COBALT CONTENT OF EAST PAKISTAN FISHES*

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Introduction

The occurrence and distribution of cobalt in biological materials has attracted the attention of several investigators during the last 30 years. Bertrand and Mokragnatz[1] as early as 1922 found cobalt and nickel to occur in plants and later Bertrand and Macheboeuf[2] detected these elements in most organs of man and other mamals, birds, fishes and marine animals which they examined. The first evidence that cobalt is an essential nutrient for mammals came from the comprehensive study of Filmer and Underwood[3] who traced the prophylactic value of an iron-free extract of limonite (Fe_2O_3, H_2O) (known to be therapeutically active), against what was known as "Denmark disease" or "Enzootic marasmus" in the farm animals of Western Australia. The similarity of this disease to "Bush sickness" in New Zealand, "salt sick" in Florida, "pine" in Scotland and "Nakuritis" in Kenya was pointed out by Filmer. Askew et al.[4] later confirmed that the deficiency of cobalt in soils that served as the pasture land for these animals was responsible for the disease.

With the discovery of vitamin B_{12}, the anti-pernicious anaemia factor, which contains one atom of cobalt per molecule,[5] cobalt has assumed tremendous importance in human hematopoeisis. Since fishes are one of the sources of vitamin B_{12}, and since they constitute the main source of animal proteins for the bulk of the population of East Pakistan, considerable importance attaches to a survey of the cobalt content of these fishes. This is particularly so because there are no available data for the cobalt or other trace element contents of East Pakistan fishes. The present paper describes such a survey, on the basis of which an attempt has been made to find out the regions where cobalt rich fishes are available in plenty.

Materials and Methods

For the colorimetric estimation of cobalt in fishes, the method used by Kidson and Askew[6] was followed, the procedure adopted being briefly described as follows :—

TABLE 1.—THE COBALT CONTENT OF THE IMPORTANT EAST PAKISTAN FISHES.

Zoological name	Local name	Sources	Cobalt content p.p.m.
Labeo rohita	Rohit	Ponds & lakes	0.42
Catla catla	Katla	,,	0.46
Labeo calbasu	Kalibahus	,,	0.21
Clarius batrachus	Magur	,,	0.32
Heteropneustes fossiles	Singil	,,	0.38
Anabas testudineus	Kaii	,,	0.42
Wallagoni attu	Boal	Rivers & canals	0.35
Mystus cavasius	Pungas	,,	0.21
Mystus vittatus	Tangra	,,	0.80
Hilsa ilisha	Hilsha	Rivers & bays	0.38
Ompok bimaculatus	Shilan	Rivers	0.86
Notopterus notopterus	Foli	Ponds & lakes	0.29
Barbus sarana	Puti	Canals	0.27
Palaemon carcinus	Chingri (big)	Rivers & canals	0.50
Pataemon carcinus	Chingri (small)	,,	0.51
Mastacembelus armatus (Lacep)	Baim	Canals	0.49
Glossogobinus giuris	Bele	,,	0.53
Ophicephalus marulius	Qajal	Ponds	0.21
Ophicephalus sonnerati	Shouli	,,	0.25
Serranus sonnerati	Bhetki	Ponds, rivers & canals	0.29

Note.—The values of cobalt content represent the average of two determinations and are on the basis of dry weight of whole fish.

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The particular fish under investigations were dried at a constant temperature of 110°C. for 48 hours and from the dried material 10 g. of sample was taken and mixed in a silica basin with 30 ml. of 7.5N nitric acid. After ignition, the basin was put into a muffle furnace, where it was heated to a dull red heat for 12 hours. The ash was moistened with 5-10 ml. of the same acid, dried and ignited again. The process was repeated a third time, after which the ash was taken up with 30 ml. of 4N hydrochloric acid and heated gently for 20 minutes. The solution was filtered into a Pyrex dish and the residue washed three times with hot water. The filtered solution was evaporated nearly to dryness and then taken up in 10 ml. of water.

10 ml. of a standard comparison aqueous solution of cobalt chloride and a "blank" consisting of 10 ml. of distilled water were also prepared at this stage, and from here onwards the standard and blank solutions were treated in the same manner as the unknown. After the addition of 1 ml. of 4N hydrochloric acid and eight drops of 7.5N nitric acid, the solution was transferred to a 100 ml. Erlenmeyer flask and boiled for a few minutes to oxidise any reducing substance and then cooled. Exactly 2 ml. of 0.1% nitroso R.-salt in water and 2 g. of sodium acetate were then added and the solution warmed to 70°C. to develop the characteristic colour fully. In order to stabilise this colour, the following procedure was adopted : 10% potassium hydroxide was gradually added with constant shaking until the solution was just alkaline to phenolphthalein (0.2% in alcohol), after which sufficient 0.5N hydrochloric acid was added to make the solution just acid. 5 ml. of 7.5N nitric acid were then added (to decompose the complexes of most of the other heavy metals that may be present), the solution boiled for 2 minutes and then cooled under a tap. The volume of the solution was made upto 25 ml. and filtered in a dark room.

The characteristic red colour developed due to the cobaltic ions was matched against the cobalt standards in a colorimeter with a green filter, the "blank" water sample being used to set the zero of the instrument. Table 1 shows the results obtained for twenty different varieties of fish. The variation between successive determination was always less than 0.1 p.p.m.

Discussion

It appears from the table that the cobalt content of these fishes varies from 0.21 to 0.86 p.p.m., the lowest quantities being found in fishes of the types *Labeo calbasu*, *Ophicephalus marulius*, *Sarranus sonnerati*, while the highest occur in fishes of the varieties *Ompok bimaculatus*, *Mystus vittatus*. Moreover, it is observed that the fishes from ponds, lakes etc., generally have a low cobalt content while those from rivers and canals contain relatively large quantities of this element. Table 1 lists ten varieties of fish from each of the two types of sources, and we find that the mean cobalt content of the fish from lakes and ponds is 0.33 p.p.m., while that of river and canal fish is 0.49 p.p.m., *i.e.*, 50% higher. Our results are the only ones available for East Pakistan.

References

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