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Effect of chronic stress exposure on behavioral responses of male albino rats

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ABSTRACT

AIM: Stress is an adaptive response or consequence of stimuli. Stimuli may be an action, situation or psychological/physical demand on an individual. This study was done to understand the effect of chronic stress exposure in a continuous manner on the behavior of an individual. **METHOD:** Animal model using male albino rats were selected and exposed to four kinds of stresses viz. intermittent maternal deprivation, Restraint stress, Electric foot shock stress and Noise stress from birth to 17 weeks of age. Behavioral alterations were observed and compared with control. **RESULT AND CONCLUSION:** A marked variation in behavioral pattern including routine and specific both was observed. Most significant variations were observed immediately after exposure to stress but later frequency and severity altered. **KEYWORDS:** behavioral alterations, electric foot shock, intermittent maternal deprivation, noise, restraint, stress, stimuli.

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1. Introduction

Stress is a non-specific response of the body to a stimulus or event (stressor). In early studies Selye [1] described it as a result of an interaction between individual's emotional, intellectual, social and physical resources and demands on it. Also it was observed under a general model of stress that individual experiencing a stressor will lead to a physiological response. All stressors, however tend to produce similar responses within the body Selye [2].

Later with advance studies it was emphasized by Pearlin [3] that different people experiencing similar life conditions are not necessarily affected in the same manner. Experimental stressors have been used to explore the interaction and consequences of chronic stress and its responses. Sayette [4] et al found that the organism usually responds to stress with a variety of behavioral, biological and cognitive changes. Long lasting effects of a single stress are difficult to obtain in animals. So, it is always suggested to obtain results from exposure to continuous and chronic stress.

Therefore, present study was undertaken to understand differential behavioral responses as a result of exposure to chronic

stress vulnerability in individual as well as within organisms of same species under similar conditions.

2. Material and Methods

The present study was carried out on a total of 72 male albino rat from birth to 17 weeks of age. The animals were procured from the animal house with the approval of Institutional ethical committee. By selective fostering male pup colony were made. Two sets consisting of one mother rat and 6 male pup. Each set consisted of 6 colonies served as control (group A) and stressed (group B) as per protocol. The rats were housed under controlled environmental conditions, maintained on a 12:12 light/dark cycle with ad libitum access to food and water.

2.1 Study protocol

From birth i.e. day 0 till day 119 (i.e. 17th week) rats were exposed to 4 kinds of stresses.

a. Intermittent maternal deprivation (M.D): Neonate pups were intermittently separated from their nursing dams and mother up to 3rd week. With every 4th day time period of exposure was doubled. Day 22 to 27 was period of first remission.

b. Restraint stress (R.S): Rats were exposed to restraint stress from 5th week to 10th week in a plexiglass econo-cage animal restrainer which is a make of Thomas Scientific was used. The restraint period was for half an hour at every 8 hour interval. Prior withdrawal of intake supplies was done. 11th week was period of second remission.

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c. Electric foot shock stress (E.F.S): It extended from 12th to 14th week and consequent week was period of third remission. It was given in an electric foot shock avoidance apparatus which was a box with a 90 x 90 cm floor of stainless-steel rods, 0.5 cm in diameter and spaced 1.9 cm apart. Inescapable scrambled 1 mA foot shock supply was executed at every one minute interval for half an hour in each session. It was inflicted at 12 hour intervals.

d. Noise stress (N.S): It was practiced from 16th up to 17th week of life in an audiogenic test chamber with sound of 100 db approximately for half an hour. Glass door provision was there for noting down observations.

Group A i.e. control remained unaltered and were directly taken out of cages for observation.

2.2. Statistical Analysis

Data was expressed as mean ± S.D. All the statistical analysis was done using SPSS 9.0 version software. T-test with a p value < 0.05 was considered statistically significant.

3. Results

Table 1 shows the general routine activities in control (Group A) and changes observed in stressed group (Group B) rats. Significant changes in routine activities were observed with licking behavior to be maximum (i.e. in 67.77%) after M.D. Running and jumping was also profound i.e. in 66.66% and 67.77% immediately after M.D and later on animals become sluggish. Circling and tail biting was considerable initially but gradually decreased a lot. Immense reduction in excretory habits was found after each stress exposure. Persistence of sleeping behavior was observed throughout experimental period after application of M.D, R.S. and E.F.S (i.e. 88.88%, 83.33% and 88.88% respectively) but after noise stress it was completely absent.

Various stressors produce differential behavior effects and the effects were stressor specific responses. Table 2 shows specific behavior responses in both control and stressed group. Marked abnormal appearance was observed at the end of employing various stresses (i.e. in 86.57% rats on 17th week) which ranged from abnormal patches to pallor of skin. Also, rapid nibble like activity i.e. Allogram was also maximum (i.e. 62.96%). After E.F.S., they showed maximum (i.e. 68.88%) of running or chase or pursuit activity. Chatter i.e. grinding of teeth was also a common activity after each stress. 1-2% of cannibalism was also observed in present study. Anxious behavior showed good amount of pica as vomiting center is found to be absent in rats. Fearfulness gave rise to Piloerection which was maximum after 10th week i.e. stress I and II.

Figure 1: showing different general routine behavior in stressed male albino rats

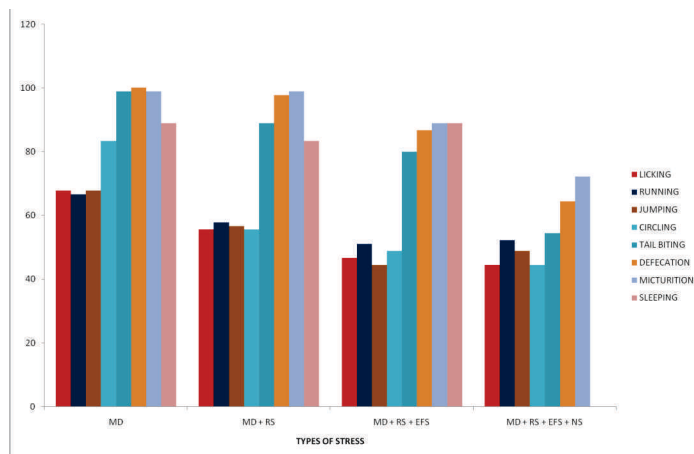


Figure 2: showing specific behavior -I response in control and stressed group

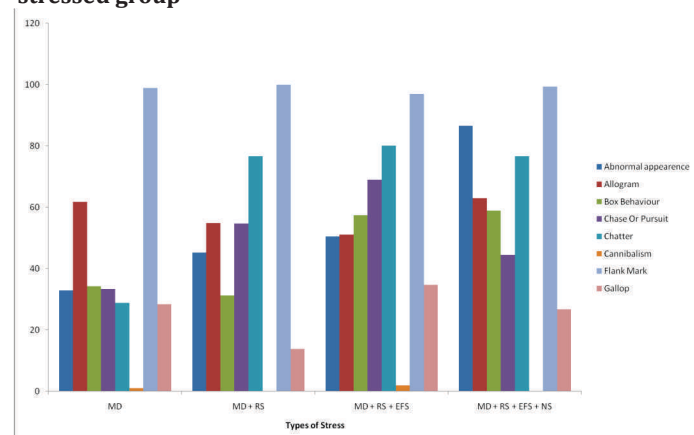
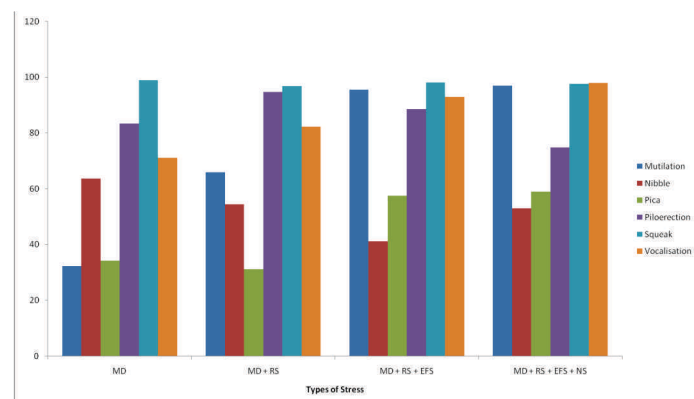


Figure 3: showing specific behavior -II response in control and stressed group



4. Discussion

Present study showed marked changes in routine and specific behavior pattern in stressed group male albino rats. Louvart H. [5] et al also reported that after end of aversive procedure, social behavior as reduced in shocked animals. It was shown that sniffing, all grooming and crawling over were reduced in shocked animals. It was also found that animals submitted to stress for first time to foot shock not only presented long term higher anxiety (in the elevated plus maze) but also altered social behavior and a specific avoidance of stimuli. It was in accordance with the studies of Van Dijken [6] et al. showing hyperactivity in the male rats in open field after exposure to electric foot shock. However these results were in contrast to those of Pynoos [7] et al describing that a foot shock associated to stress did not affect locomotor activity in an open field 3 and 6 weeks later in male mice.

Koba [8] et al found marked behavioral changes in rats 2 weeks after inescapable shock stress using shuttle box task (active avoidance). But general activity during an unstressful period (before starting test) did not differ significantly between groups.

On studying emotional activity, Armario [9] et al found that it did not modify defecation rate but reduced exploratory activity in the hole board. Krzysztof J. [10] reported increase in fear and disturbed emotional behavior after maternal separation in young pups. Novakova [11] also found marked changes after separation from mother as it affected learning ability and memory trace was less stable. Milligan G.D [12] et al in their study reported the adverse effects on behavior and physiology of laboratory animals due to high sound levels. Acoustic environment therefore was found to be having important implication for behavioral and physiological experiments.

5. Conclusion

It was clearly found that chronic stress induces significant behavioral variations in experimental rodents. These variations have far reaching consequences for survival. The data analysis of present study and study differential response to stress in animal model can be meaningful for effective stress treatment and prevention of stress-related illnesses.

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