipids (%)	1,10 ± 0,16
Crude Protein (%)	9,41 ± 2,83
Crude Fiber(%)	10,74 ± 2,61
Nitrogen Free Extract (%)	14,03 ± 5,42
Carbohydrate (%)	24,77 ± 7,69
Ash (%)	36,24 ± 11,60
Grosse Energy (cal/g)	1.889 ± 489,68

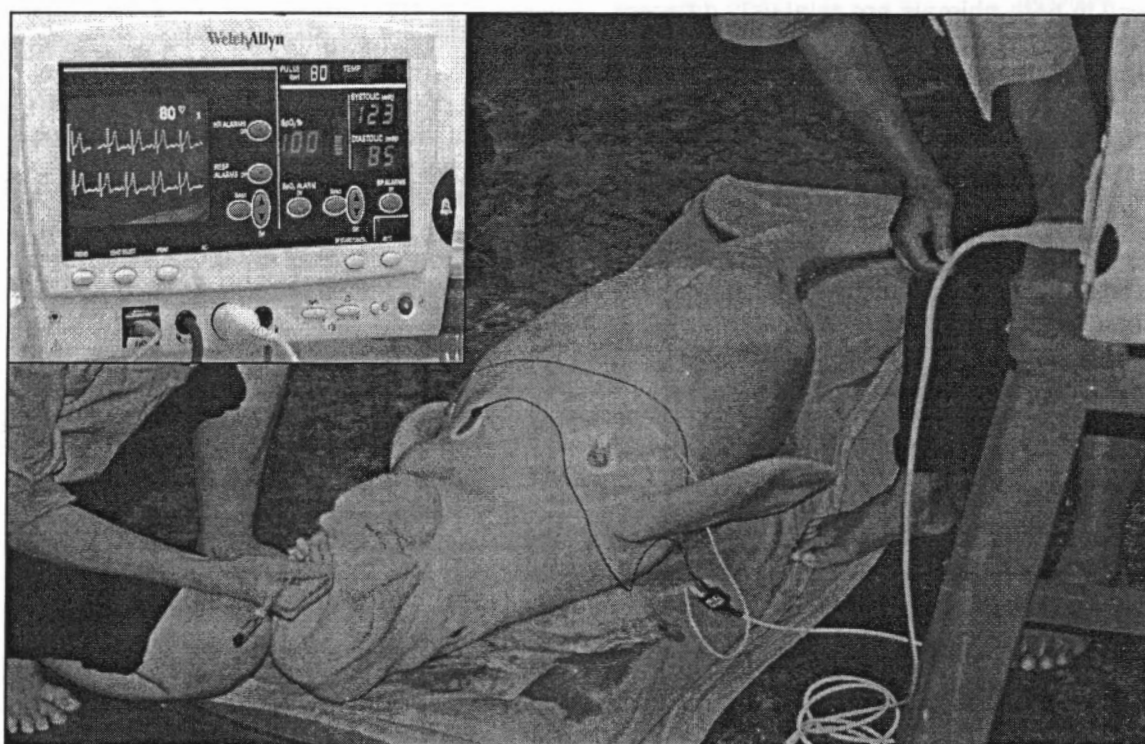


Figure 1. Physiological examination of *Dugong dugon*: Electrocardiogram, respiration, and body temperature

RESULTS AND DISCUSSION

The physiological examination of a *Dugong dugon* was conducted to know the physiological values on the cardiovascular values (ECG, MEA, and heart rate), respiration, and body temperature. The physiological values could be compared with one of terrestrial mammal

(dogs), which was already noted much as a reference by veterinary practices. It can be seen in Table 2 and Table 3.

Physiological values of ECG-waves revealed that there are no significant changes among Lead I and Lead II, otherwise it seems isoelectricity (0 mv) of ECG-waves values on Lead III (Figure 2). The ECG-waves values of Dugong seem to be much different with dogs. It can be seen that the heart rate value of Dugong obtained is lower than values of dogs, which respectively was (42 – 50) bite/min and (100 - 130) bite/min. Besides, the difference of R-wave of Dugong on Lead II obtained is also occurred lower than values of R-wave in dogs in the same lead, which respectively was $(0,07 \pm 0,02)$ mv and maximum of 3 mv. The physiological values of T-wave also show the low electricity is $(0,01 \pm 0,01)$ mv. Up to know there is no information regarding to the difference, whether the difference due to the auto-rhythmic cells (SA-node) electricity of the Dugong is lower relatively than the auto-rhythmic cells electricity of dogs or might be supposed that anatomical and thickness of thorax wall in both animals are relatively different.

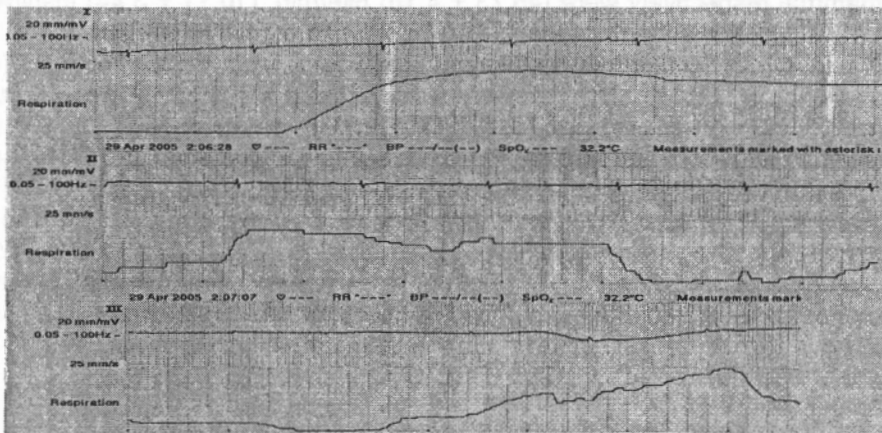
The MEA physiological values of Dugong obtained reveal the position to the right side of the frontal lead vector is $(+90^\circ) - (-135^\circ)$. It is extremely different whit the MEA physiological values of dogs, it show the position to the left side of the frontal lead vector is $(+40^\circ) - (+100^\circ)$. The difference of MEA physiological values in both animals might be caused by sloppiness of the heart in the thorax cavity, the sloppiness of the Dugong heart more shift to the right than the sloppiness of the Dogs heart. Nevertheless, studies regarding to the anatomy of Dugong's thorax cavity and its heart position are still scare.

The overall of the Dugong examination has a special impression related to the own sensitivity of the sea mammal on the surrounding area changes. The Dugong is very sensitive on the strange sounds when *patient monitor* was operated with typical alarm sounds hearing like *Blib.....Blib.....Blib*. It could be seen on the electricity disturbance occurred in the ECG recording, it might be caused by the emergence of hesitance and excitement. The conditions could be understood because the region of the brain of Dugong, large *Corpora quadrigemina*, could hear an acute sound very well [2]. A study reported that captive Dugong in the empty water pool on the recumbent position, could hear a sound which has certain frequency was 3 kHz - 8 kHz [3]. Otherwise if the Dugong swims in the fully sea water pool, they could hear a sound which has a frequency lower was 1 kHz - 4 kHz [2]. Tremble of Dugong snout was as an indicator of the sound hearing response [4].

Table 2. Electrocardiogram physiological values of *Dugong dugon* compared to the references values of dogs

Electrocardiogram Parameters	<i>Dugong dugon</i>				Dogs [5]	
	Lead I		Lead II		Lead II	
	Duration (second)	Voltage (mv)	Duration (second)	Voltage (mv)	Duration (second)	Voltage (mv)
Rhythm	Regular				Regular	
P-wave	0.06 + 0.01	0.03 + 0.01	0.05 + 0.02	0.03 + 0.01	0.04	0.4
QRS-complex	0.06 + 0.01	-	0.06 + 0.01	-	0.04 - 0.05	-
R-wave	-	0.05 + 0.02	-	0.07 + 0.02	-	Max: 3
T-wave	-	0.01 + 0.01	-	0.01 + 0.01	-	Not more: 1/3xR
ST-Segment	Isoelectricity		Isoelectricity		Between 0,2 mv from isoelectricity	
PR-Interval	0.26 + 0.01	-	0.26 + 0.01	-	-	-
QT-Interval	0.21 + 0.11	-	0.21 + 0.11	-	0.15 - 0.25	-
MEA (degree)	(+ 90°) - (- 135°) : MEA, Right position				(+40°) - (+100°): MEA, Left position	

The Dugong respiration examination showed an irregular respiration, or it could be inspiration deeply and then seen a delay of expiration several time. The phenomenon might be caused by its habitat in the deep sea and breathe with lungs, therefore they should store much oxygen enough to dive for a long time. Dugong was known to be able to dive to the deep sea for 8 minutes and then they return to the sea water surface to breathe again [6]. This study recorded that the Dugong has a physiological value of respiration rate by (10.11 ± 3.44) inspiration/min. The respiration rate value is lower than dog's respiration rate reference, which is approximately 22 inspiration/min. The respiration inspection of the Dugong showed a slight difficulty in the respiration rate calculation. It might be due to the thickness of the thorax cavity and cylindrical body form of the Dugong, which causes a difficulty in breath movement.

Figure 2. Electrocardiogram of the *Dugong dugon* on lead I, II, and III

Tabel 3. Physiological values of *Dugong dugon*: Heart rate, respiration, temperature, and environment

Physiological Values and Environment Parameters	Physiological Values	
	<i>Dugong dugon</i>	Dogs*
Heart rate (bite/min)	45.73 ± 4.10	100 - 130
Respiration (inspiration/min)	10.11 ± 3.44	22
Body temperature (°C)	31.42 ± 0.41	38.9 ± 0.5
Sea water temperature (°C)	28.73 ± 0.69	
Air temperature (°C)	30.34 ± 0.74	-

*: Source: [7]

Body temperature of Dugong shows a body metabolic rate. Physiological values range of body temperature of Dugong was (31.01 – 31.83) °C, this values was higher 1 °C compared to the temperature of air environment values was (30,34 ± 0,74) °C. The body temperature of the Dugong (Placement of indicator in right axillaries position) is still lower than the rectal temperature of dogs by (38,9 ± 0,5) °C, the placement of temperature indicator might also be affect the different temperature values on both mammal. In the examination of body temperature, the temperature of the Dugong has an interaction with the air temperature surrounding, because the homeostasis process [8]. Besides, Dugong has also higher insulation than terrestrial mammal (dogs), therefore this sea mammal could conserve their body heat metabolism [9]. In their ecosystem (Dugong swim in the fully sea water pool), there are possibility Dugong's body temperature will be lower than values obtained, it could be understood because the average sea water pool temperature of the Dugong is (28,7 ± 0,7) °C, lower than the temperature of air environment values obtained. In the deep sea water ecosystem, sea water temperature range in the Indonesian ocean was 25 °C – 30°C with salinity values was 24 o/oo - 32 o/oo [10].

CONCLUSIONS

As an attempt to be better diagnose, physiological values of *Dugong dugon* are extremely needed by veterinarian. Physiological values of heart rate, respiration, and body temperature of the sea mammal respectively were (45.73 ± 4.10) bite/min, (10.11 ± 3.44) inspiration/min, (31.42 ± 0.41) °C. Electrocardiogram physiological values revealed that there were no significant changes among Lead I and Lead II, otherwise it showed isoelectricity (0 mv) of ECG-waves values on Lead III. ECG-waves values of Lead II such as P-wave duration and voltage were (0,05 ± 0,02) second and (0,03 ± 0,01) mv, R-waves voltage was (0,07 ± 0,02) mv and duration of QRS-complex was (0,06 ± 0,01) second, PR-interval and QT-interval were (0,26 ± 0,01) second and (0,21 ± 0,11) second, MEA value was +90° up to -135° to the right side, and regularly rhythm. Physiological values of *Dugong dugon* show the specific characters compared with physiological values of dogs, it might be caused by ecological, anatomical and thickness of thorax wall in both animals are relatively different. Nevertheless, the anatomical of thorax wall and electrophysiological conductivity of the sea mammal are still unclear up to now.

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