

ACETYLCHOLINESTERASE ACTIVITY OF RAT BRAIN AND HEART IN STARVATION AND PROTEIN RESTRICTION

B, V. VENKATARAMAN, P. S. SHETTY*, THANGAM JOSEPH AND P. M. STEPHEN**

Departments of Physiology and Pharmacology,
St. John's Medical College, Bangalore - 560 034*

and

*Department of Pharmacology**
Christian Medical College, Vellore - 632 002*

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Summary : AChE activity was determined in the brain and heart of normal, acute totally starved, chronically semi-starved and chronically protein restricted groups of adult male rats. Neither acute total starvation nor chronic semi-starvation produced significant changes in AChE activity and protein content of the brain, while AChE activity and protein content in the heart were significantly decreased ($P < 0.01$) after semi-starvation. Protein restriction, however, produced a significant decrease in AChE activity and protein content of both brain ($P < 0.01$) and heart ($P < 0.001$).

Key words : AChE

protein content

protein restriction

semi-starvation

starvation

INTRODUCTION

Acetylcholinesterase (AChE) activity is affected by various factors such as age, sex, surgical interference, irradiation, nutritional manipulations etc. (7). AChE activity in the developing brain was depressed by undernutrition but restored following dietary rehabilitation (6). AChE activity is high in young animals and gradually becomes stable at adulthood (5). AChE/g/hr rose by 14% but AChE/whole brain/hr failed to show any significant difference in underfed growing rats (1). Most of the nutritional manipulations were studied in the early stage of development during which AChE activity in altered nutritional status during adulthood. The present study was undertaken to examine and compare in fully grown adult rats the effects of starvation and protein restriction on AChE activity of central organ-brain and a peripheral organ-heart.

MATERIAL AND METHODS

Sixty fully grown, adult male albino rats maintained under uniform husbandary conditions and temperature was used. They were housed individually and divided into

4 groups. Control rats were fed *ad lib* on a mixed diet of 17% protein providing 4.2 cal/g. Totally starved rats were deprived of food for 48 hr and were given a dilute electrolyte solution containing 78 mcg of sodium chloride per liter and 15 mcg of potassium chloride. Chronically semi-starved rats were fed 50% of the amount consumed by pair fed controls for 21 days. Chronically protein restricted rats were fed on a mixed diet of 4% protein providing 4.2 cal/g for 8 weeks which was isocaloric with its pair fed controls. At the end of the experimental period the animals in the different groups were decapitated and estimations of AChE activity (2) and total protein content (4) were made. AChE activity is expressed as units/whole organ/min (total activity) and units/100 mg protein/min (specific activity). Statistical analysis was done using Student's (t) test.

RESULTS AND DISCUSSION

AChE activity and protein content of brain and heart in different groups of rats are presented in Table I. Acute starvation did not show any significant change in either AChE activity or protein content of the tissue studied. Chronic semi-starvation did not

TABLE I: AChE activity and protein content in brain and heart of control, totally starved, semi-starved and protein restricted group of rats.

Group	Organ	Protein content mg/g	AChE activity	
			Total activity Units/whole organ/min	Specific activity Units/100 mg protein/min
Control (10)	Brain	96.0±0.60	16.5±1.10	10.9±0.60
	Heart	96.3±0.40	1.1±0.08	2.1±0.10
Total starvation (10)	Brain	95.0±0.40	14.9±0.90	9.9±0.70
	Heart	95.3±0.60	1.0±0.07	1.9±0.10
Control (10)	Brain	96.3±0.70	16.6±1.00	10.9±0.50
	Heart	96.9±0.30	1.2±0.04	2.2±0.10
Partial starvation (10)	Brain	95.5±0.70	14.4±1.10	9.6±0.60
	Heart	94.9±0.70*	0.9±0.60*	1.8±0.10*
Control (10)	Brain	95.5±1.80	14.7±1.30	9.8±0.50
	Heart	95.8±1.00	1.2±0.10	2.0±0.20
Protein restriction (10)	Brain	89.0±1.40*	10.7±0.60*	7.8±0.50
	Heart	88.7±0.90*	0.6±0.06**	1.3±0.10**

*P<0.01

** P<0.001

Mean±Standard error

Numbers within parenthesis indicate number of animals

show any significant change in AChE activity and protein content of brain while heart showed a significant decrease ($P < 0.01$) in both AChE activity and protein content. Protein restriction, however, produced a significant decrease in AChE activity and protein content of both brain ($P < 0.01$) and heart ($P < 0.001$). Percentage decrease (10%) in AChE activity of brain and heart after acute starvation was not significant. After chronic semi-starvation AChE specific activity decrease by 13% in the brain while in the heart the decrease (17%) observed was significant. AChE specific activity after protein restriction was significantly decreased by 21% in the brain and 36% in the heart.

Short term deprivation of food did not change either specific activity or total activity of AChE or protein content in both the tissues. The reduction in AChE activity may be due to reduction in the availability of protein during long term semi-starvation and protein restriction. Changes in cardiac tissue metabolism during long term semi-starvation observed by Gold and Costello (3) may also be responsible for the reduction in AChE activity. The lack of a similar change in the brain after semistarvation is not surprising in view of the metabolic priority enjoyed by this tissue. In most of the clinical condition nutritional deprivation leads to involvement of brain only after severe and long term deficiency (9). Hence AChE activity in peripheral organs such as heart seems to be susceptible to changes after semistarvation. Decrease in AChE activity of brain and heart bears good correlation to the changes in ACh levels reported earlier (8). The brain, however, seems to have lost its stability after severe chronic protein restriction though caloric intake was altered.

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