# CHAPTER 8

## ON THE LIPID CONTENT AND LIPASE ACTIVITY IN THE BREAST MUSCIE OF THE ROSY PASTOR (STURNUS ROSEUS)

The rapid deposition of large quantities of fat in the visceral and subcutaneous depots is one of the most conspicuous changes preceeding migration in birds. Several reports on the pre-migratory deposition of fat are available (Odum and Perkinson, 1951; MaGreal and Farner, 1956; Wolfson, 1954; Weise, 1956; Odum and Connell, 1956; Merkel, 1958). It is also known that this stored fat is continuously reduced during migration (Williamson, 1952; 1955). Furthermore, the role of fat as the major fuel for sustained muscular activity was shown by George and Jyoti (1955; 1957) and discussed in a recent review by Drummond and Black (1960). George and Scaria (1956) showed that the pectoral muscles of the pigeon and other good fliers possess a high concentration of a fat splitting enzyme, lipase and the level of activity of this enzyme was correlated with the capacity for sustained flight. The importance of lipase for splitting fat into fatty acids as the first step in the utilization of fat for muscular energy has been shown by George and Talesara (1962a).

The purpose of the present investigation therefore, was to determine the changes in the fat content and lipase activity of the breast muscle during the period of several months upto the time of actual migration, in the Rosy pastor.

## Material and Methods

All experiments were conducted in the evening hours between 4 to 6 P.M. The birds were collected either by trapping with a mist net or shot with an air rifle and brought to the laboratory within 10 minutes. A piece of the breast muscle was immediately excised and blotted with a filter paper to remove blood as far as possible. For the estimation of fat content the tissue was first weighed, then dried in an air oven at 95°C for 24 hours and then kept for 12 hours in a vacuum desiccator, weighed again and subjected to Soxhlet extraction with a 1:1 ethanol-ether mixture for 18 hours. The extracted fat was dried and weighed and the per centage of fat was calculated on dry weight basis. The water content of the muscle was also calculated from the same samples dried for fat extraction.

For the estimation of lipase activity in the muscle a piece of the muscle was homogenized in a chilled mortar and a 2% homogenate was prepared in cold distilled water. The lipolytic activity was determined manometrically in a bicarbonate-carbon dioxide buffer system of pH 7.4 at 37°C as adapted from Martin and Peers (1953). 4% tributyrin in 0.0148 M bicarbonate emulsified by shaking with a drop of 'Tween 80' was used as the substrate. The rest of the procedure was the same as described in Chapter 1. Lipase activity is expressed as µl $CO_2$ / mg. protein / hour. Protein content of the homogenate was determined according to the micro-Kjeldahl steam distillation

method (Hawk et al, 1954).

## Results

Table 1 gives the data obtained regarding the body weight, fat and water content of the breast muscle in the different months from December to April. There was a gradual increase in the body weight and muscle fat, with a corresponding loss in water content of the muscle. Total body fat just prior to migration was found to be nearly 1/4 th the body weight. On an average of four estimations the total body lipid was 21.86% in birds weighing from 96 to 100 gm.

Table 1

Showing the changes in fat and water content in the breast muscle of the migratory bird, Rosy pastor in the different months from December to April.

| Month | Body wt. in gm. | % Fat content in gm. on dry muscle | % Water content in muscle | No. of Expts. |
|---|---|---|---|---|
| December | 52 (50 -56) | 10.20 ± 0.760 | 73.60 ± 0.562 | 4 |
| January | 60 (52 -70) | 12.69 ± 1.130 | 73.21 ± 0.373 | 6 |
| February | 68 (62 -75) | 14.62 ± 0.442 | 72.13 ± 1.23 | 6 |
| March | 80 (65 -90) | 15.95 ± 2.470 | 70.90 ± 1.40 | 13 |
| April | 87 (70 -98) | 16.75 ± 1.030 | 70.56 ± 0.971 | 17 |

Table 2 presents the lipase activity in the breast muscle for only the months of December and April since there was no significant change in the activity of the enzyme in the intervening months. It could be seen from the table that during the pre-migratory phase (April) there is slight decrease in the enzyme activity of the muscle.

Table 2

Showing the changes in lipase activity in the breast muscle of the Rosy pastor in the months of December and April.

| Month | Lipase activity µl $CO_2$/ mg. protein/hr. | S. D. | No. of Expts. |
|---|---|---|---|
| December (Post-migratory period) | 35.91 | ± 5.04 | 5 |
| April (Pre-migratory period) | 26.70 | ± 7.12 | 5 |

## Discussion

The data obtained indicate that there is an appreciable increase of fat in the muscle with the increase in body weight which is due to the high amount of fat stored in the subcutaneous and visceral depots. There is approximately 3% reduction in the water content of the muscle during the pre-migratory period. It is obvious that this reduction in the water content is due to the increase in metabolite load: i.e. fat and glycogen. It was also observed that there is a decrease in the protein

content of the muscle during the pre-migratory phase (preliminary studies). The striking increase in fat nearly 6.5% of the dry weight of the muscle should serve as immediate energy reserve during the migratory flight.

The lipase activity of the muscle in the post-migratory (December) and pre-migratory (April) periods showed little fluctuation. The decrease observed in the pre-migratory period in the enzyme activity of the muscle could be considered as a metabolic adaptation for fat storage by minimizing fat utilization. Support for this inference is also available from studies conducted on the in vitro oxidation of butyrate (Chapter 10) which have shown that in the pre-migratory period the capacity of the muscle for fatty acid (butyrate) oxidation was lower.