

Effect Of Chronic Restraint Stress On Body Weight Of Male Sprague Dawley Rats

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Author's Contribution

^{1,2,5} Conception of study

¹ Experimentation/Study conduction

^{1,2} Analysis/Interpretation/Discussion

^{3,5} Manuscript Writing

^{4,6} Critical Review

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Abstract

Background: Stress disturbs body weight and food intake, but the core mechanisms are not well understood.

Study Design: Experimental.

Materials and Methods: The study was conducted at the National Institute of Health (NIH), Islamabad Sixty male Sprague Dawley rats (mean wt 250 ± 50 grams) were used and divided into 2 groups.

Each group comprised 30 rats.

Group, I was taken as control. Group II was exposed to chronic stress.

Results: The comparison of weight gain by the different groups disclosed that there was a significant decrease in weight gain of rats exposed to chronic stress as compared to the control group.

Conclusion: Chronic restraint stress has a detrimental effect on body weight.

Keywords: Body weight, Chronic stress, cortisol.

Introduction

Stress is known to change body weight and food intake in animal models. Stress is a general problem of today's life where stressors are progressively increasing.¹ Best way to prevent stress in life is to follow a healthy lifestyle which includes good nutrition, adequate exercise, sufficient sleep, and substantial work.² Chronic stress increases serum corticosterone levels. However, the effects of chronic stress-induced raised corticosterone on food intake and body weight are not clear. ³ Furthermore, the exact mechanism by which stress affects energy metabolism as well as food intake and body weight control is not well understood, especially at the hypothalamic gene manifestation level.

Stress is commonly known to change body weight and food intake in animals. Out of all the several stress models available for the study of the effects of stress, the restraint stress model is the most commonly used, as it well expresses physical and psychological stress.³ The restraint stress technique has also been used as an animal model of depression. Thus, many studies have shown that restraint stress decreases food intake and body weight gain in rats.^{4,5} The central regulation of body weight and food intake occurs in the hypothalamus, which involves multiple neuronal systems, that play important roles in the regulation of energy homeostasis.⁶ The weight loss due to stress is dependent on the acute central release of corticotrophin-releasing factor (CRF)⁷, but there is no continuous stimulation of this pathway to determine the maintained suppression of body weight.^{8,9} CRF activates the hypothalamic-pituitary-adrenal (HPA) axis, the sympathetic nervous system, and the catecholamine systems. All of these mechanisms are likely to inhibit food intake and reduce body weight, but none of them is activated notably during the hours or days after exposure to repeated restraint.

Keeping in view another detrimental effect of chronic stress, this study was designed to determine the effect of chronic restraint stress on the body weight of rats.

Chronic stress: Rats exposed to chronic stress by placing separately in meshwire -restraint for 6 hours per day for 15 days.

Materials and Methods

The study was conducted at the National Institute of Health (NIH), Islamabad Sixty male Sprague Dawley

rats (mean wt 250 ± 50 grams) were used and divided into 2 groups.

Each group comprised 30 rats. A total of 60 Sprague Dawley healthy male rats weighing 250±50 grams, 60 days (8 weeks) old were purchased from -removed for blind review--Female rats, diseased rats, or rats who developed the disease during the course were excluded from the study. Rats were divided into 2 groups. Each group comprised 30 Rats. Group-I was considered a control group. Rats in this group were fed a normal diet for 6 weeks prior to giving stress. They were supplied with simple tap water for drinking. Rats in Group II were also given a standard diet. However, these rats were exposed to daily restraint stress for 15 days. Rats of group 2 were exposed to chronic stress by keeping immobilized in a mesh wire restrainer for 6 hours daily for 15 days.¹⁰ Stress was determined by the serum cortisol level. Samples were taken early in the morning between 8.00 and 9.00 am, to avoid bias due to different levels of cortisol owing to the diurnal variations.¹¹

Composition of Pelleted Diet for Rats

INGREDIENTS

1. Wheat flour
2. Wheat Brawn
3. Dried skimmed milk powder
4. Soya bean Oil
5. Mollasen 0.15Kg
6. Fish meat 0.15Kg
7. Salt (common) 0.05Kg

This food was prepared at (NIH), Islamabad, according to the standard approved by the Universities Federation for Animals Welfare.

Eating habits and behavioral changes were also observed throughout the duration of the study. For statistical analysis, the statistical package for social sciences (SPSS) version 15 was used. The mean and standard deviation of body weight were calculated. Student-T was applied to calculate the p-value.

Results

The rats remained healthy and active throughout the study. The average intake of feed by each rat was between 15-20 grams. If the rats took more than 20 grams of diet per day, it will be considered 'improved' while less than 15 grams intake was considered 'reduced' (Table 3). The average weight of all rats at the start was 220 grams. The comparison of weight gains by the two groups shown in (table 1) showed

that there was a significant decrease in weight gain of rats exposed to chronic stress as compared to the control group.

Table 1. Comparison of body weight in different study groups of Sprague Dawley rats

Weeks	Control (n= 30)	Stress (n= 30)
9 th	235.17±7.48	234.17±7.32
10 th	261.00±6.07	261.67±7.11
11 th	279.33±6.26	279.33±7.63
12 th	300.00±5.72	299.50±7.70
13 th	313.83±6.78	306.83±7.13
14 th	320.17±6.83	309.50±7.58

In the present study, we examined the effects on the body weight and food intake of Sprague Dawley rats

exposed to chronic restraint stress. Multiple studies have tried to create the fact that chronic exposure to restraint stress diminishes the body weight and food intake of rats.¹²⁻¹⁴ However, the mechanisms underlying these restraint-induced fluctuations in body weight and food intake remain to be elucidated. Our results have shown that restraint stress speedily induces a marked reduction in body weight that may be due to a decreased food intake.

Table 2 Serum cortisol levels were highest in group 2

Variable	Group I Mean SD±	Group II Mean SD±	P Value
Cortisol	21.4 ± 0.92	34.71± 1.45	< 0.001

Table 3 Comparison of eating habits of rats in different groups.

Groups (n= 30)	9 TH week	10 th week	11 th week	12 th week	13 th week	14 th week
Control	Normal	Normal	Normal	Normal	Normal	Normal
Stress	Normal	Normal	Normal	Normal	Reduced	Reduced

*Normal: daily dietary intake of each rat = 15-20 grams; Reduced = dietary intake less than 15 grams/ day; Improved = dietary intake more than 20 grams/day.

Discussion

The stress-induced decrease in body weight may be due formerly to an early decrease in food intake but then maybe later maintained by increases in energy expenditure and body temperature during restraint. Increased serum cortisol levels suggest that physiological responses to repeated stress are associated with the stimulation of the HPA axis. Results of a study conducted by Santos, back our results that chronic stress causes a reduction in weight gain (2.0 ± 0.65 g/day)¹⁵, while Dallman et has documented differing results and hypothesized that chronic stress resulted in an increase in weight gain ($2.5 \pm .32$ g / day). It might be due to a reduction in growth hormone secretion, reduced linear growth, and sympathetic neural outflow along with reduced fat mobilization, which led to obesity.^{16,17,18} Moreover, this study also showed that during exposure to restraint stress significantly decreased

food intake, once the stress ended, the food intake of the stressed group returned to the normal level. In the study, serum corticosterone levels were increased by repeated restraint stress.

The data of the present study has disclosed that stress, whether psychological or physical, could lead to lower body weight of the individual. Stress is one of the important factors, which, in one way or the other, disrupts many physiological functions. The higher the intensity or duration of stress, the greater will be the disruption.

Conclusion

The results of this study showed that chronic restraint stress is responsible for elevated serum cortisol level, which directly or indirectly affects the food intake, and reduces body weight.

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