

# Ulcerative Gastric Lesions in August and Wistar Rats: Effect of Acute Emotional Stress

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Wistar rats, but not August rats, developed ulcerative lesions in the gastric mucosa as a result of exposure to severe emotional stress caused by immobilization in closed tubes submerged in water. In addition, the stressed rats of both strains showed an increased ratio of thymus weight and a decreased ratio of adrenal weight to body weight. It is concluded that emotionally stressed Wistar, but not August, rats are prone to develop ulcerative gastric lesions.

**Key Words:** *emotional stress; gastric ulcers; August and Wistar rats*

Rats from genetically different strains exposed to acute or chronic emotional stress (ES) differ in survival rates [3]. They also develop changes in the regulation of different physiologic functions in similar ES-generating conflict situations; under immobilization-induced stress, for example, Wistar rats exhibit greater resistance of cardiovascular functions than do August rats, but are more prone to develop gastrointestinal lesions [1,2].

Although gastric lesions have been shown to be best defined in rats in general following exposure to immobilization-immersion stress [5,7], little is known about the differences in gastric ulcer formation between August and Wistar rats exposed to such stress. The present study was designed to bridge this gap.

## MATERIALS AND METHODS

The study was conducted on 8 male August rats (body weight  $212.4 \pm 11.9$  g) and 10 male Wistar rats (body weight  $262.5 \pm 27.7$  g). The rats were kept in cages at 20-22°C under natural illumination (from 7:05 to 20:10 h) and had free access to food and water. Acute ES was induced in 4

August and 5 Wistar rats (two test groups), while the remaining 4 August and 5 Wistar rats made up two control groups.

During the 24 h preceding the experiment, all rats were deprived of food but continued to have free access to water. Acute ES was produced by immobilizing each test rat in a plastic tube (length = 16.5 cm, inner diameter = 5.5 cm) and immersing the tube in water (23°C) for 2 h [6]. Thereafter they were returned to the cages for another 2 h and then decapitated and dissected. The thymus, adrenals, and spleen were removed and weighed and the stomach was opened along the greater curvature to count, under a binocular microscope, the number of ulcerative lesions in the gastric mucosa and thus to determine the severity of mucosal damage.

Ulcerative gastric mucosal lesions were classified into three grades: up to 5 erosions per stomach

**TABLE 1.** Number of Rats in Each Group with Ulcerative Gastric Mucosal Lesions of Different Grades

Group	Grade of mucosal lesions			
	0	1	2	3
<i>August rats</i>				
Control	-	1	3	-
Stressed	1	2	1	-
<i>Wistar</i>				
Control	1	4	-	-
Stressed	-	-	1	4

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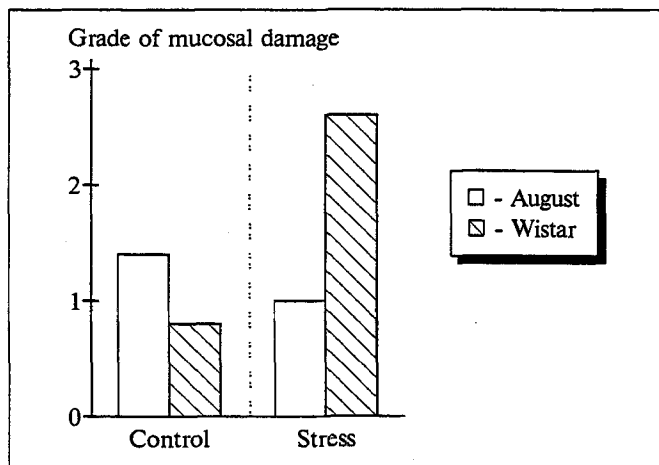


Fig. 1. Ulcerative gastric mucosal lesions in control and stressed August and Wistar rats.

(grade 1); 6 or more erosions or the presence of not more than 1 ulcer per stomach (grade 2); and 2 or more ulcers per stomach (grade 3).

The results were evaluated by analysis of variance (ANOVA) (stress-control and rat strain). For multiple comparisons, the least significant difference (LSD) test was used. Numerical data in the text and Table 2 are the means and their standard deviations.

## RESULTS

Gastric ulceration was noted in all four groups (Table 1). In the control August rats, the degree of gastric damage according to the grading system described exceeded 2.2-fold ( $F=9.1$ ,  $p<0.02$ ) that in the Wistar controls (Table 2). Multivariate ANOVA revealed a significant (LSD,  $p<0.011$ ) impact of the acute ES on the formation of ulcerative lesions in both strains. The stress exacerbated mucosal damage in the Wistar rats by a factor of 3.5 ( $F=50.0$ ,  $p=0.0001$ ) as compared to the control animals of this strain. The stressed August rats had fewer gastric lesions than the August controls, but the difference was not statistically significant. A comparison of the stressed August and Wistar rats showed that the degree of ulcerative gastric lesions in the latter rats was 2.8 times greater ( $F=18$ ,  $p<0.004$ ) than in the former (Table 2 and Fig. 1).

TABLE 2. Mean Degrees of Ulcerative Gastric Mucosal Lesions in August and Wistar Rats

Strain	Control	Stress
August	1.75±0.25	1.00±0.41
Wistar	0.80±0.20	2.80±0.20

The acute ES tended to increase ( $p<0.07$ ) the relative thymus weight, the increase being 17.57% in the August rats ( $0.87\pm0.07$  g vs.  $0.74\pm0.09$  g in the controls) and 14.46% in the Wistar rats ( $0.95\pm0.06$  g vs.  $0.83\pm0.04$  g in the controls).

The relative adrenal weight in the August controls was significantly greater (LSD,  $p=0.0007$ ) than in the Wistar controls and, as shown by multivariate ANOVA, tended to be lower ( $p<0.06$ ) after the acute ES - by 22.22% in the Wistar rats ( $0.07\pm0.007$  g vs.  $0.09\pm0.007$  g in the controls) and by 5.36% in the August rats ( $0.106\pm0.005$  g vs.  $0.112\pm0.004$  g in the controls). These decreases might have been due to the activation of hypothalamic-hypophyseal-adrenal mechanisms and the enhanced release of corticosteroid hormones from the adrenals [4].

The acute ES did not cause a significant change in the relative spleen weight in either Wistar or August rats.

The findings indicate that immobilization-immersion stress induces gastric ulcers primarily in Wistar rats. The factors determining genetic differences in bodily resistance to stressors and the mechanisms of ulcer development in the stomach in response to acute ES are topics for our further research.

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