

**MESAUREMENTS OF SOME PHYSIOLOGICAL PARAMETERS
IN THE HERBIVOROUS DUGONG AND THE CARNIVOROUS
COMMON DOLPHIN OF THE RED SEA**

By

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SUMMARY

— Blood was taken from two mature adult marine species, the common dolphin of the Red Sea and the dugong. Only males were sampled.

— Basic haematological characteristics, including erythrocytes, haemoglobin and packed cell volume were determined. The analyses indicated differences between the two species studied. The significance of the high values of the three mentioned parameters for dolphin is interpreted as an indication justifying its activity.

— The concentration of several components of blood indicate that several changes accompany the nature of nutrition of each species.

INTRODUCTION

In the course of this investigation, some haematological studies of the rare Red Sea male dugong species, not previously noted, came to the light and are here included. The dugong had been studied in greater or lesser detail by a number of investigators. Ruppel's record (1833) appears to be one of the earliest we have on the general description of a female specimen which he had obtained. It forms a good foundation for our knowledge of the gross anatomy and osteology of the animal. Besides the account by RUPPEL, many other authors gave informations on dugongs from different points of view (OWEN, 1838; FREUND, 1910; RIHA, 1911; OSMAN HILL, 1943; PETIT, 1945; and GOHAR, 1957).

Dugongs are fairly common in the Indo-Malayan Islands and along the north-eastern coast of Australia and round Madagascar. The Red Sea dugongs are extremely rare at the present time, but seem to have been much more abundant a century or more before. They are believed to have become extinct in this area, a fact which would have been expected, in view of the defenseless nature of those creatures and the relentless pursuit by fishermen who seek them for their flesh, oil, hide and tusks. Females seem to be commoner, or at least more often caught than males. Deprived of all kinds of offensive weapons, dugongs - usually living in small families - often retire to well sheltered bays and lagoons of shallow water, where

their food of sea grasses is abundant and there they may live in relative security from the assaults of larger and stronger predatory animals. As is well known, the dugong is a strictly herbivorous animal and does not take any sort of animal food. The food of the Red Sea dugong is constituted entirely and solely of the sea grass *Diplanthera uninervis* (Forsk.) Williams. The herbivorous nature of the dugong created interest and stimulated us for a comparative study between this species and the carnivorous common dolphin of the Red Sea to interpret the reflection of dietary effect on blood constituents.

It was hoped to give an account of the physiology of the two species mentioned concerning, blood counts, haemoglobin content, haematocrit values, serum total proteins, protein fractions, serum total cholesterol and the electrolytes represented by sodium and potassium, to throw special light on the many interesting points in this respect.

MATERIAL AND METHODS

Two male mature adult specimens were investigated Fig.(1), the Red Sea dugong of length 180 cm and weight 120 k. gm. and the common dolphin of the Red Sea of length 232 cm and weight 120 k gm. fig (2) The blood for investigation was drawn directly from the heart.

For haemoglobin readings, a Sahli haemoglobinometer was used and an improved Neubauer haemocytometer was used for blood counts. Packed cell volume was estimated after the samples were centrifuged at 2,700 r.p.m. for 15 minutes.

The level of total protein in serum was estimated by colorimetric biuret method. The separation of serum proteins was made with the help of paper electrophoresis. The electrophoresis was made in buffer barbital of a pH 8.6, ionic strength 0.12, in room temperature, on strips of paper Whatmann 1 (4 × 30 cm at a constant voltage 150 V. The time of total separation was 7 hrs.

The colorimetric determination of serum total cholesterol was carried out according to the procedure described by Hang *et al* (1961).

Sodium and potassium were determined by flame photometry using the EEl type flame photometer.

RESULTS

The two forms studied represent species of widely different food habits and activities. They show a wide range of variation in the values of the three haematological parameters studied being lower in dugong than in dolphin.

The non cellular blood examinations revealed a number of features of interest. Striking differences are found in total cholesterol and sodium values of dolphin and dugong. The values reported for the former are distinctly higher than for the latter type, values which closely resemble those found in human blood. A reversal of this condition is to be noted in the concentration of potassium. Data on the distribution of serum proteins of the blood of the two species are presented. There is no sharp variations in the total proteins and in the distribution of the various fractions. Samples of human blood serum were analysed under the same experimental conditions used in this investigation, so that, the fish patterns might be compared with one which is widely known.

DISCUSSION

It is now well recognized that haemoglobin, erythrocytes and haematocrit determinations serve as criteria of the condition of fish and are important as a routine procedure in fish studies. These values have been found to show great interspecific variations and the haemoglobin concentration has often shown a correlation with the activity of the species (Hall & Gray, 1929; Eisler, 1965). Also it is well established that in the blood of healthy vertebrates there is a close correlation between the number of erythrocytes, haematocrit value and haemoglobin content. Therefore the significance of the high values of the above mentioned constituents recorded for dolphin is an indication justifying its activity.

The amount of total serum proteins in both species are approximate. Also the albumin and globulin components of their serum patterns present a picture of general similarity in the relative proportions of each and in their mobilities. Plate I Fig. (3),(4) ; Plate II Fig. (5) , (6).

The higher potassium level in the blood of dugong than dolphin may be due to the fact that the sea grass (*Diplanthera uninervis*) on which dugong fed is rich in potassium and much of it may pass into the blood. Also it is clear from the table that the concentration of sodium in dolphin is 186 mEq./L. while it is 172.5 mEq./L. in dugong. Therefore, the needs of each species change with respect to the amount of the electrolyte sodium, and the homeostatic mechanism seems to be readjusted to these needs.

The greater reduction of cholesterol values in dugong than in dolphin probably indicates the presence of fatty substances in the diet of the former species in very small amounts.

The meager data obtained left much to be desired. It seemed advisable to extend these studies. Further investigation should throw light on these differences and make possible their correlation with the peculiarities of the fish.

Concentrations of blood constituents in dugong and dolphin

	Dugong	Dolphin
R.B.C./Cm ³	1.2 × 10 ⁶	3.2 × 10 ⁶
Haemoglobin %	75	109
Haematocrit %	32	41
Serum total proteins g. %	5.5	5.9
Albumin fraction	4.3	5
α ₂ -globulin fraction	1.5	1.6
β-globulin fraction	4.2	3.4
Total cholesterol mg. %	111	312
Potassium, mEq./L.	22.2	18
Sodium, mEq./L.	172.5	186

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Fig. 1

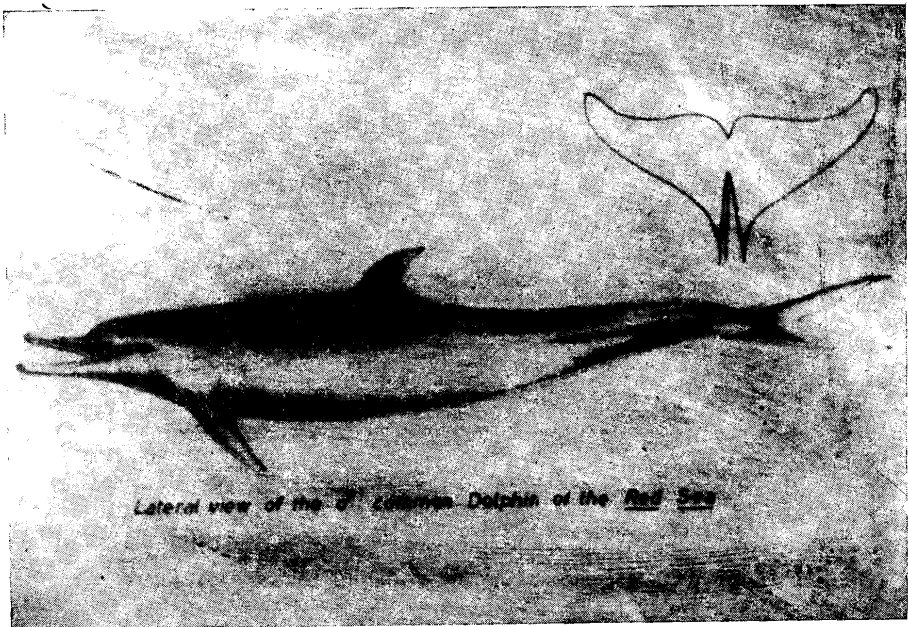


Fig. 2

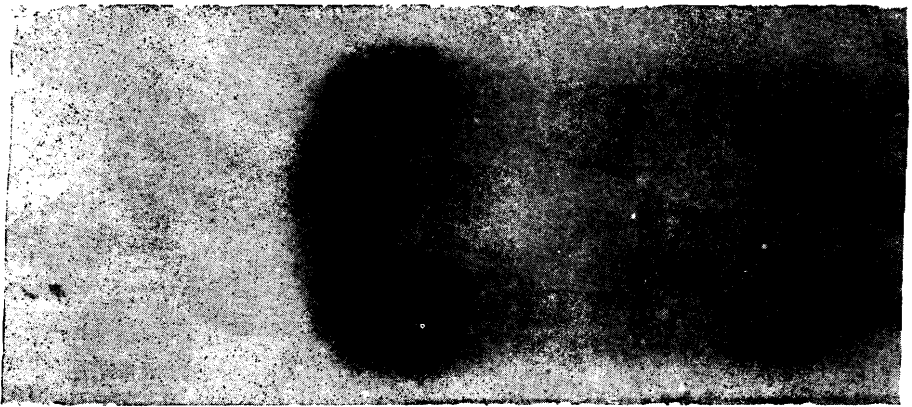


Fig. (3) Electropherogram of male mature adult dugong

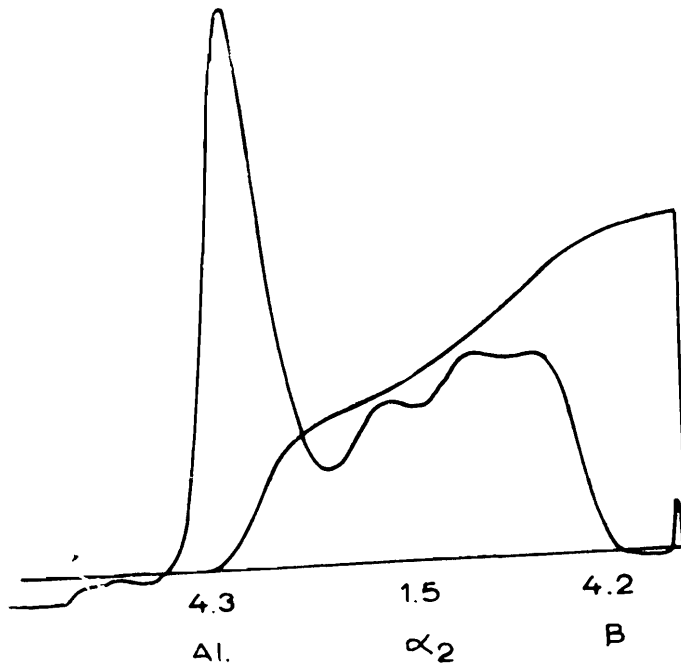


Fig. (4) Scan pattern of Serum protein of male mature adult dugong

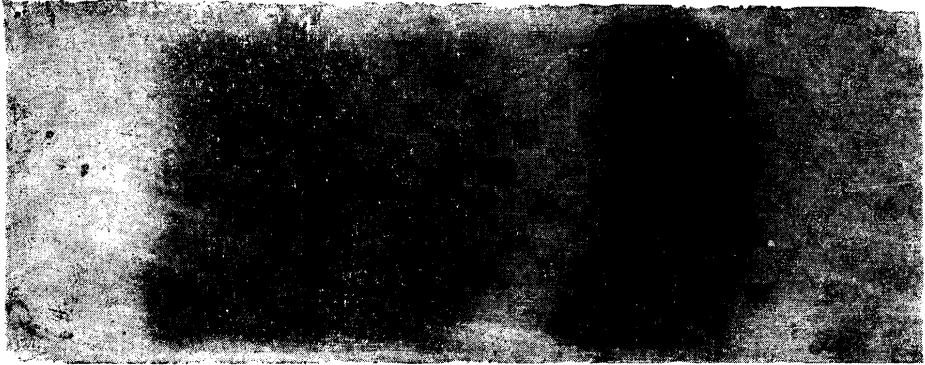


Fig. (5) Electropherogram of male mature adult dolphin

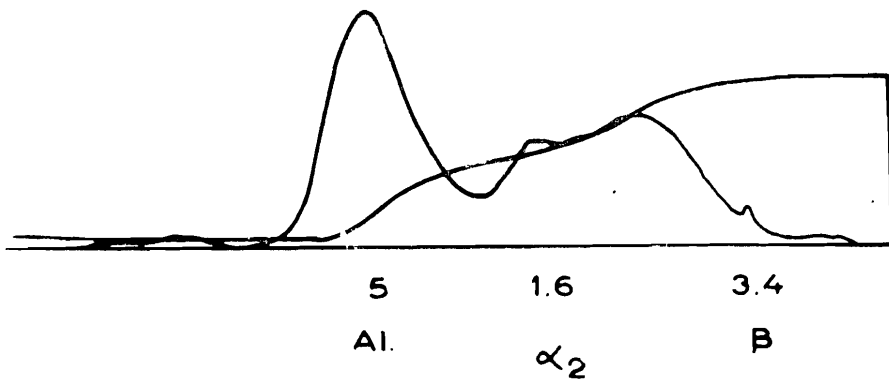


Fig. (6) Scan pattern of Serum protein of mature adult dolphin