NOTE: II

SOME PHYSICAL PROPERTIES OF THE MUSCLE LIPID OF TWO FRESHWATER TELEOSTS, *OPHICEPHALUS STRIATUS* (BLOCH.) AND *CLARIAS BATRACHUS* (LINN.)

Though there is a considerable body of literature on the chemical qualities of fish lipids (Brocklesby, 1941; Lovern, 1964; Ackman and Eaton, 1966; 1970; Ackman *et al.*, 1967; Addison *et al.*, 1969; Malins and Wekell, 1969), information on the physical properties of the lipids of freshwater fishes is almost lacking. The present work is intended to report some important physical properties like specific gravity, viscosity, fluidity and surface tension of the muscle lipid of two common Indian teleosts, namely *Ophicephalus striatus* (Bloch), a freshwater murrel, and *Clarias batrachus* (Linn.), a freshwater cat-fish.

The evaluation of the interspecific differences in these properties has been one of the interesting results of the present study.

Ophicephalus striatus of the size range 380 - 520 mm. and *Clarius batrachus* of 180 - 260 mm. were obtained live from the local fish market. The muscle lipid was extracted using a soxhlet extractor. The specific gravity of the lipid was estimated by the method as given in the A. O. A. C. (1960). The viscosity was determined with an Ostwald Viscometer using the following equation:

$$\eta = \frac{dl\ tl}{dw\ tw}$$

where, η is the coefficient of viscosity of the lipid

dl is the density of lipid (g/cc),
dw is the density of water (g/cc),
tl is the time of descent of lipid (sec.),
and tw is the time of descent of water (sec.).

The fluidity (ϕ) of the lipid was determined as the reciprocal of the coefficient of viscosity,

$$\phi = \frac{1}{\eta}$$

The surface tension (λ) of the lipid was estimated by the capillary-height method using the following equation:

$$\lambda = \frac{1}{2}\text{ r.h.d.g.}$$

where, r is the radius of the capillary (cm),
h is the height to which the lipid ascended (cm),
d is the density of the lipid (g/cc), and
g is the acceleration due to gravity (981 cm. per sec.^{2})

TABLE I

Physical properties of the muscle lipid of *O. striatus* and *C. batrachus*

	Specific gravity	Viscosity dynes/cm²/unit velocity gradient	Fluidity dynes/cm²/unit velocity gradient	Surface tension dynes/cm.²
Ophicephalus striatus	0.894	5.190	0.192	12.058
Clarius batrachus	0 947	7.576	0.131	25.083

The values of specific gravity, viscosity, fluidity and surface tension of the muscle lipid of *Ophicephalus striatus* and *Clarius batrachus* have been given in Table I. It may be evident from the Table that the specific gravity of the muscle lipid was higher in the cat-fish, *C. batrachus* than in the murrel, *O. striatus*. The specific gravity of the lipid of the two species was, however, lower than that of the water and this might be of advantage to the fish in its active movement in water. It was taken as established fact that like any liquid, the lipid also consisted of a number of molecular layers arranged one over the other. The movement of these different molecular layers relative to one another, was opposed by the internal friction or the viscosity of the lipid. The force per unit area required to maintain unit difference of velocity between each set of two parallel layers in the lipid, one centimetre apart, as expressed by the coefficient of viscosity, was found to be higher in *C. batrachus* as compared to that in *O. striatus*.

As was evident from the reciprocal relationship between the fluidity and coefficient of viscosity, the fluidity of the muscle lipid of *O. striatus* was higher than that of *C. batrachus*.

The surface tension of any liquid, and so also of the lipid has been known to be the seat of a special force as a result of which the molecules in the surface were bound together, forming a stretched layer tending to compress the molecules below to the smallest possible volume. This force in dynes acting upon a line of 1.0 cm. length of the surface of the lipid, as expressed by the surface tension, was found to be greater in the muscle lipid of *C. batrachus* as compared to that of *O. striatus*.

It was, therefore, evident that the specific gravity, viscosity, fluidity and surface tension of the muscle lipid of fishes are species specific.

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