Arquivos de Ciências do Mar

ANÁLISE DE PARÂMETROS SOROLÓGICOS DE TRÊS ESPÉCIES DE TUBARÃO DO ARQUIPÉLAGO DE FERNANDO DE NORONHA

Analysis of serological parameters of three shark species from Fernando de Noronha Archipelago

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RESUMO

Valores de referência relativos à bioquímica do sangue de tubarões são informações raras na literatura. O objetivo deste trabalho é a determinação de valores médios de parâmetros séricos de três espécies de tubarão, Carcharhinus perezi, Ginglymostoma cirratum *e* Negaprion brevoristri, *comumente encontrados no Arquipélago de Fernando de Noronha. Com o auxílio de um analisador bioquimico automatizado, foram determinados onze parâmetros, incluindo glicose, creatinina, ácido úrico, sódio, potássio, cálcio, fosfato, proteína total, albumina, globulina e aspartato aminotransferase/AST. Os valores médios de cada parâmetro foram comparados entre as três espécies de tubarão e entre outras previamente relatadas na literatura. As análises comparativas indicaram que alguns dos valores médios obtidos apresentaram variações entre espécies. Os resultados sugerem que podem ocorrer variações em parâmetros bioquímicos do sangue de tubarões relacionadas com as condições de obtenção, processamento e armazenamento das amostras em campo e/ou ao estresse de captura.*

Palavras-chaves*: análise do sangue, bioquímica do soro, tubarões,* Carcharhinus perezi, Ginglymostoma cirratum, Negaprion brevirostris, *Arquipélago de Fernando de Noronha.*

ABSTRACT

Documentation concerning reference values for blood biochemistry of sharks is rare in the literature. This research work was designed to provide mean values for several serum biochemical parameters of three shark species, Carcharhinus perezi, Ginglymostoma cirratum *and* Negaprion brevoristri, *found in Fernando de Noronha Archipelago. Using a biochemical automated analyzer, eleven serum parameters were estimated, including glucose, creatinine, uric acid, sodium, potassium, calcium, phosphate, total protein, albumin, globulin and aspartate aminotransferase/AST. The parameters' mean values for the three species were compared with one another and with reported values in the literature for those and other species of shark. The comparative analyses indicated that some mean values show variation among species, implying that potential blood biochemical changes which may occur in sharks are related to field sample collections, processing and storage, and/or stress associated with capture.*

Key words*: blood analysis, serum constituents, serum biochemistry, sharks,* Carcharhinus perezi, Ginglymostoma cirratum, Negaprion brevirostris, *Fernando de Noronha Archipelago.*

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INTRODUCTION

Recreational fishermen have released an increasing number of sharks in recent years (Skomal & Chase, 2002). However, sharks and other fishes generally react to stress of capture, severe exercise and handling, with relevant alterations to their physiology, which may reduce survivorship after release (Wood *et al*., 1983; Wood, 1991). Therefore, knowledge of exhaustion and stress degree imposed during capture is critical to the management of catch-and-release (Manire *et al*., 2001). Despite this, little is known about serological parameters and the effects of capturing and handling sharks in wild conditions, except for data provided by Cliff & Thurman (1984), Wells *et al*. (1986), Manire *et al*. (2001), Hoffmayer & Parsons (2001) and Harms *et al*., (2002).

Practical difficulties in such field studies involving these potentially dangerous animals, and also in establishing truthful 'baseline' values are major problems to initiate serological analyses, especially in isolated insular areas. Another challenge in the fieldwork related to serum biochemical analyses is to maintain blood constituents integrity before the analytical stage. It is well known that quality of pre-analytical procedures, as collecting, processing and storing blood samples is critical (Henry & Kurec, 2001).

Caribbean reef shark, *Carcharhinus perez*, nurse shark, *Ginglymostoma cirratum*, and lemon shark, *Negaprion brevirostris*, are relatively common throughout the tropical northwestern Atlantic Ocean (Compagno, 1984). They are the most common shark species found at the insular shelf off Fernando de Noronha Archipelago, an isolated group of islands located 345 km off northeastern Brazil, where they were commercially exploited by a longline fishery in the years 1992-1997. Although there has been a ban on fishing activities ever since, and the marine protected area now encompasses about 70% of the archipelago's coastline, local fishermen still occasionally land sharks. Nowadays, commercial and recreational fishermen use only handlines as gear. An initial task towards fisheries management is to obtain baseline values of serological constituents for the focused species. In this paper, preliminary values of eleven blood serum components in *C. perezi*, *G. cirratum*, and *N. brevirostris* are provided as background information for future studies of capture stress.

MATERIAL AND METHODS

Sharks were captured with rod-and-reel and handline in February 2003, and blood samples (3-5 mL) were taken via caudal venipuncture (Stoskopf *et al*., 1984). Animals were usually released five minutes after being caught. As baseline values of serum constituents for the three species were not available, an index of relative behavioral response to capture and release was utilized. All captured individuals were released under conditions 1 and 2, proposed by Manire *et al*. (2001): condition 1 (good) – rapid swimming upon release; condition 2 (fair) – slow, but strong swimming. Blood samples were kept in rest for separation of the serum, and were subsequently frozen at –20° C for further analysis. Serum values were measured in a Cobas Mira™ Biochemical Automated Analyser (Roche Laboratories).

RESULTS AND DISCUSSION

Blood samples were collected from nine *C. perezi* (87-110 cm TL, mean = 94 cm TL; 2-7 kg, mean = 3.8 kg), fourteen *G. cirratum* (125-148 cm TL, mean = 136 cm; 12-19 kg, mean = 15.6 kg), and seven *N. brevirostris* (68-144 cm TL, mean = 119 cm; 1.5-18 kg, mean = 8.9 kg). Values of the serum constituents for each species are given in Table I.

Most of the serum components showed variation among individuals within each species. Creatinine, globulin, albumin and total protein exhibited mean values similar to previous published data for other sharks (Table II). Of these, glucose was one of the highly variable constituents, specially in *G. cirratum*, what may be caused by chemical degradation or differential capture stress. Additionally, the time interval among feeding bouts would likely affect the glucose levels.

An interesting finding was that mean glucose values in *C. perezi* and *N. brevirostris* are similar to those reported in other highly stressed species of carcharhinid sharks. However, individuals of *C. perezi* and *N. brevirostris* captured during this research work showed rapid swimming upon release, a behavioral response attributed to minimally stressed animals (Manire *et al*., 2001), raising the possibility that baseline values for both species are lower than those for other carcharhinid sharks. Inorganic elements (calcium, sodium, iron, phosphate and potassium) also exhibited little variation (Table I). In this case, chemical degradation cannot be used to explain the observed individual variation. Overall, the estimated mean values (Table I) were similar to those previously reported for other shark species (Table II).

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Table I - Mean and range values variation of eleven serum constituents in three species of sharks captured at Fernando de Noronha Archipelago, Brazil.

Species	Calcium (mg dL^{-1})	Sodium (mEq l^{-1})	Iron (mg dL^{-1})	Phosphate (mg dL^{-1})	Potassium (mEq l^{-1})	Uric acid (mg dL^{-1})	Glucose (mg dL^{-1})	Creatinine (mg dL^{-1})	Globulin (g dL^{-1})	Albumin (g dL^{-1})	Total protein (g dL^{-1})
C. perezi (n=9)	11.3 (5-16.4)	268.7 (234-290)	72.9 (18-158)	12.1 (8.3-19.3)	6.8 (2.8-10.6)	1.8 (0.2-6.1)	29 (12-56)	0.5 (0.4-0.7)	2.2 (1.5-3.2)	0.4 (0.3-0.5)	2.6 (1.8-3.6)
G. cirratum (n=14)	12.5 (2.4-17.9)	240.3 (146-294)	89.2 (51-180)	8.1 (4.7-13.2)	5.1 (3-8.2)	3.7 (2-5.8)	58.4 (10-161)	0.4 (0.3-0.9)	2.5 (1.1-3.9)	0.3 (0.3-0.4)	2.8 (1.4-4.3)
N. brevirostris (n=7)	13.9 (11.9-14.5)	275.7 (240-294)	117.1 (48-205)	9.4 (6-18.5)	4.4 (6-18.5)	1.7 (0.1-3.4)	22.1 (12-42)	0.6 (0.4-1.1)	2.7 (2-3.3)	0.3 (0.2-0.4)	3.0 (2.4-3.5)

Table II - Comparison of mean values of various serum constituents in six shark species.

Variable	*S. tiburo* *	*C. limbatus* *	*C. leucas* *	*C. perezi*	*G. cirratum*	*N. brevirostris*
Glucose (mgdL^{-1})	183	62	54.5	17.4	67.6	23.8
Creatinine (mg dL^{-1})	0.2	0.2	0.2	0.5	0.4	0.5
Úric acid (mgdL^{-1})	0.35	0.1	0.2	2.6	4.1	2.2
Sodium (mEq L^{-1})	312	321	288	268.7	240.3	275.7
Potassium (mEq dL^{-1})	6.4	4	6.3	9.3	7.3	6.8
Calcium (mg dL^{-1})	16.5	17.1	17.3	11.3	12.5	13.9
Phosphate (mg dL^{-1})	7.4	8	8.1	12.1	6.5	6.8
Protein (g dL^{-1})	3.2	2.2	2.9	2.6	3.1	3.2
Albumin (g dL^{-1})	1	1	1.1	0.4	0.3	0.3
Globulin (g dL^{-1})	2.3	1.2	1.8	2.3	2.9	2.9
AST (µg L^{-1})	88.5	28	16	17.4	11.2	7.8

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