OXYGEN CONSUMPTION IN THE SMALL, SHORT-TAILED SHREW (*CRYPTOTIS PARVA*)

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Interest in the increase of metabolic rate with decrease in body size of mammals and other organisms has stimulated investigation of oxygen consumption in very small mammals. Several species of the shrew are representative of the smallest living mammals, and consequently are unique for such experimentation.

Comparative studies of oxygen consumption of the wandering shrew (*Sorex vagrans vagrans*), the Monterey shrew (*Sorex trowbideii monteryensis*), and the Sonoma shrew (*Sorex pacificus sonomae*) have been reported by Pearson (1948). Also, the rate of oxygen consumption has been determined for the long-tailed shrew (*Sorex c. cinereus*) by Morrison (1948). Reports are lacking, however, in regard to one of the smallest species of shrews, the small, short-tailed shrew (*Cryptotis parva*). Thus, it is the purpose of the present communication to report on the oxygen consumption of three small, short-tailed shrews, as determined in the apparatus of Watts and Gourley (1953).

Materials and Methods

Three captive wild specimens of the small, short-tailed shrew (*Cryptotis parva*) were utilized for all experiments. One adult female of undetermined age was tested in the post-lactational stage, and two, six- to seven-week old weanlings from the litter of the adult female were studied initially. Oxygen consumption determinations were subsequently carried out on one of the shrews from the litter at the age of about four months. At this time the shrew was full-grown and was proven to be a male. A total of eighteen experiments were run. All animals were sustained on live insects, ground beef, and water. However, the shrews were not fed two to three hours prior to the experiments in order to provide a post-absorptive state.

The apparatus employed was similar to that used by Watts and Gourley (1953), except for the following modifications. A 375 ml dark-tinted jar with a number 10 rubber stopper, a standard 5 ml pipette, and an aluminum screen wire grid were utilized. In addition, the cylindrical wire compartment was eliminated so that the shrew was allowed freedom of movement. This apparatus utilizes a layer of soda lime (8 mesh) beneath the wire grid to absorb carbon dioxide. The rate of oxygen consumption can be determined since the volume of oxygen consumed is measured by the excursion of a moveable soap film in the pipette. Watts and Gourley (1953) have demonstrated with the rat that this apparatus is of adequate reliability and sensitivity for determination of oxygen consumption in small mammals.

Ten minutes were allowed for temperature equilibration, and the duration of each experiment was equal to the time for the utilization of 5 ml of oxygen.

Results

The results are given in Table 1. It is evident that oxygen consumption increases greatly with increased activity. Indeed, the rate of oxygen consumption in the adult male shrew almost doubled from a *basal* rate of 7.0cc/g/hr to 13.2cc/g/hr under conditions of vigorous activity. Due to the normal incessant activity of shrews in the waking state, it is probably impossible to simulate conditions with the shrew that are characterized as *basal* with other less active mammals. It was found that slight changes in activity of the test animals caused immediate alterations in oxygen uptake, as registered with the soap film excursions. Shrews in the respirometer generally were very active and frequently chewed on the screen grid or rubber stopper. In a few instances general activity was relatively low and as indicated in Table 1, a subjective rating of *slight* activity was applied to shrews at comparative *rest*.

Discussion

It has been demonstrated by Hamilton (1944) and others that the rate of digestion in shrews is exceedingly rapid. In one instance Hamilton (1944) observed that the passage of chitin through the alimentary tract in a captive, non-fasted shrew required only 95 minutes. The shrews used in the present investigation

Table 1.—Oxygen Consumption of Small, Short-Tailed Shrew (*Cryptotis parva*) as Related to Activity.

Animal	Weight (g)	Air Temp. (°C)	Number Experiments	Standard Deviation	Activity[1]	Mean O_2 Consum. (cc/g/hr)
Adult Female	6.02	25	2	.39	Moderate	9.4
Adult Female	6.02	25	4	.97	Vigorous	11.4
Adult Male	6.36	27	5	.78	Slight	7.0
Adult Male	6.36	26	5	.57	Vigorous	13.2
Immature Shrews[2]	a 4.59	25	1	..	Vigorous	11.9
	b 4.73	25	1	..	Vigorous	10.4

[1] Activity was subjectively rated: slight, shrew at rest; moderate, shrew walking or chewing on grid half time; vigorous, shrew constantly and vigorously chewing on grid.

[2] Sex undetermined.

probably were in a post-absorptive state, since they had not been fed two to three hours prior to each determination. However, true *basal* conditions were approached only during five experiments with the adult male shrew at the periods of least activity. This lack of muscular repose in the shrew during metabolism determinations has also been encountered by other investigators (Morrison, 1948).

The results of the present report are in accord with those of other investigators (Morrison, 1948; Pearson, 1938). The oxygen consumption of 7.0cc/g/hr for the 6.36g *Cryptotis parva* at *basal* conditions falls on the curve constructed by Pearson (1948) where oxygen consumption of small mammals is plotted as a function of body weight. Also, the high oxygen utilization of 13.2cc/g/hr obtained during those experimental runs characterized by vigorous shrew activity can be compared to the oxygen utilization of 13.7cc/g/hr for the long-tailed shrew (Morrison, 1948).

Summary

The normal rate of oxygen consumption was determined in three small, short-tailed shrews (*Cryptotis parva*), one of the smallest species of shrews. Determinations were obtained for both immature and adult male and female shrews in the post-absorptive state, and in varying degrees of activity. A simple closed chamber basal metabolism apparatus was utilized for the determinations. Mean oxygen consumption rates of 7.00cc/g/hr in the *resting* state and as high as 13.2cc/g/hr in states of vigorous activity were calculated.

Literature Cited

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