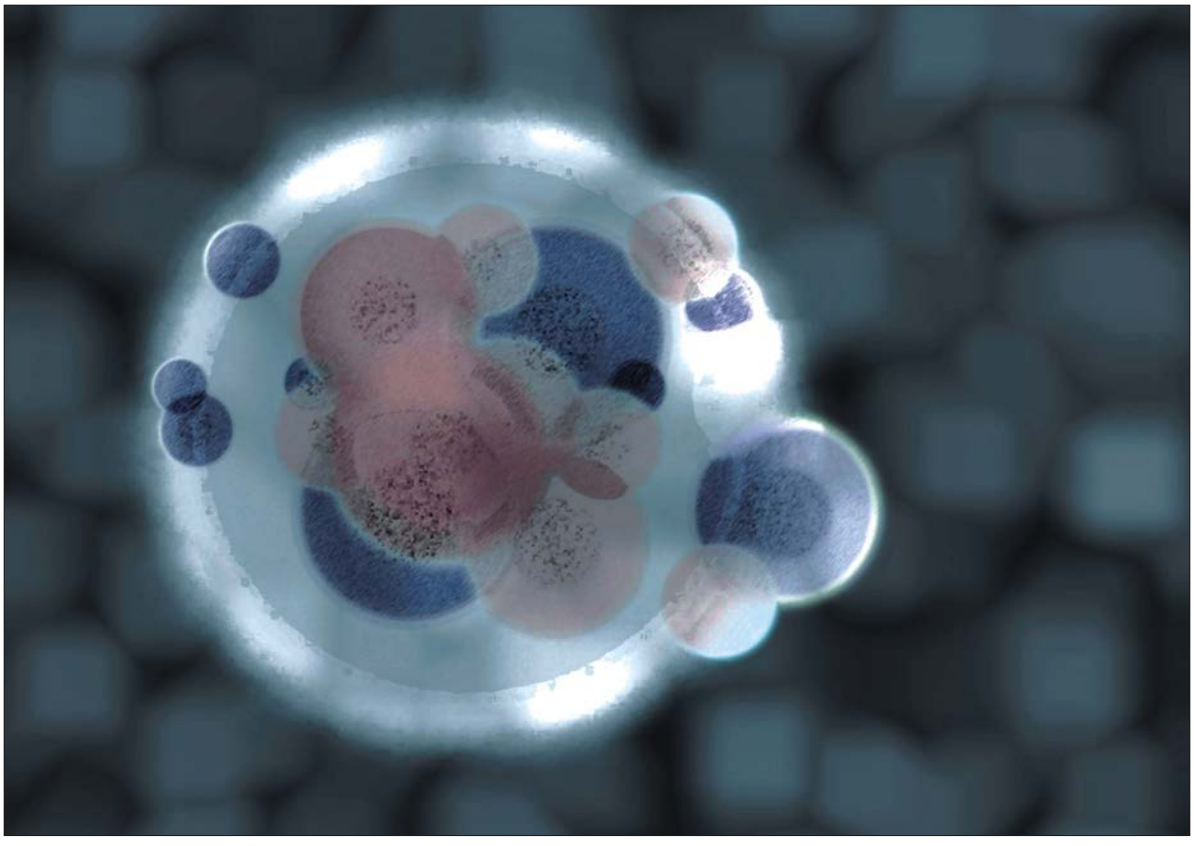

Journal of Biological Sciences

ISSN 1727-3048

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Journal of Biological Sciences 6 (2): 301-304, 2006
ISSN 1727-3048

Macronutrients Found in Some Edible Herbivorous and Carnivorous Fishes of Arabian Sea

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Abstract: The macronutrients Na, K, Ca and Mg have been determined in 25 samples of seven common edible marine fishes. The samples were collected from the fish harbor Karachi, Moosa colony and Korangi creak area. The representative samples were drying ashed in quartz crucible and the ash was treated with the suitable amounts of concentrated HCl and few drops of concentrated HNO_3 solution was then used for the analysis of Na, K, Ca and Mg by flame photometry and atomic absorption spectrophotometry. The macronutrients were estimated in flesh muscles of these species to check the nutritional quality of fish and potential of these elements in guts and gonads in contaminated coastal area and deep-sea region on the basis of recommended dietary limits at international level. The highest potential of Na, K, Ca and Mg in edible fishes can be related with the size, weight and feeding habits of fishes.

Key words: Macronutrients, muscles, potential, pollution

INTRODUCTION

The effect of industrial processing on mineral composition like Fe, Cu, Zn, Mn, K, Mg, Co, Na and Ca were studied by collecting samples at several stages shows that mineral composition were increased in fishes which were collected from the damping site. Na content increases six times greater in final cooked product after using spices and salt as compare to fresh fish (Tahvonen *et al*., 2000).

The multiplicity of results from essential macronutrients metals monitoring of herbivorous and carnivorous fishes, as of Na, K, Mg and Ca includes, besides comparison more or less contaminated areas, deep sea, aspect of both change by time, size and aspects of human health, respectively. The statistical analysis of ash Na, K, Ca, Mg, Fe, Zn, Cu and Mn in different species of fishes has been reported (Aleshko *et al*., 1986) to develop the new tables on chemical composition of food product. Studies regarding the contamination of the fish, by observing the distribution and the concentration of the harmful metals in various tissues and organs are not as numerous (Kraiushkina *et al*., 1975; Houstan 1985; Natochin *et al*., 1994).

Jaffar and Ashraf (1988) reported concentration of Ca, K and Mg in twelve marine fish and compared the nutritional quantity on the basis of recommended dietary allowances laid down internationally. Eighty samples of 10 kinds of fish samples were analyzed for Sr, Li and Ca content to justified that Sr and to some extent Li are able to modulate Ca metabolism and vice versa reported by Nabryzki (2002), Talat *et al*. (2005) investigated minerals like phosphorous, calcium, sodium, potassium, iron and magnesium in the trash fish for their utilization as poultry feed and other useful by product. The permeability characteristics to water and ions, of the sea water in adopted eel fish have been studied in the absence and presence of external Ca and Mg and found that role of Ca and Mg helps in maintaining of the hydro mineral equilibrium of the eel (Isaia and Masoni, 1976; Qudrat *et al*., 1962, 1981).

The hypothesis of present research is the investigation of potential impact of pollution in the Arabian sea with regard to essential macronutrient by the surrounding environment (due to marble industry). Therefore this research will examine the essential mineral ions (Na, K, Ca and Mg) found in edible herbivorous and carnivorous fishes of Arabian sea to established a relation in between the recommended dietary limits at international level and pollution. The results will discuss the feeding habit of fishes, their size and weight and there effects on human body.

MATERIALS AND METHODS

The seven marine edible abundant coastal fishes selected are: *Hilsa kelee,* (Palli), *P. olivaccum,* (Saddle grunt) *P. maculatum*, (Smallspoted grunt)

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(Gaint catfish) *Arius thalssinus,* (Tiger tooth croaker) (*Otolithus rubber*), Belanger's croaker (*Johnius belangerii)* were collected from fish harbor Karachi in May and June 2005 in the morning at 3:00 O'clock. Work is carried out in Department of Zoology and Chemistry. Twelve fishes of palli were taken in order to increase the investigation material for verifying the results concerning the macronutrients potential in edible fishes. All fishes were measured [total length (TL)], weight [total weight (TW)] prior to the investigation and metal analysis. All fishes in the present investigation were analyzed individually in order to enable distinctions between flash and organs for Na, K, Ca and Mg by flame photometry and atomic absorption spectrophotometry. Five grams of dried samples were wet ashed with 40 mL (1:1) HNO_3-$HClO_4$ and heated to near dryness in a platinum dish, few drops of hydrofluoric acid were added and heating was continued to dryness. The residue was treated with 10 mL concentrated HCl and boiled for 30 min, then 20 mL distilled water was added and solution was heated for further 15 min and made up to 50 mL. Heavy metal analysis were carried out by Hitachi Z-8000 Atomic Absorption Spectrophotometer with Zeeman correction using air acetylene flame with standard addition methods.

RESULTS AND DISCUSSION

The total 25 fishes of seven species were analyzed with there size, weight and for essential mineral ions like Na, K, Ca and Mg. Total length of all fishes were ranged from 12 to 20 inches where as weight were 0.25 to 0.75 kg. Table 1 shows that *Hilsa kanagurta* (Palli), *P. olivaccum* (Olive grunt), *P. maculatum* (*Saddle grunt*, *P. commersonni* (Smallspoted grunt), Arius thalssinus (Gaint catfish), *Otolithus rubber* (Tiger tooth croaker), *Johnius belangerii* (Belanger's croaker) are more prevalent in different coastal area of Arabian sea Karachi (Table 1).

The results of Table 2, 3 and 4 indicated that there were highest potential of sodium (Na), potassium (K), calcium (Ca) and magnesium (Mg) in all fishes were observed but concentration of these mineral ions found in herbivorous fish were less as compared to carnivorous fish which may be attributed with the feeding habit of both fishes. Because big fish eat smaller fish, thereby getting dose of accumulated toxin. The concentration of metals like Na, K and Mn in muscle tissues of *Clarias focus, which* were significantly higher in hepatic tissues due to air borne pollutant-emission from the power plant as a probable source (Wagner and Bomen, 2002). The feeding habit of herbivorous fishes consists of plankton, mud, sand grains, Dinoflaglate and Molluscs while carnivorous fishes eat small fishes.

The Na, K, Ca and Mg are very important minerals elements and found insoluble salts in the sacroplasm of the muscular cells, inter cellular fluid, blood and plasma. These elements are also play an important role in physiological processes involves in structure of several organic compounds (Oilverreae *et al*., 1981). An increase in concentration of K, Na or Mg contents in sea-water may alter the morpho-functional changes in fishes. These changes include the increase in the height and the diameter of the micli of pinealcytes, the increase being followed by apocrynic secretion in the cells which may disturb the ionic balance of internal miles (Dean and Woo, 2005). Mg reaction in fishes also related with seasonal variation as well as with respect to constant, diurnally cycling and progressively increasing temperature condition. It is also observed that magnesium is not actively transported, cellular concentration appears to reflect processes influencing membrane potential and may also be related to maintenance of cellular electro neutrality.

The sodium content in 14 specimen of two species of palli and Boi was ranged from 180-360 ppm. These results showed that significant variation in sodium contents due to size weight and feeding habits of fish which may be attributed with the morphological functional changes in fish with very large scale. Sodium involved in the ionic balance of internal milieu. While in carnivorous fishes the contents of sodium were ranged from 250-300, which was higher than herbivorous fishes. It may be related with the feeding habit of carnivorous fish whose diet depends upon small fishes.

The potassium content founds in herbivorous fishes were studied. The results showed that potassium content were less than sodium contents. Variation in potassium content can be related with the seasons, size and weight

Table 1: The identified species of edible fishes

Order	Family	Specific Name	Common Name	Local Name
	Haemulidae	*Pomadasys olivaceum*	Olive gmnt	Dhotor, Kumpo
	"	*Pomadasys maculatum*	Saddle grunt	Dhotor, Tantar
	"	*Pomadasys commersonni*	Smallspoted grunt	Dhotor, Holra Aloola
Siluriformes	*Ariidae*	*Arius thalssinus*	Gaint Catfish	Khagga, Kun
Cyprinoformes	*Sciaenidae*	*Otolithus ruber*	Tiger tooth croaker	Mushka
"	"	*Scomberomorus guttatus*	Belanger's surmi	Mushka surmai
Clupeoidei	*Clupeide*	*Hilsa Kanagurta Liza varigeransis*	Palli- Boi	Palli

Table 2: Essential macronutrients founds in some herbivorous and carnivorous Fishes of Arabian Sea

Essential nutrient ions									
Herbivorous fishes					Carnivorous fishes				
Fishes	Na (ppm)	K (ppm)	Ca (ppm)	Mg (ppm)	Fishes	Na (ppm)	K (ppm)	Ca (ppm)	Mg (ppm)
Palli 1	180±0.6	170±0.5	110±0.2	190±0.2	Catfish 1	250±0.6	190±0.2	120±1.0	220±0.2
Palli 2	200±0.4	190±0.1	130±0.5	210±0.4	Catfish 2	240±0.5	210±0.2	140±0.6	230±0.8
Palli 3	180±0.5	200±0.4	140±0.9	230±0.3	Catfish 3	220±0.4	240±0.2	160±0.8	240±0.25
Palli 4	240±0.2	170±0.5	110±0.2	230±0.3	Mushka 1	250±0.5	220±0.5	140±0.5	220±0.2
Palli 5	270±0.3	190±0.3	130±0.5	250±0.5	Mushka 2	270±0.5	240±0.02	150±0.5	240±0.6
Palli 6	290±0.2	200±0.1	160±0.4	220±0.5	Mushka 3	300±0.3	250±0.2	170±0.5	260±0.5
Palli 7	310±0.2	220±0.2	170±0.5	290±0.8	Dhotor 1	220±0.01	130±0.6	220±0.3	300±0.5
Palli 8	340±0.2	240±0.1	190±0.1	310±0.6	Dhotor 2	240±0.14	170±0.8	240±0.2	310±0.5
Palli 9	360±0.1	260±0.1	210±0.4	320±0.5	Dhotor 3	170±0.2	120±0.4	170±0.5	220±0.5
Palli 10	250±0.5	220±0.2	240±0.14	270±0.5	Dhotor 4	190±0.2	130±0.5	210±0.5	260±0.58
Palli 11	280±0.1	230±0.1	260±0.3	280±0.2	Dhotor 5	240±0.2	150±0.2	240±0.2	290±0.2
Palli 12	300±0.2	250±0.1	270±0.12	300±0.2					
Boi 1	310±0.1	280±0.2	310±0.36	310±0.2					
Boi 2	350±0.1	290±0.2	330±0.2	340±0.2					

Table 3: Macronutrients found internal organs of herbivorous fishes

Organs	Na (ppm)	K (ppm)	Ca (ppm)	Mg (ppm)
Gut	120±0.2	230±0.5	400±0.5	400±0.5
Gonads	130±0.3	350±0.5	420±0.5	350±0.5
Liver	200±0.5	350±0.5	420±0.5	370±0.5

Table 4: Macronutrients found in internal organs of carnivorous fish

Organs	Na (ppm)	K (ppm)	Ca (ppm)	Mg (ppm)
Guts	160±0.2	150±0.5	500±0.2	420±0.2
Gonads	100±0.4	300±0.5	350±0.5	310±0.2
Liver	250±0.4	220±0.2	520±1	450±0.5

and feeding habit of fishes. Potassium also involves in the ionic balance of internal milieu.

In carnivorous fishes the content of Mg was less as compared to herbivorous (Table 2). Mg is located in the bones with calcium and in the soft tissues. It regulates the acid- alkaline balance in the body, the ratio of Ca to Mg is important in absorption use and excretion of these minerals. Mg showed the half to that of Ca while the excess of Mg as compared to the calcium could disturb the metabolic activity of body.

Ca is required for normal nerve transmission. The nerve becomes hypersensitive when blood calcium levels drop below normal and tetary (painful spasms of the muscles) can result a high in take of calcium is a potential source of hyper calcemia (an abnormally large amount of calcium in the blood). This may result in excessive calcification of the bones and some tissues such as kidney or heart. Highest potential of essential macronutrients founds in different organs especially in gonads of herbivorous and carnivorous fishes shows that it may be transferred to the embryo of the fish. This may lower the fisheries product (Table 3 and 4). It was observed that carnivorous fish contain potassium>sodium than herbivorous fish and where as Ca>Mg in both fish.

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