

# INFLUENCE OF STRESS ON OXYGEN CONSUMPTION AND RECTAL TEMPERATURE IN PARABIOTIC ALBINO RATS

N.V. ADINARAYANA MURTHY, O.P. BHATNAGAR\* AND D.P. THOMBRE

*Department of Physiology,  
Jawaharlal Institute of Post-graduate Medical Education and Research,  
Pondicherry - 605 006*

**Summary:** Stress can alter the functional status of the animal through a chain of complex interactions. In this work, influence of stress on oxygen consumption and rectal temperature was studied in parabiotic albino rats, to show the possibility of involvement of humoral factors. Stress has resulted in fall in rectal temperature and increase or decrease in oxygen consumption even when one animal of the pair was subjected to stress, suggesting involvement of humoral factor(s).

**Key words:** stress oxygen consumption, temperature parabiosis humoral factor restraint

## INTRODUCTION

Stress can alter the functional status of the animal through a chain of complex interactions. In this work, an attempt was made to demonstrate the influence of stress on oxygen consumption and rectal temperature in parabiotic albino rats, in order to show the possibility of involvement of humoral factors.

## MATERIALS AND METHODS

Female albino rats of same litter with an average weight of  $120 \pm 10$  gm were grouped as follows:

- I. Control group consisted of:
  1. Nonparabiotic albino rats (NPC)
  2. Mock parabiotic albino rats (MPC) and
  3. Parabiotic group (PC).
- II. Restraint group/Experimental group consisted of:
  1. Restraint on nonparabiotic albino rats (NPR)
  2. Restraint on one mate of the parabiotic pair (PRI) and
  3. Restraint on both the animals of the parabiotic pair (PR II).

\*Present address: Department of Physiology, Maulana Azad Medical College, New Delhi-110 002

### *Parabiotic procedure*

Under ether anaesthesia parabiotic union was performed by modification of Bunster and Beyer method (1) suggested by Tuan A Tran & R.V. Gregg (7). Each pair was housed in separate cages. A period of 15 to 20 days was allowed for recovery and adjustment to the parabiotic life. Weight gain was taken as the principal criterion for successful parabiotic union (3 and 6).

### *Restraint procedure*

Procedure described by Tuan A Tran (7) was followed to induce stress in one animal of the parabiotic pair (PRI) using wheeled metal cart, whereas cages of appropriate sizes were used to restrain nonparabiotic (NPR) animals and both the animals of the parabiotic pair (PR II). In each of these above groups (PRI, NPR & PR II) the animals were split into two sets in order to induce stress for 4 & 24 hours respectively.

### *Determination of oxygen consumption*

Methodology described by McLeod (4) was employed to determine oxygen consumption in rats. Animals were placed in the animal chamber of the set up for 3 hrs each day to get them accustomed to the conditions. Food was withheld the evening before the actual determination was made (6). Oxygen consumption was measured for a period of 10 minutes and the volume was reduced to standard conditions. Oxygen consumption of the animal was expressed in Litres/Sqm/hr (6).

### *Rectal temperature*

Rectal temperature was measured daily using a clinical thermometer, before and after inducing stress.

## RESULTS

### *Oxygen consumption*

Oxygen consumption in NPC group was  $5.2 \pm 0.02$  l/Sqm./hr. It was  $10.5 \pm 0.02$  l/Sqm./hr in MPC & PC groups (animals in pairs). But after a period of four hour restraint there was a significant decrease in oxygen consumption in NPR, PRI & PR II (Table I). When the restraint was continued for 24 hrs, there was significant increase in oxygen consumption in the above groups (Table I).

### *Rectal temperature*

Restraint for a period of 4 hours has not produced any change in the rectal temperature ( $37.5^\circ$ ) in all the groups but after restraint for 24 hours there was fall of rectal temperature by  $1^\circ\text{C}$ . (Table I) in NPR, PRI & PR II. groups.

TABLE I : Oxygen consumption and rectal temperature in albino rats  
(Values are mean  $\pm$  S.E.)

	CONTROL			EXPERIMENTAL			
	Non- parabiotic	Mock- parabiotic	Parabiotic	Non-parabiotic stress		Parabiotic stress PR & PR II	
				4 hrs	24 hrs	4 hrs	24 hrs
No. of animals	(10)	(10)	(10)	(10)	(10)	(10)	(10)
Oxygen con- sumption l/Sqm/hr.	5.2 $\pm$ 0.02	10.5 $\pm$ 0.02	10.5 $\pm$ 0.02	*5.0 $\pm$ 0.01	*5.4 $\pm$ 0.03	<sup>+</sup> 10.4 $\pm$ 0.04	@11.1 $\pm$ 0.10
Rectal tem- perature (°C)	37.5	37.5	37.5	37.5	36.5	37.5	36.5

\*P 0.01

<sup>+</sup>P 0.02

@P 0.001

## DISCUSSION

No significant alteration in oxygen consumption in PC group when compared to NPC & MPC groups suggests that the parabiotic state has no effect whatsoever on oxygen consumption.

The observed significant decrease in oxygen consumption following restraint for 4 hours is probably due to decreased TSH secretion, since it is well established that TSH secretion is depressed by stressful stimuli (8). Moreover, restraint for a period of four hours may not be a severe form of stress. The significant increase in oxygen consumption observed in animals following a restraint of 24 hours, may be due to tensing of muscles, tachycardia and increased respiratory rate which is the associated phenomena of severe form of stress.

Fall in rectal temperature following stress for 24 hours is difficult to explain at this stage. Most probably the stressful stimuli may act on hypothalamus resulting in fall in body temperature and this aspect has to be investigated further. Moreover, adrenaline and 5-HT are known to reduce body temperature by their central action (5).

Fall in rectal temperature and increase or decrease in oxygen consumption following stress, even when one animal of the pair was restrained or subjected to stress, suggest involvement of humoral factor(s) which is (are) transmitted from restrained mate of the pair to the unrestrained mate of the pair to produce the observed effect.

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