

EFFECT OF SEASONAL VARIATIONS, STARVATION AND COLD ACCLIMATION ON SERUM ACID PHOSPHATASE ACTIVITY OF COMMON INDIAN FROG *RANA TIGRINA*

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ABSTRACT

A study, extending throughout the year exhibits a definite seasonal change in serum acid phosphatase activity of common frog *Rana tigrina*. Starvation does not significantly influence the enzyme but cold acclimation depresses the activity.

EARLIER work¹⁻³ on serum acid phosphatase (Orthophosphoric monoester hydrolase E.C. 3.1.3.2) in amphibia is confined to kinetics and general properties of the enzyme. No information is available concerning the influence of seasonal variations and cold acclimation on this enzyme. In the present communication the effects of seasonal changes, starvation and cold acclimation on the level of serum acid phosphatase have been studied during an annual cycle with a population of *Rana tigrina*.

MATERIALS AND METHODS

The methods of selection, feeding and maintenance of experimental animals were the same as reported earlier⁴. Acid phosphatase activity was determined according to Bergmeyer⁵, using Spectronic-20 spectrophotometer at 37°C and at pH 4.5. The typical assay medium consisted of 1 ml buffer containing 5.5 μ moles of sodium *p*-nitrophenyl phosphate, to which 0.2 ml of serum was added. The results are expressed in units/mg protein. One unit of enzyme activity is equivalent to the liberation of 0.01 μ mole of *p*-nitrophenol per minute. As reported earlier⁶, the effect of cold acclimation was determined by keeping the frogs at 13°C, when the atmospheric temperature was 38°C.

The points in the figures are the mean of 12-16 observations.

RESULTS

The values of serum acid phosphatase activity throughout the year are shown in Fig. 1. The acid phosphatase activity was lowest in January (8.0 units/mg P); higher values were obtained from July to November and the peak (Female 18.0; Male 15.0 units/mg P) was observed in September. The effect of cold acclimation of frog at 13°C from 72 to 168 hours is shown in Fig. 2. Starvation of frogs upto 30 days did not significantly ($P > 0.5$) influence the serum acid phosphatase activity.

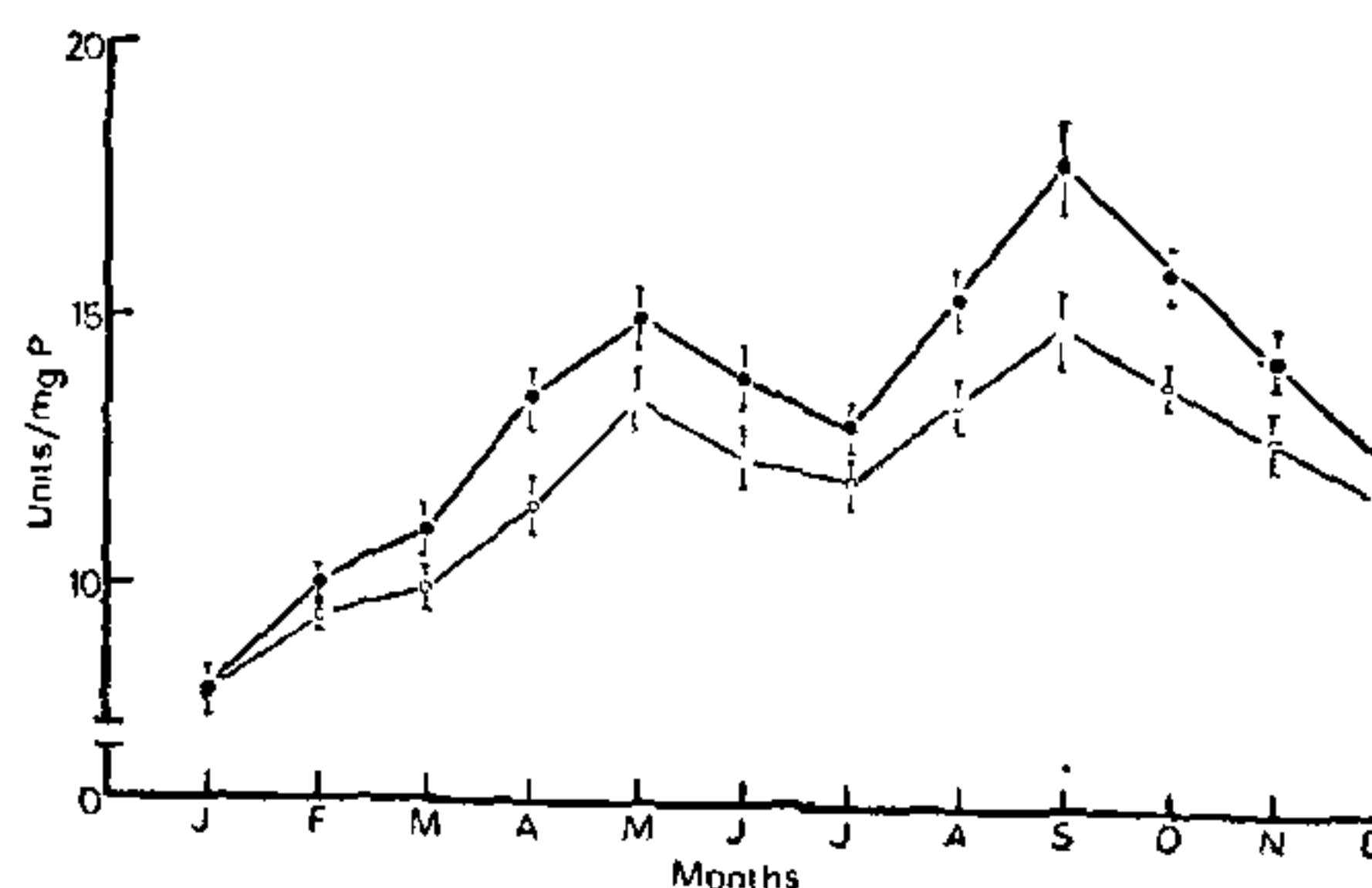


FIG. 1. Monthly average serum acid phosphatase activity \pm S.E.M. (—O—) showing seasonal changes in *Rana tigrina*. (Average value of the whole year: Male 11.0 ± 1.4 ; Female 13.0 ± 1.7 units/mg P.)

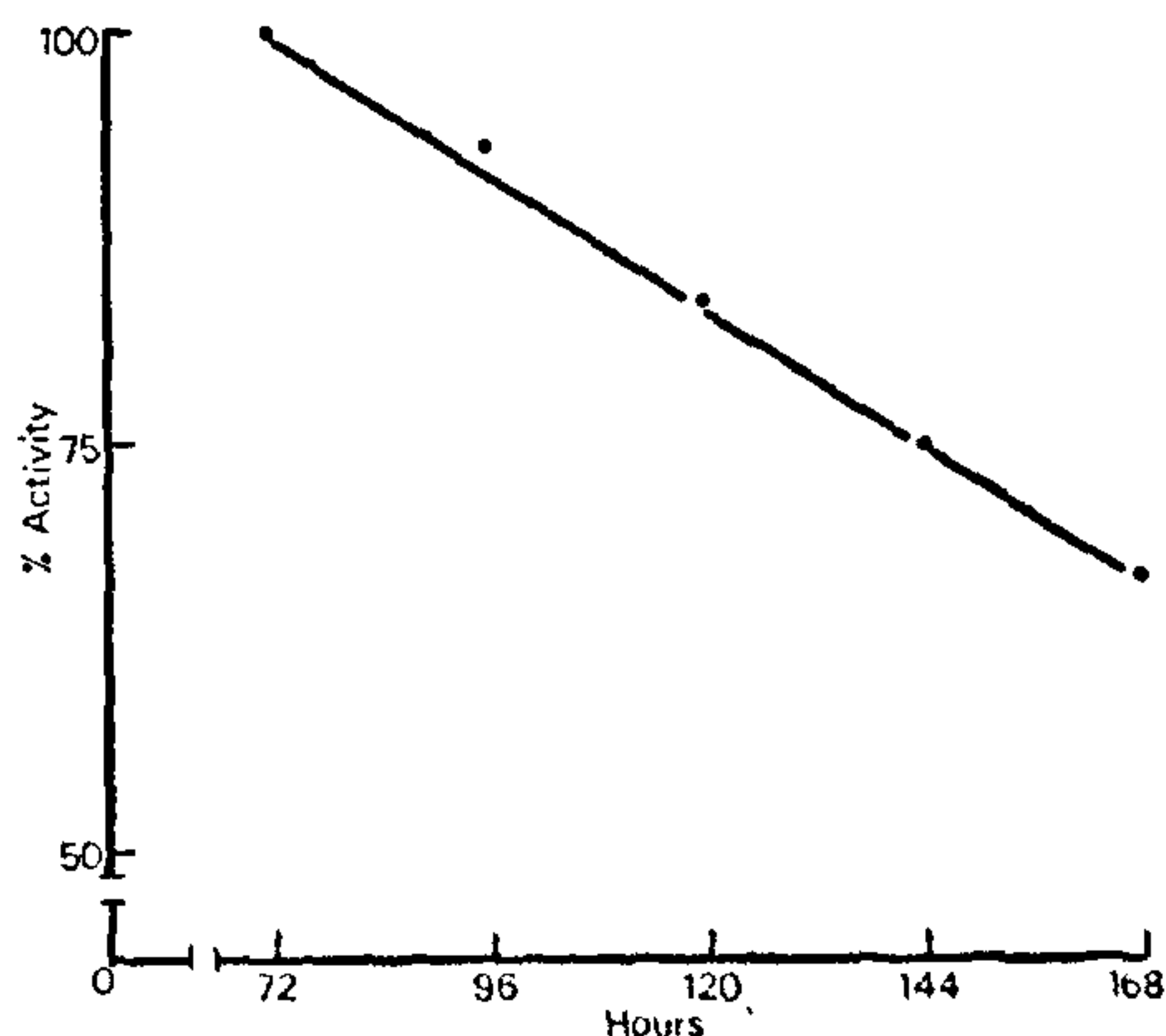


FIG. 2. Serum acid phosphatase activity determined at regular intervals of 24 hours in female *R. tigrina* acclimated at 13°C (Control at 38°C: 100% activity).

DISCUSSION

It is well known that phosphomonoesterases play a significant role in various metabolic processes and have

been extensively studied in connection with carbohydrate metabolism and the glycolysis cycle⁷ and therefore their activity is to some extent indicative of carbohydrate metabolism. The present results, on the activity of acid phosphatase in *R. tigrina* serum, exhibit a definite seasonal variation in this enzyme and may be divided into three phases. The first phase extending from December to February is characterised with low acid phosphatase activity, lowest value being recorded in January. The second phase extending from March to June is characterised with an increase in the acid phosphatase activity with a small peak in May. In the third phase extending from July to November, the acid phosphatase activity, after recording a slight fall, rises again reaching the peak in September, when the frogs are most active and spawning. The low values observed in winter months appear to be related with a fall in temperature from 40°C in summer to 15°C in winter and consequent inactivity in the general metabolism of the body. This is further confirmed by acclimation experiments. As shown in Fig. 2 a steep fall was recorded in acid phosphatase activity during cold acclimation from 4th day onwards.

During the period beginning with March a rise in temperature is accompanied with a rise in serum acid phosphatase activity. This may also be related with concomitant increase in blood glucose level reported⁸ in this animal. This suggests that the carbohydrate metabolism in the frog is low in winters and increases with a rise in temperature.

Besides temperature, another important factor which appears to influence the acid phosphatase activity is the spawning period of this animal. The usual spawning period of this animal in our country is from early July to late October. The high level of this enzyme in the spawning period is indicative of active phase and higher carbohydrate metabolism. Since it is the period of breeding, the metabolic activity of the animal

is at its peak, resulting in the rise of the acid phosphatase activity. This may also be correlated with the concomitant rise in the serum phosphate⁹ and sugar¹⁰ level. The effect of starvation on acid phosphatase indicates a direct relationship between enzymic activity and carbohydrate metabolism. Glucose level of serum also remained unaffected¹⁰⁻¹² upto 28 days of starvation, as is the case with acid phosphatase activity in the present experiments.

The decrease recorded in the activity of the enzyme during cold acclimation indicates that the acid phosphatase activity does not retain its natural rhythm and is altered with experimental conditions.

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