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Record of Skeletal System and Pin Bones in Table Size Hilsa *Tenualosa ilisha* (Hamilton, 1822)

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Abstract: The number, shape, sizes of intermuscular bones in table size (around 900g) hilsa (*Tenualosa ilisha*) has been studied after microwave cooking and dissection. Hilsa intermuscular bones have varied shape and size. These pin bones are slender and soft which of two types, Y Pin bones and straight pin bones. Total number of pin bones in hilsa was found to be 138 nos. Y pin bones in each side was found to be 37 and straight bones in each side was 32. Both types of pin bones were slender springy and their distal end were not brushy. Branched pin bones were located on the dorsal broad muscle and unbranched pin bones were found in the posterior tail region.

Key words: Hilsa · Intermuscular Bones · Pin Bones · Tenualosa ilisha · Y Pin Bones

INTRODUCTION

The Indian shad hilsa, *Tenualosa ilisha* (Hamilton, 1822) is one of the most important tropical fishes in the Indo-Pacific region and has occupied a top position among the edible fishes due to its delicious taste, mouth watering flavour and delicate culinary properties [1]. *Tenualosa ilisha* comes under the subfamily Alosinae, family clupeidae, order clupeiformes and it is a fast swimming euryhaline fish known for its composition distribution in brackish water estuaries, marine and riverine environments where it migrates for breeding [2].

Hilsa body is oblong and compressed having 30-33 spines like scutes on abdomen. *Tenualosa ilisha* dorsal and ventral profile of the body is equally convex. Hilsa musculature has two bundles of muscles on each side of the vertebral column and each of the bundles is further separated into an upper mass above the horizontal axial septum and ventral mass below this septum. In between the upper and lower bundle mass, along the axial septum, a thick sheet of dark muscle develops, spreading widely on the surface beneath the skin, but extending conically up to back bone [3]. Branched pin bones extend horizontally from the neutral or hemal spines into the white muscle tissue. Abdominal portion of lower bundles are devoid of pin bones. Due to higher pin bones filleting of hilsa is difficult. Patience separation of cooked flesh from bone is required that may restrict fish loving people, unfamiliar to hilsa taste [4]. Fish bones are thin and light in weight with no bone marrow in the center [5].

Fish has muscle cells running in parallel and connected to sheaths of connective tissues myocommata which are anchored to skeleton and the skin. A light weight skeleton is advantages to an animal that need to be buoyant to live in a water environment [6]. Intermuscular bones referred as pin bones are spike like formation that occurs when ligaments calcify. They lie on the intermuscular border of both sides of fish, over and under the back bone [7]. Patterson and Johnson [14] reported that the single unbranched ends of intermuscular bones are not free but attached to the vertebrae by the ligament from their simple (non-brushy) branches. Results indicate that anchoring of intermuscular bone is stronger than their tensile strengths, which equals 2.90 ± 1.33 N [8].

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Intermuscular bones in fish have varied shape and size and number of them is an individual characteristics. The pin bones number in *Cyprinus carpio* varied from 99 to 104 [9]. Bones other than ribs found in a fish fillet, for example the Y bones in northern pike are called pin bones. These are floating bones can be taken out doing deboning [10]. The accurate detection of bones using a planar x-ray imaging system has been developed [11]. The number of intermuscular bones has been counted in many fish species; either by cooking fish flesh and dissecting out intermuscular bones. The back bone run from head to the tail fin and is composed of vertebrae. These vertebrae are extended dorsally to form neutral spines. In the trunk region they have lateral processes that bear ribs. The ribs are bony structures in the connective tissue between muscle segments. There are also a corresponding number of false ribs or "pin bones" extending more or less horizontally into the muscle tissue variability of intermuscular bones, vertebral ribs, dorsal fin rays are responsible for skeletal disorder in fin fishes [12].

Milk fish (*Chanos chanos*) is the fish shot through with large number of thin spines or pin bones. These are part of the fish sensory system, allowing is to detect tiny changes in the water column. Milk fish spines are in bundle and can be removed during deboning and filleting. Intermuscular pin bones in freshwater carp fishes are bolder and stronger. Pin bones number varied from 104 to 110 in rohu, catla and mrigal. Pin bones in carps varied from straight, Y shaped and brushy or branched [13]. Information about muscular skeletal system and pin bones in Hilsa (*Tenualosa ilisha*) has been poorly studied.

MATERIALS AND METHODS

Samples of Hilsa fish were collected from Kharagpur, West Bengal fish market. Five specimen of 800g weight ranges were collected and taken to post-harvest laboratory. The whole fish was cooked in microwave oven (Sanyo Model 130 M 700T); each side was cooked for two minutes and turned. The whole fish after cooking were chilled and placed on a dissecting tray, the skeleton and pin bones were dissected out using needle and artery forceps.

RESULTS

Musculoskeletal system and pin bones of hilsa (*Tenualosa ilisha*) (Fig. 1 and Fig. 3) has been presented. The muscles (white muscle bundles and dark muscle) characteristics have been depicted in Figure 2.

Table 1: Intermuscular bones in hilsa (*Tenualosa ilisha*)

Parameter	*Tenualosa ilisha*
Total wt (g)	810.5 ± 32.1
Total length (cm)	40.1 ± 0.8
Age of fish	1 Year
Y pin bones (nos.)	74
Straight pin bones (nos.)	64
Total pin bones (nos.)	138
	(n=5)

Fig 1: Hilsa (*Tenualosa ilisha*) (810 g size)

Fig 2: Cuttability traits of Hilsa (*Tenualosa ilisha*)

Fig 3: Musculoskeletal system and pin bones of Hilsa (*Tenualosa ilisha*)

The information on Y shaped and straight pin bones are presented in table 1. Hilsa fish has more pin bones than Indian major carps (Rohu, Catla and Mrigal).

YP = Y pin bones 37 nos x 2 sides = 74
SP = Straight pin bones 32 nos x 2 sides = 64

DISCUSSION

Most of the muscle tissues of Hilsa is white (65-70%) and dark muscle is about 30-35% of the total flesh. Dark muscle is located just below the skin, originates from base of the caudal region and extends along the horizontal axial septum up to the cranium. Dark muscles are generally devoid of pin bones [1].

The dark muscle primarily functions as a cruising muscle, i.e., for slow continuous movement which is a characteristics of migratory species [6]. Hilsa has two bundles of muscles on each side of the vertebral column and each of the bundles is further separated into an upper mass above the horizontal axial septum and a ventral mass below this septum. Muscles of the upper bundles are characterized with huge Y-shaped branched pin bones. Pin bones extend horizontally from the neural or hemal spines into the muscle tissue. Skeletal muscle is the largest organ system in fish which represents the edible part. Due to the large number of pin bones it is very difficult to fillet the hilsa fish [1].

The intermuscular bones in hilsa fish are of two types such as Y shapes and straight. Paterson and Jhonson [14] reported there are three types or pin bones, they are single unbranced, branched and brushy at single end. According to Lieder [9], total number of pin bones in *Cyprinus carpio* varied from 99 to 104. Indian major carps, catla, rohu and mrigal contain more intermuscular bones in comparison to common carp. Milk fish (*Chanos chanos*) has 180 numbers of pin bones, which are in bundles and can be removed during deboning and filleting. Hilsa pin bones are embedded in muscles and they are extremely fine bones. Branched pin bones extended horizontally from the neural or hemal spine into the white muscle tissue. Abdominal portion of lower bundles are devoid of pin bones [1]. Bundles of muscles, mostly upper bundles are characterized with huge Y-shaped branched pin bones. Pin bones extend horizontally from the neural or hemal spines into the muscle tissue [3].

Due to stiffness and branched shape the intermuscular bones of cyprinids pose a health hazard to fish eaters [15]. The pin bone of hilsa is very fine and loosely embedded in muscle. Hilsa muscle fibres are also very soft. Researchers are indicated that anchoring of branched intermuscular bones in cyprinids is stronger than their tensile strength, which is equal to 2.90±1.33 N [8]. Intermuscular bones within cyprinids family varied in shapes and sizes, the number of them is an individual characteristics studies on northern Pike [10] Salmon [11], Indian major carps [13] and milk fish skeleton and pin bones have reported variation in size, shape, form and orientation in different fish species.

CONCLUSION

Hilsa pin bones have varied shape and size pin bones are of two types i.e. Y pin bones and straight pin bones. Hilsa have more pin bones in comparison to carps. *Tenualosa ilisha* have very slender and soft pin bones deeply embedded in muscle. Branched pin bones are located on the dorsal broad muscle of the hilsa and unbranched pin bones are located in the tail region.

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