SOME DIFFERENCES IN THE SALINE CONSUMMATORY BEHAVIOR OF ACUTE AND CHRONIC SODIUM DEFICIENT RATS

By

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SCOPE AND CONTENTS: The effect of acute and chronic sodium deficiency on the saline appetitive behavior of rats was investigated using a brief exposure multistimulus taste test that was shown to eliminate post-ingestional factors. The chronically deficient adrenalectomized rats showed a distinct preference for dilute salt solution. The acutely deficient formalin injected animals generated saline acceptability curves which were similar to the normals, but increased their salt consumption overall by taking more trials. It is concluded that the sodium appetite of adrenalectomized rats is mediated, at least in part, by peripheral events.

When rats are given a choice between a salt solution and water to drink, they typically begin drinking more saline than water when a solution of 0.06% NaCl is offered. Increasing amounts of saline are drunk as the concentration is increased to 0.9% NaCl, the concentration at which the peak preference for saline ordinarily occurs. Progressively less saline is drunk when more concentrated salt solutions are presented until the amount of saline and water consumed are equal once again when 2% NaCl is offered. Concentrations exceeding 2% NaCl are said to be aversive to normal rats since more water than saline is drunk when such solutions are offered in the two-bottle test (Richter, 1956). Using a one-bottle procedure, Weiner and Stellar (1951) obtained a saline preference-aversion function similar to that characteristic of the two-bottle method previously used by Richter.

The immediate appearance of the normal rats' preference for dilute saline solutions and aversion for saline solutions exceeding 2% NaCl suggested to Weiner and Stellar (1951) that postingestional effects and experience are not necessary conditions for the appearance of salt consummatory behavior of normal rats. Stellar, Hyman and Samet (1954) used the single-stimulus method to investigate the contributions of post-ingestional factors to saline acceptability. When gastric factors were eliminated by preparing rats with esophageal fistulae, preference-aversion functions of the same form as those obtained from intact rats resulted. Once again, postingestional factors were shown to be relatively unimportant for the appearance of normal saline consummatory behavior. Taste factors alone seemed to be responsible for the acceptability of saline solutions for the normal rats. It has been argued that rats, like humans, consume what they like (find palatable) regardless of what they need to maintain homeostasis (Young, 1948).

But other factors have been shown to be very much involved in the saline consummatory behavior of normal rats. Although gastric factors may not be essential for generating the basic form of the saline preference curve, the amount of saline consumed by a thirsty rat may depend upon postingestion factors. Novin, Fox and Berger (1966) investigated the postingestional effects of drinking different saline solutions. The conductivity of the rat brain was measured to serve as an indicator of the effective osmolarity of the body fluids. Less of a reduction in conductivity occurred when more concentrated saline solutions were being drunk. These results imply that a thirsty rat may begin to drink isotonic saline in preference to water because of palatability considerations, while the tendency to consume more saline may be related to its relative inability to dilute the body fluids and satiate thirst. Mook (1963) failed to obtain the typical saline preference curves from esophagostomized rats that tasted saline solutions while an equal amount of water was delivered through a gastric fistula. Most striking was the absence of a maximum preference for isotonic saline, suggesting that postingestional factors are involved in the saline preference behavior of thirsty rats.

Much more work needs to be done before the saline preference behavior of normal rats is well understood. Ultimately, the peripheral events should be isolated from the visceral aspects of saline preference. In the past, an esophageal fistula has been installed so that only peripheral events control drinking. Since the operation is time consuming and the fistulated animals are difficult to maintain, an alternative technique is desirable. The first experiment to follow presents a method which isolates the peripheral aspects of saline consumption from postingestional factors in the intact rat by using a brief taste test in which intake is so small that postingestional factors are minimized. The effectiveness of the procedure in minimizing postingestional factors is determined by comparing the saline preference-aversion function of the normal rats to that of esophagostomized rats in which postingestional factors have been totally eliminated. The second experiment employs the brief taste test to investigate the contribution of peripheral factors to the sodium appetitive behavior of acute and chronically sodium deficient rats.

Method

Apparatus:

The test cage consisted of a 10" x 11" x 8" box. Ten tubes fitted with metal nozzles were mounted on a circular motor-driven turntable located behind the opaque wall of the test cage. The nozzles appeared, one at a time, in a horizontal slot cut out of the opaque wall in front of the turntable.

Subjects:

Twelve male hooded rats divided into two groups as described below were used. They were housed in individual cages in a constantly illuminated room. Purina Rat Chow was present ad libitum at the home cages.

Training:

Throughout training, all 10 drinking tubes on the turntable contained distilled water. The turntable was programmed by relay equipment to advance one position 2.7 seconds after they began to drink from the available nozzle. If the rat did not lick, the nozzle remained in place.

Thirty minute drinking sessions separated by 23½ hour fluid deprivation periods were used to accustom the rats to drink while in the test cage. During this phase of training, each rat received all of its water during the daily 30 minute training sessions. Food was not present in the test cage. After each training session, the rat was returned to its home cage. Only those rats which completed at least 50 trials, i.e., drank from the first 50 nozzles, during each 30 minute training session were included (6/8 rats met this criterion).

After the third day of training, six rats that met the criterion were returned to their home cages where tap water and food were available for the next 23½ hours. A 24 hour fluid deprivation period intervened before the next 30 minute test session. This cycle of 24 hour fluid deprivation, 30 minute test session, and 23½ hour maintenance was continued throughout the remainder of the experiment for this group. These six animals constituted the "normal" control group.

A similar training procedure was used to select six rats to undergo esophagostomy and testing, except that at least 5 days of daily training was given in order to obtain rats that drank readily while in the test cage. Following this selection procedure, the six rats were esophagostomized 2 hours after being returned to their home cages. The operation was done under Nembutal anesthesia using the surgical procedure described by Stellar, Hyman and Samet (1954). Food and water were not present at the home cages after esophagostomy.

Testing:

Saline solutions of 0.09, 0.9, 2, 3, and 6% NaCl by wt. were presented in a random sequence at every other position of the turntable. Distilled water occupied the five positions that separated the saline solutions. The normal rats were tested twice. The First Test Day sequence was 6/0.9/3/0.09/2% NaCl and the Second Test Day sequence was 0.09/0.9/3/2/6%

NaCl. Because this group was to serve as the control group for Experiment II, these rats were injected subcutaneously with 2.5 ml of 0.15M NaCl 24 hours before the Second Test Day.

Each test session lasted 30 minutes. The average amount of time spent licking from the nozzle containing each solution during the first 50 trials of each test session was used as a measure of saline preference. Only the last 2.5 seconds of each 2.7 second trial interval was recorded on a Sodeco Print Out Counter. In addition, the total number of trials completed by each rat during each test session was recorded.

The esophagostomized rats were tested only once approximately 22 hours after the operation. The sequence of saline and distilled water on the turntable was the same as that occurring on the Second Test Day for the normal rats (0.09,0.9,3,2,6%).

Results:

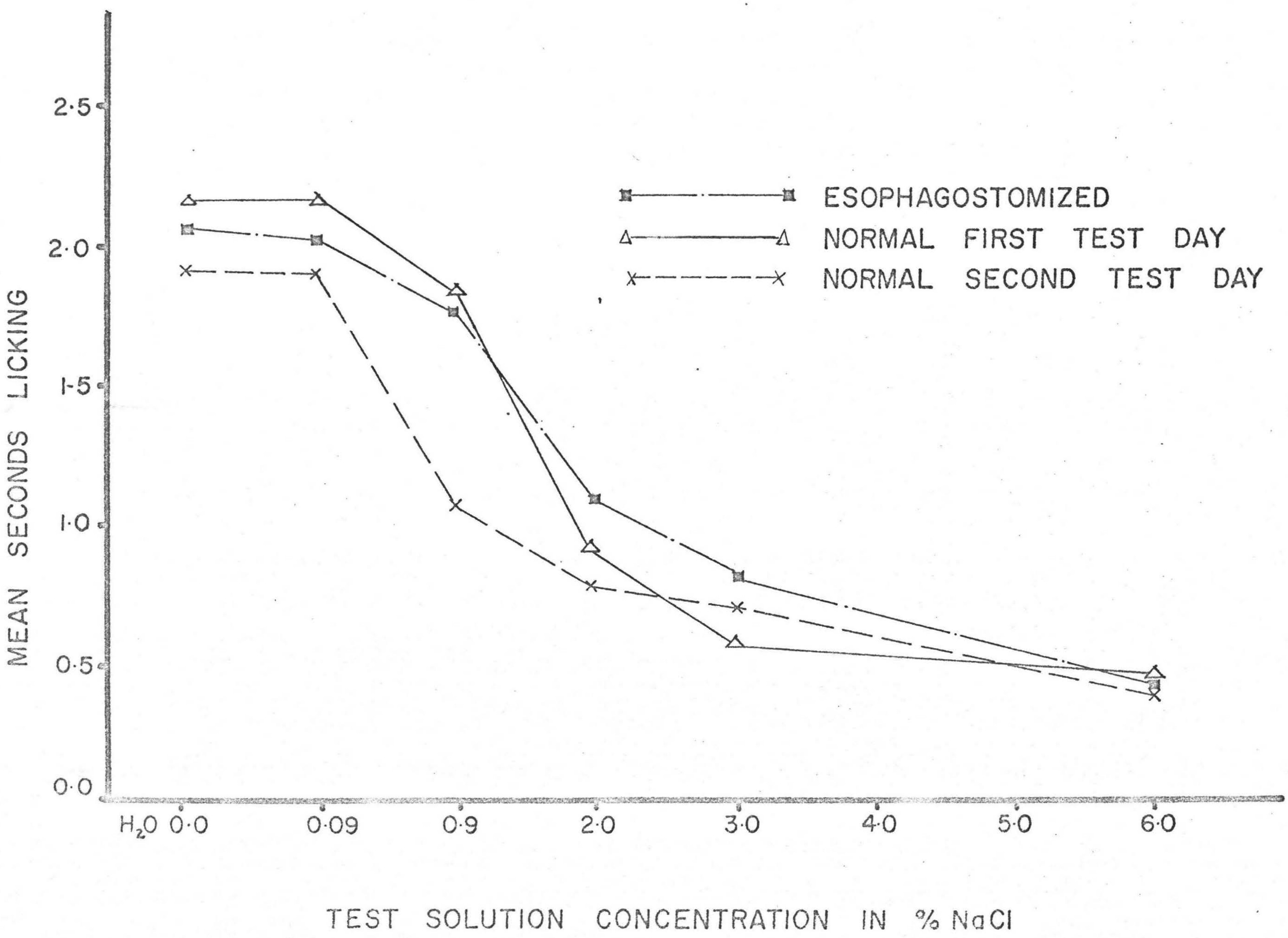
Figure 1 presents the saline preference functions for the normal and esophagostomized rats. Both the First and Second Test Day results of the normal rats are shown. The general form of the saline preference curves for both groups is a decreasing monotonic function. As the NaCl concentration is increased, the amount of time spent licking decreases. Both groups showed a maximum preference for distilled water. An analysis of variance revealed no significant differences between the saline preference functions for the two groups (Table I).

Discussion:

The brief exposure, single-stimulus procedure used in the present experiment appears to have essentially eliminated the contribution of post-ingestional effects to the saline preference curves obtained for the normal rats. Since a maximum of only 0.1 to 0.2ml of fluid could be ingested by the normal rat during each 2.7 second trial, they were forced to drink from all the tubes in order to satiate their thirst. Consequently, no particular test solution was completely responsible for repleting the body fluids. In other words, the test procedure prevented the formation of associations between a particular fluid and the postingestional relief from the discomfort of thirst. Thus, both learning and postingestional factors were minimized by the experimental procedure described for the normal rats.

The absence of a peak preference for isotonic saline is a curious result. Since the occurrence of saline preference behavior has been shown to be highly dependent upon the experimental procedure (Young and Falk, 1956), it is possible that some aspect of the present test situation served to preclude the appearance of a distinct saline preference. At first, it was thought that the forced consumption of the unpalatable

Figure 1. Saline acceptability curves for esophagostomized and normal groups.



ESOPHAGOSTOMIZED
NORMAL FIRST TEST DAY
NORMAL SECOND TEST DAY
MEAN SECONDS LICKING
2·5
2·0
1·5
1·0
0·5
0·0
H2O 0·0
0·09
0·9
2·0
3·0
4·0
5·0
6·0
TEST SOLUTION CONCENTRATION IN % NaCl

TABLE I

Summary of analysis of variance comparing the normal and esophagostomized groups.

Source	SS	df	ms	F
Subject	5.48	11	0.50	
Groups	0.86	1	0.86	1.87
error b	4.62	10	0.46	
wS	33.92	60		
Concentrations	27.00	5	5.40	45.00
Conc. x Groups	0.93	5	0.19	1.55
error w	5.99	50	0.12	
Total	39.40	71	0.12	

hypertonic saline solutions may have caused the formation of a generalized aversion to the taste of salt. This hypothesis was tested by offering another group of rats only 0.9% NaCl and distilled water at alternate positions on the turntable. Under these conditions a progressive reduction over days occurred in the amount of time spent licking when 0.9% NaCl was presented, i.e., isotonic saline was not prefered to water. Evidently, generalization cannot account for the absence of the well-known peak preference for isotonic saline. Some other aspect of the test situation may have been responsible for the absence of a peak preference for isotonic saline. The taste of salt solutions may have been modified by the intervening distilled water rinses so that the rats may have tasted the saline solutions more sharply (Pfaffmann and Powers, 1964). This may have made the saline taste more aversive. On the other hand, the taste of the distilled water may have been less distinct due to the residual taste of NaCl. This may have resulted in an exaggerated preference for the distilled water (Deutsch and Jones, 1960). Whatever the cause may be, the present method did not obtain a distinct preference for dilute saline solutions from the intact or esophagostomized rats.

One important advantage of the brief exposure single-stimulus procedure used in the present experiment is that the effect which various physiological manipulations may have on the peripheral aspects of saline acceptability can be readily studied using otherwise intact animals. If sodium appetite is viewed as the willingness of a sodium deficient animal to accept saline solutions that are not preferred by normal animals, then the present brief exposure test seems to be well-suited for the study of sodium appetite since normal rats were found to show an aversion to the saline solution offered. The following experiment uses this test procedure to investigate the saline appetitive behavior of acutely and chronically sodium deficient rats.

Experiment II

Introduction:

A variety of treatments produce a sodium appetite in rats. Richter (1936) found that adrenalectomized rats had an appetite for 3% NaCl in a two bottle test. Adrenalectomized rats that were not given access to salt soon died due to the continuous loss of sodium ions in their urine. Compared to normals, adrenalectomized rats were found to begin drinking saline solutions in preference to water at much lower concentrations. Since the concentration of saline solutions first preferred by the adrenalectomized rats was so low that beneficial postingestional effects could not have accrued as a result of drinking the dilute solutions, Richter (1939) suggested that the increased intake was due to an altered gustatory sensitivity for salt. To date, a number of experiments have failed to support this hypothesis (Pfaffmann and Bare, 1950; Carr, 1952; Nachman and Pfaffmann, 1963).

In addition to the effects of chronic treatments, an appetite for sodium has been shown to follow acute sodium deficiency in rats. Stricker and Wolf (1966) induced an acute sodium deficiency in rats by injecting 2.5 ml of 1.5% formalin subcutaneously. This treatment produced an acute hypovolemia 24 hours after injection when the rats were food and fluid deprived. Significantly more 2% NaCl was drunk by the formalin injected rats within the first 5 minutes of the two-bottle test session. These investigators made no attempt to determine the relative contribution of taste and postingestion to the saline drinking behavior of the acutely deficient rats.

The relative importance of taste and postingestion in the sodium appetite of both acute and chronically deficient animals remains unsettled. Since the actual physiological consequences of the acute and chronic treatments differ with respect to the kind and degree of sodium deficit induced, it is possible that more than one mechanism may operate to give rise to sodium appetitive behavior. The present experiment compares the saline drinking behavior of rats made sodium deficient by adrenalectomy or formalin injection in an attempt to expose differences in the behavioral expression of the need for sodium. In order to minimize the contribution of postingestional and learning factors to the results, the brief exposure single stimulus procedure described in the preceeding experiment is used.

Method:

The apparatus, training and testing procedures were identical in every respect to those described for the normal rats of Experiment I.

Subjects:

Twelve male hooded rats weighing from 300 to 350 grams, housed in individual cages in a constantly illuminated room were used. Six rats were bilaterally adrenalectomized after the first maintenance period of the training sessions. After the 24 hour fluid deprivation period that followed, the adrenalectomized rats were returned to the test cage for further training. The regime of 23½ hour fluid deprivation, 30 minute training, and 23½ hour tap water maintenance period occurred twice before testing began on the fifth day after adrenalectomy.

Six rats were injected subcutaneously with 2.5 ml of 1.5% formalin after the 23½ hour maintenance period following the First Test Day. The 24 hour fluid deprivation period intervened before testing on the Second Test Day.

Results:

The mean number of seconds that each group spent licking each

Figure 2a, Saline acceptability curves for normal pre-formalin and adrenalectomized groups on first test day.

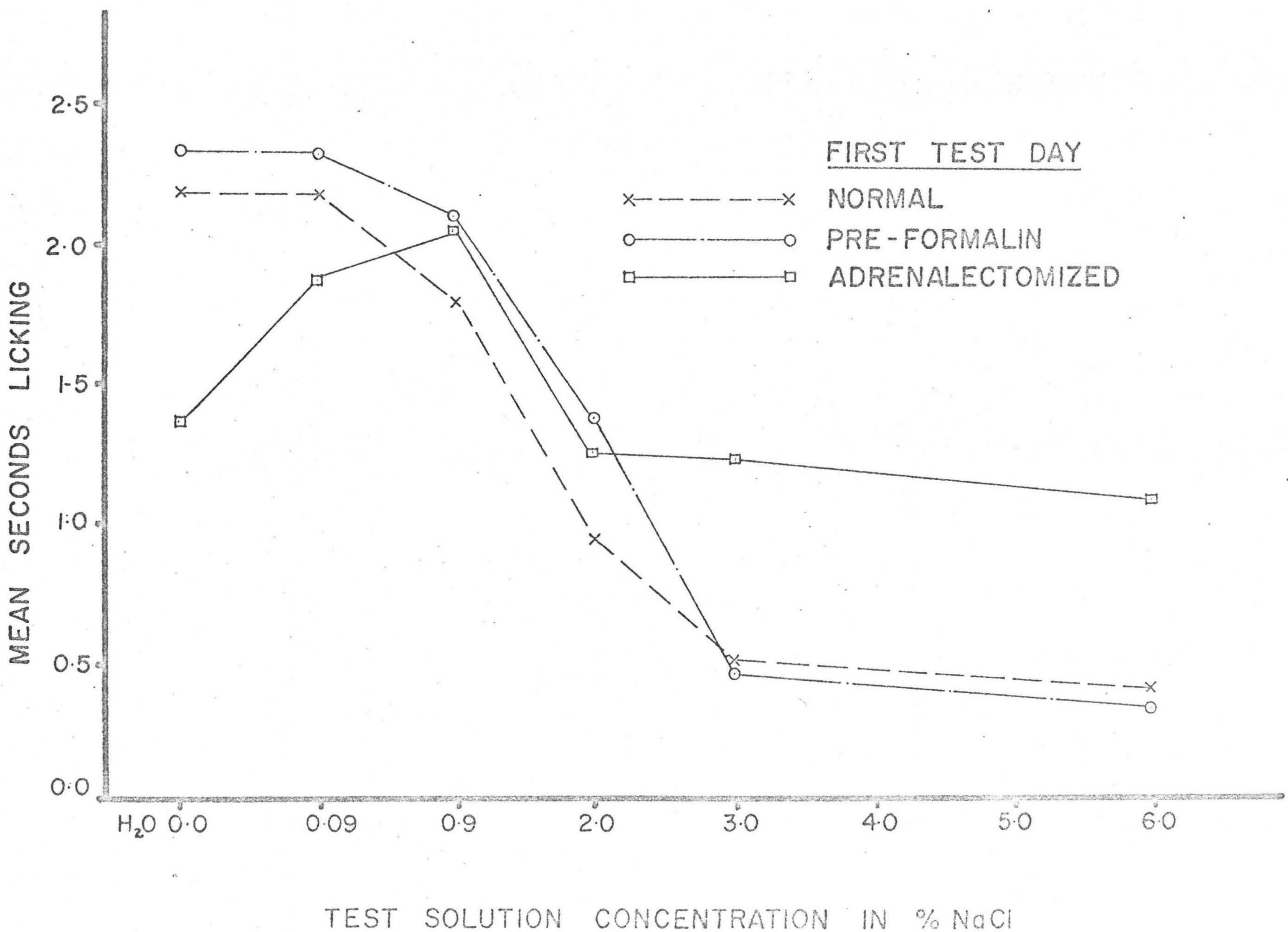
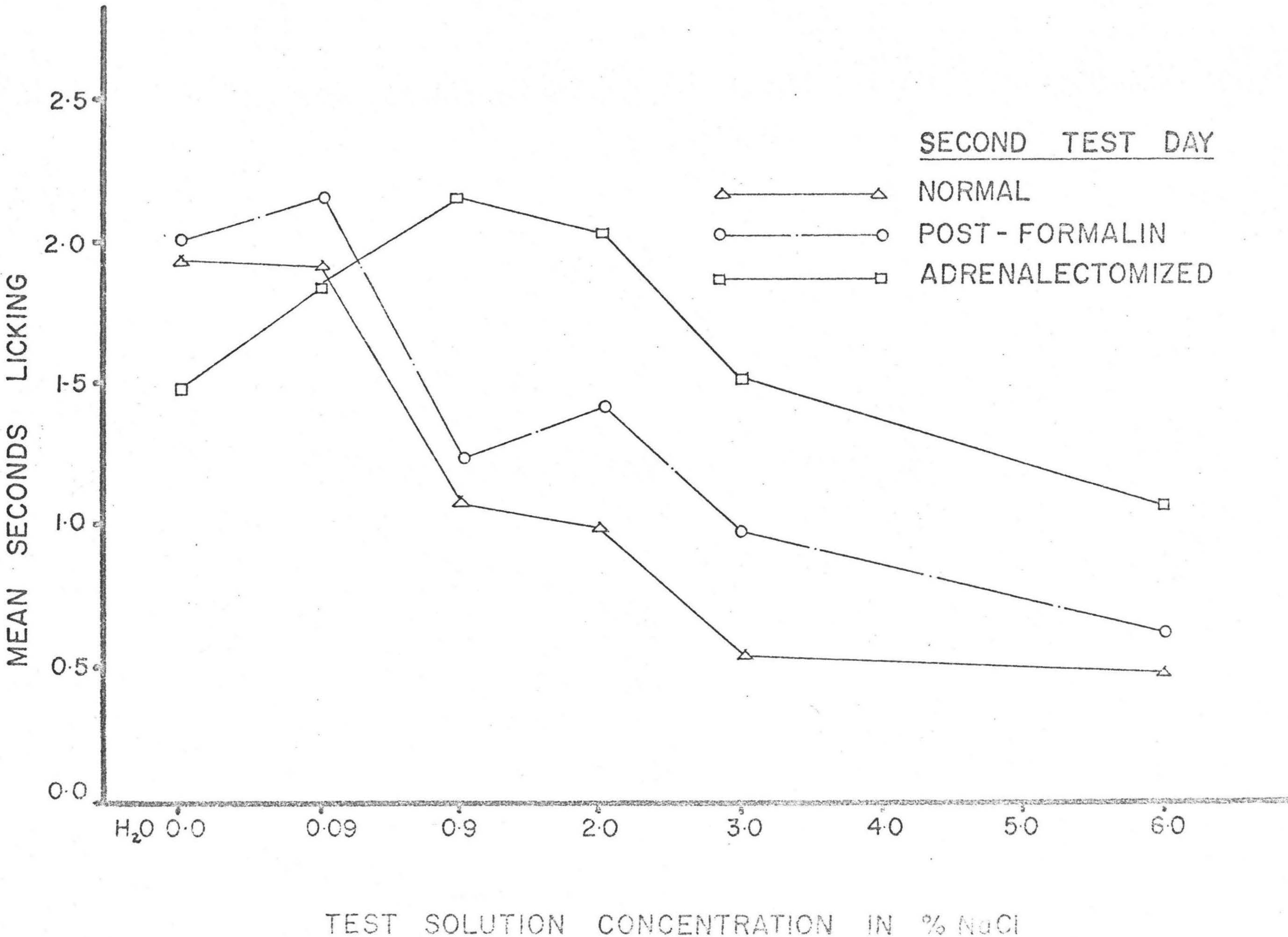

FIRST TEST DAY
NORMAL
PRE-FORMALIN
ADRENALECTOMIZED
MEAN SECONDS LICKING
2·5
2·0
1·5
1·0
0·5
0·0
H2O 0·0
0·09
0·9
2·0
3·0
4·0
5·0
6·0
TEST SOLUTION CONCENTRATION IN % NaCl

Figure 2b Saline acceptability curves for normal, post-formalin, and adrenalectomized groups on second test day.



SECOND TEST DAY
NORMAL
POST - FORMALIN
ADRENALECTOMIZED
MEAN SECONDS LICKING
2·5
2·0
1·5
1·0
0·5
0·0
H₂O 0·0
0·09
0·9
2·0
3·0
4·0
5·0
6·0
TEST SOLUTION CONCENTRATION IN % NaCl

TABLE II

Summary of analysis of variance comparing the saline acceptability curves for the normal formalin injected and adrenalectomized groups on each test day.

Source	SS	df	ms	F
Between				
Subjects	7.70	17	0.453	
Groups	3.89	2	1.945	7.66
error b	3.81	15	0.254	
Within				
Subjects	108.54	198		
Day	0.02	1	0.02	0.11
Concentrations	61.21	5	12.242	58.57
DayxConc.	4.09	5	0.818	9.74
DayxGroups	2.23	2	1.115	6.13
Conc.xGroups	14.10	10	1.410	6.75
DayxConc.xGroups	2.25	10	0.225	2.68
error w	24.64	165		
$error_1 w$	2.73	15	0.182	
$error_2 w$	15.64	75	0.209	
$error_3 w$	6.27	75	0.084	
Total	116.24	215		

solution presented on the First and Second Test Days is shown in Figures 2a and 2b respectively. The curves obtained for the normal rats in Experiment I are shown to serve as a Control Group. It can be seen that on the First Test Day, as the saline concentration increased, the average amount of time spent licking by both the normal and the pre-formalin injection group decreased. The functions for both the normal group and the pre-formalin group decrease monotonically from the value for distilled water shown to the extreme left of Figure 2a. The adrenalectomized rats, on the other hand, spent the most time licking when 0.9% NaCl was presented on the First Test Day. More or less concentrated saline solutions were less preferred by the adrenalectomized rats. Distilled water was not preferred to either 0.09% or 0.9% NaCl.

On the Second Test Day (Figure 2b), the adrenalectomized rats again showed a peak preference for 0.9% NaCl. As on the First Test Day, the characteristic inverted "U" shaped preference function obtained for the adrenalectomized rats. In addition, the licking time spent at 2% and 3% NaCl appears to be increased considerably over the First Test Day values, while the distilled water intake was unchanged.

The general form of the normal group licking-time function for the Second Test Day is practically identical to that obtained on the First Test Day, except for a reduction at the 0.9% NaCl solution. Inspection of the pre and post-formalin injection curves reveals that the amount of time spent licking on the Second Test Day is slightly increased for the more concentrated solutions, decreased for the less concentrated solutions, and unchanged for the 2% NaCl.

The summary of the analysis of variance for the data represented by Figures 2a and 2b appears in Table II. Of primary interest are the main effects of treatment and the concentration by groups interaction. These were significant at the 0.025% and 0.001% confidence intervals respectively. The remaining interaction involving groups was significant at the 0.025% confidence interval. It is clear from these data that the treatments had a highly significant effect on the saline-preference behavior of the rats.

The response of the adrenalectomized rats to the saline solutions is visibly different from the other two groups. Compared to the normals, the adrenalectomized rats spent less time licking when water or 0.09% NaCl was presented and more time when more concentrated solutions were offered. The normal group and the formalin group appear to have responded similarly on both test days. The results of an analysis of variance comparing the licking-time of the normal rats to that of the formalin group gave no indication of differences due to the treatments. In addition, the concentration by group interaction was not significant, indicating that the saline preference curves of these two groups are essentially the same.

Closer inspection of the data was able to expose some additional differences between the three groups. Table III presents what shall be termed the "relative percentage salt intake" for each group of rats on each test day. The values were computed by multiplying the percentage concentration of each NaCl solution by the average amount of time spent licking that solution. A similar calculation was done, using the appropriate percentage value, to determine the relative amount of water consumed in the saline solutions as well as from the 5 distilled water drinking tubes. Multiplying the NaCl: Water ratio by 100 gave a decimal value that expresses, as a per cent, the amount of NaCl that was consumed during each test session by each group. These computations can be made from the data

TABLE III

Relative Percent Salt Intake for Each Group on Each Test Day.

	TEST DAY I	TEST DAY II
CONTROL GROUP	0.46% (0.079M)	0.52% (0.089M)
FORMALIN GROUP	0.46% (0.079M)	0.65% (0.111M)
ADRENALECT. GROUP	0.98% (0.168M)	1.03% (0.176M)

presented in Figures 2a and 2b.

On the First Test Day, the relative per cent salt intake of the normal and pre-formalin injection group was identical, as would be expected, since no treatment had been administered to either group. The pre-formalin group was, in fact, "normal" in every respect on the First Test Day. On the Second Test Day, the relative per cent salt intake of the rats injected with formalin increased considerably, while the intake of the normal group remained essentially unchanged. Remembering that a relative per cent salt intake of 0.9% (0.154M NaCl) would be equivalent to the concentration of normal plasma, it can be seen that hypotonic amounts of salt were consumed by both the normal and pre-formalin groups on the First Test Day. On the Second Test Day the tonicity of the fluids drunk by the formalin injected rats increased overall and approached the isotonic range.

The relative per cent salt intake of the adrenalectomized rats was hypertonic on both test days. There was very little difference in the overall tonicity of the fluids consumed by the adrenalectomized rats each day.

It became evident early in the course of training, that the number of trials taken during each session was well related to the length of the deprivation period, i.e., more trials were taken by those rats that had been (accidentally) deprived longest. In anticipation of the drive inducing properties of formalin injection and adrenalectomy, the total number of trials taken by each rat was recorded and an analysis was done in order to evaluate the motivational state of the deficient animals. Table IV presents the results of an analysis of variance performed to determine if the total number of trials taken by each group on each test

TABLE IV

Average Number of Trials Taken by Each Rat in Each Group on Each Test Day.

	First Test Day	Second Test Day
Control	117	54
Formalin	104	85
Adrenalectomy	74	101

Summary of Analysis of Variance Comparing the Total Number of Trials Taken by Each Group on Each Test Day.

Source	SS	df	ms	F
Subject	25193.25	17		
Groups	543.17	2	271.59	1.65 N.S.
error b	2465.08	15	164.34	
wS	26349.50	18		
Days	154.69	1	154.69	0.16 N.S.
DayxGroups	12109.06	2	6054.53	6.45 p< 0.01
error w	14085.75	15	939.05	
Total	51542.75	35		

day was unaffected by the treatments. The statistically significant day by group interaction indicated that the treatments did have an effect on the number of tube presentation trials completed by each group during the 30 minute test sessions. Further analyses revealed that both the formalin injected and the adrenalectomized rats completed significantly more trials on the Second Test Day than the normal animals.

Discussion:

A controversy exists concerning the nature of the saline consummatory behavior caused by sodium deficiency. The experiments of Bare (1949) indicated that the saline consummatory behavior occurring under conditions of a need for sodium appear, but to a lesser extent, in normal animals. Young (1948) reports having failed to demonstrate a difference in preference behavior based upon palatability and that based on organic need. The differences in saline preference behavior of rats made sodium deficient by chronic or acute means was studied by Wolf and Quartermain (1966). They found the saline intake of formalin treated rats to be highly dependent upon the palatability of the solutions, while adrenalectomized rats showed an appetite for all concentrations of saline offered. Although their conclusions are complicated by the contribution of postingestional factors, Wolf and Quartermain considered their data to cite against the theory that a single mechanism underlies sodium appetite induced by the two treatments.

The present experiment supports Wolf and Quartermain, and differentiates experimentally between the acceptability of NaCl for adrenalectomized, formalin treated and normal rats. The results of Experiment I indicate that the differences appearing in the general form of the saline acceptability functions of the acutely and chronically sodium deficient rats in Experiment II were maximally dependent upon the peripheral aspects of salt consumption. The general form of the adrenalectomized rats' saline acceptability curves were clearly different from those of the other two groups. If saline preference were to be viewed in the conventional sense, as a tendency to drink more of a particular salt solution than water, then only the adrenalectomized rats showed a preference for saline. Interestingly, the range and peak of this group's saline preference agrees fairly well with the results obtained by conventional procedures.

Determination of the relative percent salt intake furnished important information about the general orientation of the drinking behavior done by each group during the test sessions and supplied an explanation for the absence of a peak preference for 0.9% NaCl for the normal and formalin injected groups. Under the testing regime, the extracellular fluid of the normal rats was probably hypertonic when each test began (Adolph, Barker, and Hoy, 1954). Physiological considerations indicate that homeostasis would have been restored most rapidly if only distilled water had been consumed. But the test conditions were such that drinking some salt was unavoidable. Since all of the solutions had to be ingested to some extent, the normal rat was required to distribute its drinking across all of the solutions in order to consume enough fluid to replete the water deficit. The hypotonic value of the relative per cent salt intake obtained by the normal rats indicates that their drinking was primarily directed toward consuming water and satiating thirst.

Since subcutaneous formalin injection leaves a food and fluid deprived rat hypovolemic 24 hours after injection (Stricker and Wolf, 1966) the extracellular space of the formalin treated rats in the present experiment would have been restored to normal most rapidly by isotonic saline. The fact that the formalin treated rats responded to the test solutions in such a way as to achieve a higher relative per cent salt intake than the normals suggests that some degree of regulatory fluid consumption occurred. In addition, the formalin treated animals consumed more NaCl overall than the normals by taking more trials during each test session. Viewed in this way, the formalin injected rats appear to have been drinking in such a way as to consume elevated amounts of nearly isotonic saline overall.

At the time of testing, the adrenalectomized rats were probably hypovolemic and hyponatremic. The relative per cent salt intake of the adrenalectomized group on both test days was appropriate to their probable physiological needs since slightly hypertonic fluids would be able to restore homeostasis most efficiently. In spite of this, the amount of salt consumed by the adrenalectomized rats during the 30 minute test sessions was not sufficient to keep them alive. They continued to lose weight and become moribund throughout testing. One of the six adrenalectomized rats died soon after an exceptional amount of drinking on the Second Test Day. Because of this, the remaining 5 rats were given 2% NaCl and water during the 23½ hour maintenance period following the Second Test Day. An average of 32 ml of 2% NaCl and 19 ml of water was drunk by the adrenalectomized rats during this period. Comparable data were obtained for 3 of the 6 formalin injected rats. An average of 12 ml of 2% NaCl and 63 ml of water was drunk by the three formalin treated rats during the 23½ hour maintenance period following the Second Test Day. Three of the normal rats drank and average of 03 ml of 2% NaCl and 57 ml of water during the same maintenance period. These data, combined with the information concerning the total number of trials taken by each group during the test periods, reveal that while the adrenalectomized rats were motivated toward consuming salt, the formalin treated rats were equally motivated toward consuming slightly hypotonic fluid. Evidently, one major effect of the acute and chronic treatments was to increase the animals motivation to perform the appropriate consummatory behavior.

These results offer strong support for the notion that there is a difference between the sodium appetitive behavior of chronically and acutely deficient rats. Since learning and postingestional factors were essentially eliminated by the testing procedure, the major differences among the experimental groups must have been mediated by peripheral events. The physiological changes that accompanied adrenalectomy and lead to the observed sodium appetite must have affected the peripheral aspects of salt intake in some way. Mook (1968) found that esophagostomized rats began to increase their intake of 3% NaCl a few days after being adrenalectomized, even though only water entered their stomachs by means of a gastric fistula. These data clearly rule out postingestion as a necessary condition for the expression of an appetite for sodium in adrenalectomized rats. Evidently, postingestional factors are not necessary for the onset and development of sodium appetite. While taste stimulation may or may not determine how much of a particular salt solution an adrenalectomized animal will drink (Nachman and Valentino, 1966; Epstein and Stellar, 1955), the altered salt preference of chronically deficient animals must be mediated, at least in part, by peripheral events. The hypertonic saline solutions may have been more palatable for the adrenalectomized rats due to a change in the reinforcing value of the taste of salt (Bare, 1949), even though the actual taste of the saline solutions may not have changed as a result of adrenalectomy.

Unfortunately, the present experiment did not investigate changes in the taste of salt due to the treatments, so that conclusive statements about alterations in the gustatory mechanism of the chronically deficient animals cannot be made. Nevertheless, the various physiological explanations that have been advanced to account for sodium appetitive behavior (Denton, 1965; Stricker and Wolf, 1966) neglect peripheral factors such as taste which have now been shown to contribute significantly to the sodium appetitive behavior of adrenalectomized rats (Experiment II, Mook, 1968, Nachman and Valentino, 1966). Consequently, the role of taste in the regulation of sodium appetite should be reconsidered in the light of these experiments.

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