

# BRIEF COMMUNICATION

## Comparison of Frequency, Intensity, and Duration of Aggressive Responses in Rats<sup>1,2,3</sup>

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HALAS, E., G. REYNOLDS, M. ROWE, M. HEINRICH AND M. PIRC. *Comparison of frequency, intensity, and duration of aggressive responses in rats.* *PHYSIOL. BEHAV.* 18(5) 975-977, 1977. — Three judges were trained to evaluate the frequency, intensity, and duration of aggressive responses in rats. Intrajudge and interjudge reliability ranged from .84 to .99. Correlation coefficients between frequency, intensity, and duration of aggressive responses ranged from .89 to .99. All three measures were found to be highly reliable methods of measuring aggression.

Aggression    Agonistic behavior    Shock-induced aggression    Measurement of aggression

VARIOUS methods of measuring aggressive behavior in rats, such as vocalization [5], contact with an inanimate object [4], and contact between two animals [1], have been used. Perhaps the most widely used method of measuring aggressive responses utilizes the frequency of contact between two rats while they were biting, sparring, in an upright attack posturing, or supine submissive posturing [1]. However, this frequency data does not take into account the intensity or the duration of the aggressive responses. Intensity and duration are different dimensions of aggression that have not been systematically studied in the rat and these two measures may provide additional information in the understanding of aggression. There is also considerable doubt among investigators about the validity and reliability of their measures of aggression. The purpose of this paper is to develop methods of measuring intensity and duration of shock-induced aggression and determine how well each of these three dependent variables measures aggression and the intercorrelation among them.

### METHOD

#### *Training Procedure*

Two weeks were spent training three judges to evaluate the aggressive responses for frequency, intensity, and

duration. The first day was spent showing the judges shock elicited aggression of several pairs of live rats. Videotapes of aggression were shown on the following days. The criteria for each measure were carefully explained to the judges. For frequency, aggressive attacks were defined as "directed movement toward the opponent which resulted in contact, including at least one of the following responses: biting, sparring, upright attack posturing, or supine submissive posturing adopted by the attacked rat" [1]. The intensity of the aggressive response was judged on a scale from zero to six. A grade of zero represented no aggression between the rats while a grade of six meant the highest intensity of aggression. Grades two to five represented intermediate levels of aggression. The duration of the aggressive responses was recorded on Hunter Model 120C digital clocks. The judges were seated in student armchairs with built in writing boards. A push button microswitch was mounted in the writing board. With his arm resting on the armrest and writing board, a judge could keep his finger comfortable on the push button. At the start of aggression, the judge depressed the push button which activated the digital clock. When the aggression stopped, the judge released the push button which deactivated the digital clock. Time was recorded cumulatively in hundredths of a second.

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<sup>3</sup> Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the U. S. Department of Agriculture, and does not imply its approval to the exclusion of other products that may also be suitable.

During a given training session, the judges practiced on only one of the three measures of aggression. All judgments of aggression were made independently by the three judges and then compared. Differences among the judges were discussed and the videotapes reviewed a second time and a second comparison made. Although there were discrepancies between judges during the early phase of training, by the end of the two week training period the three judges were usually in agreement as to what constituted aggression. For example, if Judge A observed 10 aggressions in 25 trials, Judges B and C also observed 10 aggressions during the same 10 out of 25 trials. On occasion a given judge may differ from the other two judges but a careful review of the videotape would show that the rats in a given trial were so positioned that it was difficult to see, even in slow motion, if an aggressive response had occurred. In these situations, each judge was told to make his best judgment and not to be concerned about the evaluations of the other two judges. Different videotapes were used for the various training sessions. At the conclusion of the training period, the judges were tested on a videotape they had never seen before. The same videotape was used for all four days. Intensity of aggression was measured on the first day of the test. Frequency of aggression was automatically tabulated by counting the number of zero's and subtracting that number from the total number of trials. On the second day of testing, the duration of aggression was recorded. The judges were then given three days of rest. Intensity was evaluated on the third day of testing while duration was judged on the fourth. To determine intrajudge reliability, each judge's performance on the first and third day of testing (intensity) and on the second and fourth day of testing (duration) were correlated. Interjudge reliability was computed by comparing judges' responses for each day.

#### Experimental Design

With the completion of the training sessions, the judges were shown the videotapes of an experiment involving 15 pairs of female rats. Each pair of rats was given 25 trials of shock per day for 12 days. The shock duration was 0.5 sec and the intertrial interval was 5.0 sec. On odd numbered days the shock intensity was 1.6 mA while on even numbered days the shock intensity was 1.3 mA. The scramble shock was delivered by a Lehigh-Valley Model 113-33 shock generator. The rats were placed in a Plexiglas box measuring 32.0 cm by 25.5 cm by 30.5 cm. The grid floor consisted of 0.3 cm stainless steel rods spaced 1.9 cm from center to center. The 15 pairs of rats were the offsprings of three different groups of dams. Five pairs were the offsprings of dams (ZD) who suffered zinc deficiency from the 14th through the 20th day of pregnancy. Because zinc deficiency causes anorexia, the second 5 pairs were the offsprings of dams (PF) who were individually paired with the ZD dams and given the same quantity of the zinc deficient diet as was consumed by the ZD dams. The drinking water of the PF dams contained 50 ppm Zn/cc. The third 5 pairs of rats were the offsprings of dams (AL) who received the zinc deficient diet ad lib and the zinc supplemented drinking water. The female offsprings began the shock elicited aggression experiment when they were 75 days old. The 15 pairs of rats were run in a different random sequence each day. The judges did not know the group identity of the 15 pairs of rats. Duration and intensity were never evaluated on the same day. Corre-

lations were based on the total scores of each pair of rats for each day.

#### RESULTS

Since frequency, duration, and intensity of aggression were measured on different scales, it was necessary, in order to make comparisons, to convert the raw data of each dimension to T-scores. The T-scores for high shock (1.6 mA) were graphed in Fig. 1 while the T-scores for low shock (1.3 mA) were plotted in Fig. 2. Inspection of both figures would suggest that the three measures of aggression were correlated. The test-retest method was used to compute the intrajudge reliability. There was a 60 day interval between the original evaluation of the data and the reevaluation. For the frequency measure, the correlation coefficient for Judge A was .84, while it was .97 and .98 for Judges B and C respectively. Judges A, B, and C had correlations of .84, .89, and .95 respectively for the duration measure and correlations of .95, .96, and .97 respectively for the intensity measure. There were 13 degrees of freedom for each correlation and all correlations were significant beyond the 0.001 level of confidence.

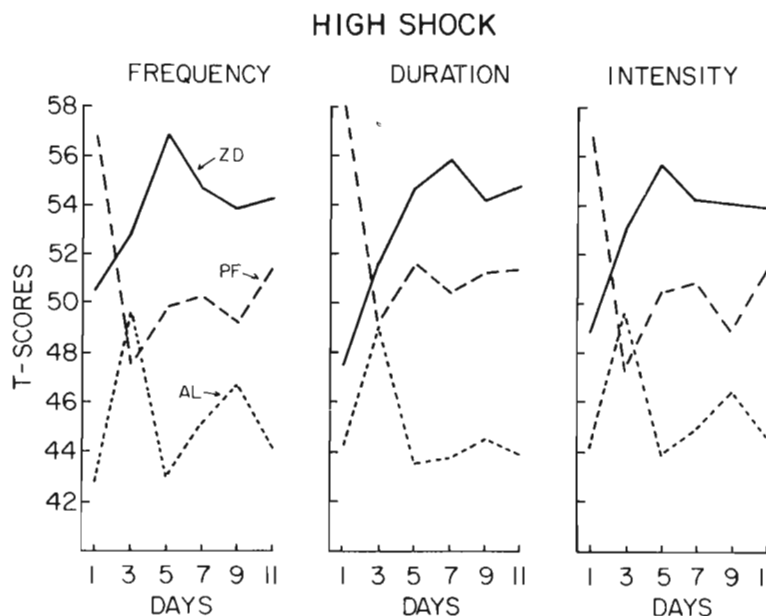


FIG. 1. Aggressive responses of three groups of rats were judged for frequency, duration, and intensity at a high shock level (1.6 mA).

One hundred and eight correlation coefficients were computed to determine the interjudge reliability of the three measures for the high and low levels of shock [3]. Interjudge reliability for the frequency measure for both the high and low shock (36 correlations) ranged from .85 to .99 with a mean of .93. These results are in agreement with those published by Ulrich and Azrin [6]. For the duration measure, the interjudge reliability ranged from .89 to .99 with a mean of .95 for both high and low shock while the interjudge reliability for the intensity measure ranged from .84 to .99 with a mean of .93 for the two levels of shock. There were 13 degrees of freedom for each correlation and all correlations were significant beyond the 0.001 level of confidence.

Correlation coefficients between the three measures of aggression were computed. Table 1 shows the results for both high and low levels of shock. It should be noted that

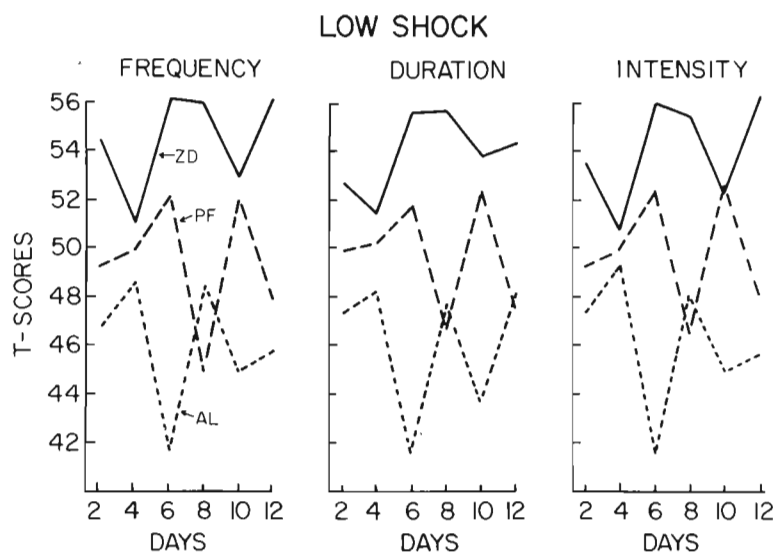


FIG. 2. Aggressive responses of three groups of rats were judged for frequency, duration, and intensity at a low shock level (1.3 mA).

TABLE 1

CORRELATION COEFFICIENTS OF THE THREE MEASURES OF AGGRESSION FOR THE THREE GROUPS OF RATS

	HIGH SHOCK			LOW SHOCK		
	F-D*	F-I	D-I	F-D	F-I	D-I
ZD	.91	.96	.89	.95	.98	.93
PF	.96	.99	.97	.97	.99	.98
AL	.97	.99	.98	.98	.99	.97

\*Abbreviations: F-D = Frequency-Duration, F-I = Frequency-Intensity, D-I = Duration-Intensity.

the distribution of judgments were approximately normal, with not one of the three measures significantly skewed or kurtotic for any of the three judges on any of the twelve days of aggression. Since a considerable range in evaluations existed, the judges were not merely agreeing that the rats were aggressive, but were reliably differentiating among animals that demonstrated different degrees of aggression.

#### DISCUSSION

Even though the three judges made their judgments independently of each other and did not know the group identity of the 15 pairs of rats, the results were consistent. Over 60 days had elapsed between the original evaluation and the reevaluation and yet the lowest intrajudge reliability was .84 which would suggest that the criterion of evaluation within each judge was stable from day to day. The lowest interjudge reliability was .84 which suggests that the evaluations between the judges were also consistent. The results presented in Table 1 show that the three measures of elicited aggression in rats are highly correlated. In view of the within judge stability and the between judge reliability, a high degree of confidence can be placed in the reliability of these three measures of aggression. For all three measures, the pattern of aggression as well as the level of aggression for each group (Figs. 1 and 2) was remarkably consistent. The group that suffered intrauterine zinc deficiency (ZD) was the most aggressive while the ad lib fed group (AL) was the least aggressive. The undernourished pair fed group (PF) was intermediate between these two groups. In no case was the overall position of one group relative to the other two changed by using a different measure of aggression. These results are in agreement with a previously published study [2].

In summary, all three measures were highly correlated and appear to be equally effective in measuring the level of shock-induced aggression. All things being equal, intensity may be the preferred measure because it is quick, convenient, and utilizes the frequency measure's definition [1] of zero level of aggression and by subtraction provides the experimenter with both frequency and intensity measures of aggression.

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