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Food Intake as a Function of Duration of Food Deprivation in the Albino Rat

John H. Wright

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TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

INTRODUCTION

There have been a large number of studies done which have attempted to determine accurate measures of drive. With drive operationally defined in terms of hours of deprivation (food or water), these studies have been concerned with finding measures which reflect not only the presence of a drive but also the degree to which the drive is present. This has involved the search for measures which vary with hours of deprivation. Some of the measures used for this purpose have been body weight, activity, and intake of the deprived substance. In particular, the intake measure has been attractive to investigators interested in this problem because of the apparently direct relationship it might bear to hours of deprivation.

A number of studies dealing with the stabilization of hunger and thirst for animals on repeated cycles of a constant number of hours of deprivation have used intake of the deprived substance as a measure of adjustment to the deprivation schedule. Examples of such studies for cycles of water deprivation are those by Young, Heyer, and Richey (1952) and Blick (1960). Similar studies for adjustment to food deprivation cycles have been done by Reid and Finger (1955) and Lawrence and Mason (1955). These studies in general have found that the intake measure increases day by day to a limit that is reached for food in from fifteen to twenty days and for water in approximately five days.

Other investigators have been interested in variations in the intake measure after varying hours of deprivation. Part of this interest has originated in the question of whether or not intake of the deprived substance is a suitable indicator of different intensities of drive resulting from different lengths of deprivation. Siegel (1947) found that the amount of water consumed in a five-minute drinking period plotted as a function of various periods of water deprivation up to 48 hours gave a negatively accelerated increasing function to asymptote. Stellar and Hill (1952) found that amount of water consumed in a two-hour drinking period as a function of hours of water deprivation also yields a negatively accelerated increasing function. These investigators used a very wide range of deprivation periods, from 6 to 168 hours, and from these results conclude that amount of water consumed is the best measure of thirst drive. Kessen, Kimble, and Hillmann (1960) found an increasing negatively accelerating curve for water intake up to 47 hours deprivation.

The evidence on food deprivation shows a somewhat different picture. Bousfield and Elliott (1934) introduced feeding delays of 3.5, 12, 24, and 48 hours for animals already on a 23-hour food deprivation cycle and found that both rate of eating and amount eaten decreased with increasing lengths of food deprivation. Horenstein (1951), using increase in body weight as the measure of amount of food eaten, found that amount of food consumed as a function of hours of deprivation produced a generally increasing curve up to 23.5 hours.

Miller (1955-56) presents data which show that food intake increases sharply for six hours deprivation, reaches its maximum for

30 hours deprivation, and falls off for longer deprivation periods. Other evidence cited by him indicates that food intake does not increase for deprivations longer than 24 hours (1955-56, 1956-57). Miller has further suggested (1955-56, 1956-57, 1957) that food intake is not the best measure of hunger, particularly at the higher levels of deprivation. He bases this conclusion on the fact that food intake fails to increase steadily with hours of deprivation and also fails to agree with other measures of strength of drive, such as bar-pressing and a score based on tolerance to eating food which contains quinine following different lengths of food deprivation. A good example of such lack of agreement is shown in a study by Miller, Bailey, and Stevenson (1950), who found that rats with hypothalamic lesions ate more food but bar-pressed less for food than normal hungry rats. Miller attempts to explain the failure of food intake to increase with increasing hours of food deprivation in terms of limitations on intake produced by stomach volume or the inability of the subject to deal with food, this limitation increasing as deprivation becomes more severe. He observes that the consummatory response is sensitive at the shorter lengths of deprivation, the bar-pressing measure is sensitive at the longer lengths of deprivation, while the quinine test is sensitive throughout the entire deprivation range, but in a very gross manner only.

The present study is an attempt to investigate food intake as a function of hours of food deprivation for a wide range of deprivation values. On the basis of the existing evidence it is expected that intake will increase for the shorter deprivation values but subsequently decrease for the longer deprivation values. Additional interest here lies in the secondary measures of weight loss during deprivation, water intake during the consumption period, and weight gained during the consumption period.

METHOD

Subjects. The Ss consisted of 44 experimentally naive male albino rats of the Sprague-Dawley strain, approximately 215 days old at the beginning of the habituation phase of the experiment.

Apparatus. All Ss were housed in individual home cages with wire-mesh bottoms placed on metal racks throughout the entire experiment. These cage racks were located in a small soundproof room in which the temperature was thermostatically controlled. Average temperature during the experiment was 77°F. Illumination was furnished by a single, small window facing in a north-westerly direction. The Ss were exposed to the natural day-night cycle. Body weight and weight of food were measured by a triple-beam balance scale sensitive to 0.1 gm. The water measures were recorded from a 150 ml. graduated cylinder accurate to 0.5 ml.

Procedure. Upon receipt from the supplier the Ss were placed on ad lib food (Purina lab pellets) and water. The experiment began with a seven-day habituation phase. During this time body weight was recorded daily and seven 24-hour food consumption measures were taken. These measures were taken daily at 1:00 P.M. All Ss had free access to both food and water during this period.

On the last day of habituation the Ss were ranked on the basis of their mean 24-hour food intake during the preceding seven days. The Ss were assigned at random, eleven at a time, to one of the eleven food deprivation conditions. These conditions were 0, 12, 24, 36, 48, 72, 96, 120, 144, 168, and 192 hours of food deprivation.

Thus four matched groups (blocks) of eleven Ss each were formed (Edwards, 1960; Ray, 1960).

The experiment proper began the day after the last day of habituation. A two-hour eating period for all Ss in all groups was set on the eighth day after the first day of the experiment proper, from 1:00 P.M. to 3:00 P.M. Food was removed from each group and the Ss in each group were weighed at the appropriate number of hours before this eating period. Thus each group was maintained, as in habituation, on ad lib food and water until its food was removed. The Ss in each group continued to have free access to water during their period of food deprivation. The 0-hour food deprivation group was not deprived of food or water at any time prior to the eating period. Since the eating began at 1:00 P.M., it was necessary to enter the experimental room at 1:00 A.M. twice---to remove food from the 36-hour and the 12-hour deprived groups. E's activities at these times were guided by a weak flashlight.

Just before the beginning of the eating period all Ss were weighed. Pre-measured food and water were given to all groups at 1:00 P.M. A control bottle was mounted on an empty cage to determine the amount of water lost by spillage and evaporation during the two-hour eating period. There was no activity in the experimental room during the eating period. At the end of the eating period, the remaining food and water were removed from the animals' cages. All Ss were then weighed. Finally the remaining food and water were measured and each S's intake of food and water during the two-hour period was determined. It will be noted that the weight measures taken permit the computation of weight loss during deprivation and weight gain during the intake period for all groups.

RESULTS

Analysis of variance for food intake during habituation was done to determine if matching resulted in treatment groups equal on this measure. Table 1 shows that the results of this test were not significant ($P > .05$), thus permitting the null hypothesis to be retained. The significant blocks effect was produced by the procedure of matching on ranked habituation food intake.

Principal interest lies in the four measures taken for all groups during the experiment proper. These measures are: (1) weight loss during the deprivation period; (2) food intake during the consumption period; (3) water intake during the consumption period; and (4) weight gain during the consumption period.

Weight loss during the deprivation period. The function relating this measure to hours of deprivation is shown in Figure 1. Since the 0-hour group was never deprived at any time, 0.0 gm. weight loss for this group was assumed. Weight loss was a generally increasing function of hours of deprivation throughout the entire range. There is a tendency for the curve to assume slight negative acceleration, particularly at the last three points. The major exception to the above noted trend was the point for the 48-hour deprived group which failed to rise from the point exhibited by the 36-hour deprived group.

Analysis of variance of the data in Figure 1 is presented in Table 2. Differences among groups were found to be significant ($P < .001$). In view of the overall significance of these differences, Duncan's test (Edwards, 1960) was used to evaluate differences between

Table 1

Analysis of Variance of Twenty-four Hour
Food Intake During the Habituation Period

Source	df	ss	ms	F	P
Treatments	10	3.98	0.398	1.07	>.05
Blocks	3	137.97	45.990	123.96	<.001
Residual	30	11.13	0.371		
Total	43	153.08			

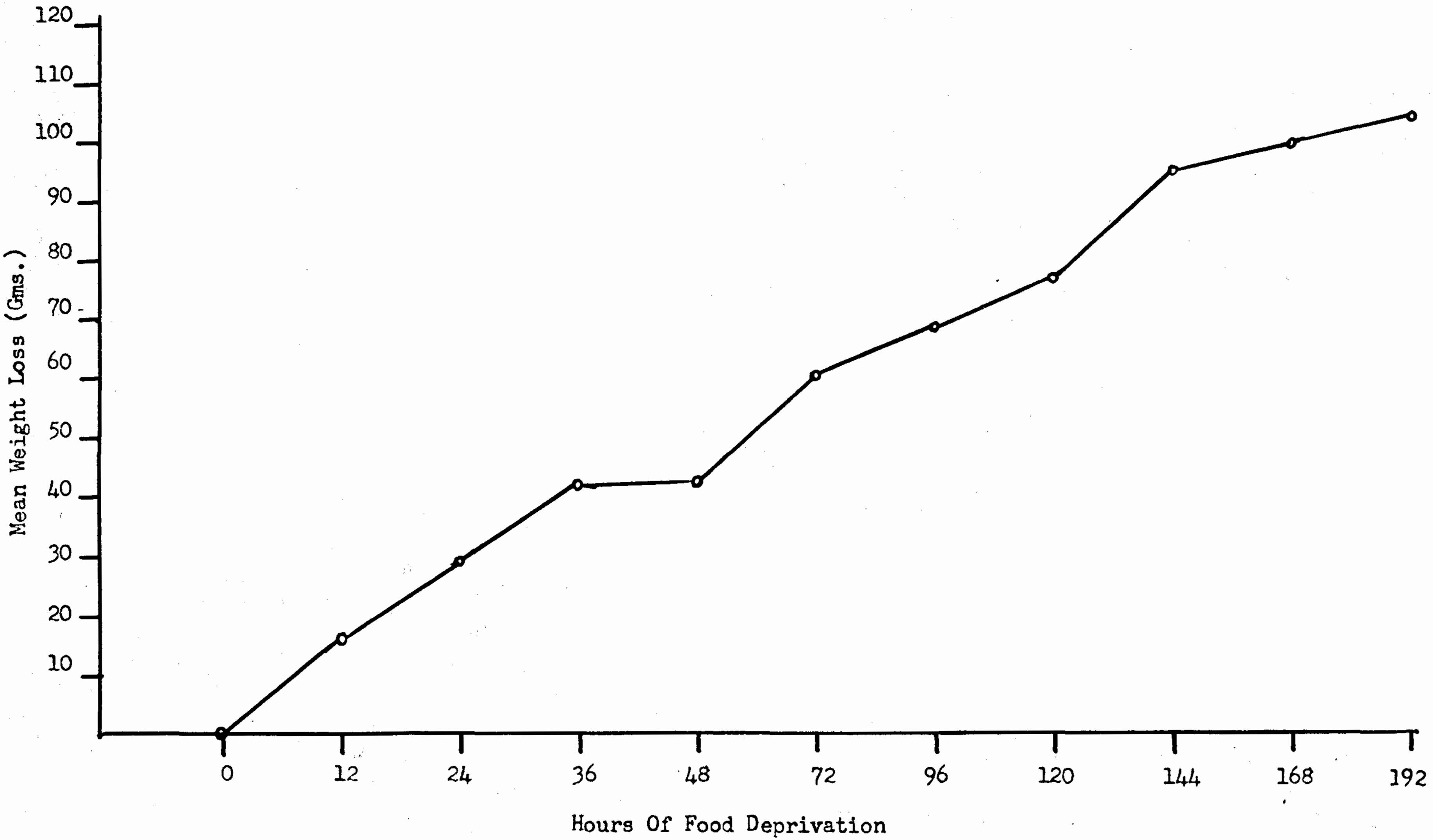

Fig. 1. Mean body weight loss as a function of hours of food deprivation.

Table 2

Analysis of Variance of Weight Loss During the Deprivation Period

Source	df	ss	ms	F	P
Treatments	10	48,138.65	4,813.87	192.25	<.001
Blocks	3	364.24	121.41	4.85	<.01
Residual	30	751.35	25.04		
Total	43	49,254.24			

individual group means. This analysis is presented in Table 3. The principal findings from the inter-group comparisons are that: (1) the 36-hour and 48-hour deprived groups do not differ significantly; (2) the 144-hour and 168-hour, and the 168-hour and 192-hour deprived groups do not differ significantly, but the 144-hour and 192-hour groups do differ significantly; (3) all other adjacent group mean differences are significantly different. With the exception of the first findings, the analysis supports the notion that the function in Figure 1 is an increasing one with some tendency to flatten out at the upper end.

Table 2 also shows a significant blocks effect; weight loss during deprivation was different for blocks formed from habituation food intake. Further statistical analysis showed that this effect was produced by the block containing the Ss with the smallest habituation food intake. This block lost less weight than the other blocks ($P < .05$); there were no other differences among blocks.

Food intake during the consumption period. This measure is presented in Figure 2. The curve rises sharply to 24 hours followed by a more gradual rise to 72 hours, and then drops to a reasonably constant level for the more severely deprived groups.

The analysis of variance in Table 4 yielded highly significant group differences ($P < .001$). Inter-group comparisons appear in Table 5. As in Table 3 and in subsequent analyses of inter-group differences, the .05 level was used to evaluate the significance of the differences. Table 5 shows that the only significant differences in mean food intake are between the 0-hour food deprived and all other groups, and between the 12-hour deprived and all other groups; groups deprived for 24 hours or longer consumed amounts of food that were identical

Table 3

Duncan's Test of Weight Loss During the Deprivation Period *

Means	(0) 00.0	(12) 16.6	(24) 29.4	(36) 42.0	(48) 42.0	(72) 60.4	(96) 68.8	(120) 76.6	(144) 94.8	(168) 99.2	(192) 103.9	Shortest Significant Ranges	
						Differences in Means							
00.0 (0)		16.6	29.4	42.0	42.0	60.4	68.8	76.6	94.8	99.2	103.9	R2	7.23
16.6 (12)			12.8	25.4	25.4	43.8	52.2	60.0	78.2	82.6	87.3	R3	7.59
29.4 (24)				12.6	12.6	31.0	39.4	47.2	65.4	69.8	74.5	R4	7.83
42.0 (36)					00.0	18.4	26.8	34.6	52.8	57.2	61.9	R5	8.00
42.0 (48)						18.4	26.8	34.6	52.8	57.2	61.9	R6	8.13
60.4 (72)							8.4	16.2	34.4	38.8	43.5	R7	8.23
68.8 (96)								7.8	26.0	30.4	35.1	R8	8.31
76.6 (120)									18.2	22.6	27.3	R9	8.38
94.8 (144)										4.4	9.1	R10	8.43
99.2 (168)											4.7	R11	8.48
	(0)	(12)	(24)	(36)	(48)	(72)	(96)	(120)	(144)	(168)	(192)		

* Any two means underscored by the same line do not differ significantly at the .05 level.
Any two means not underscored by the same line do differ significantly at the .05 level.

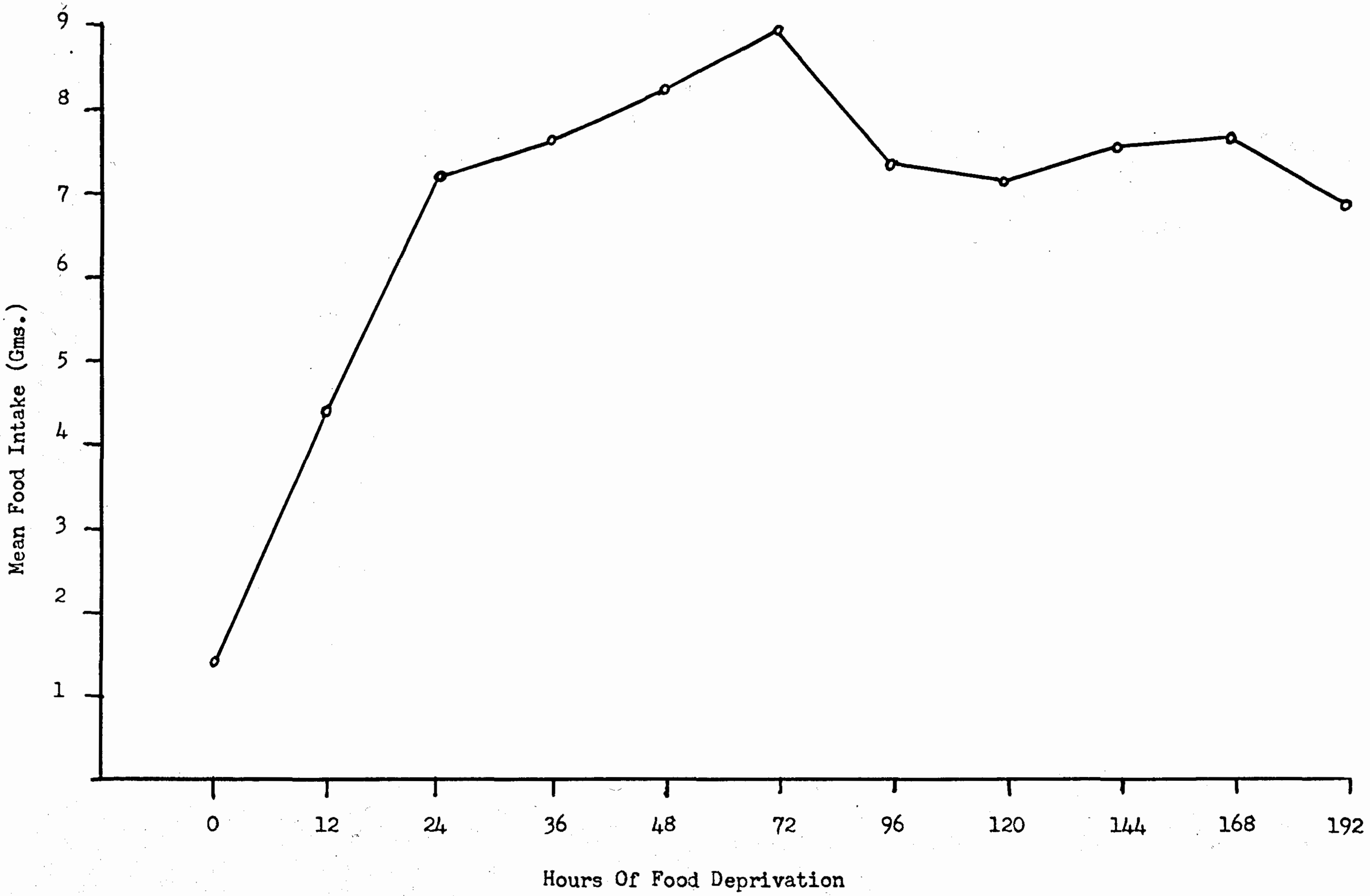

Fig. 2. Mean food intake as a function of hours of food deprivation.

Table 4

Analysis of Variance of Food Intake
During the Consumption Period

Source	df	ss	ms	F	P
Treatments	10	171.69	17.17	9.49	<.001
Blocks	3	8.65	2.88		
Residual	30	54.38	1.81		
Total	43	234.72			

Table 5

Duncan's Test of Food Intake During the Consumption Period

	Differences in Means												
Means	(0) 1.4	(12) 4.4	(192) 6.8	(120) 7.1	(24) 7.2	(96) 7.3	(144) 7.5	(168) 7.6	(36) 7.6	(48) 8.2	(72) 8.9	Shortest Significant Ranges	
1.4 (0)		3.0	5.4	5.7	5.8	5.9	6.1	6.2	6.2	6.8	7.5	R2	1.94
4.4 (12)			2.4	2.7	2.8	2.9	3.1	3.2	3.2	3.8	4.5	R3	2.04
6.8 (192)				0.3	0.4	0.5	0.7	0.8	0.8	1.4	2.1	R4	2.11
7.1 (120)					0.1	0.2	0.4	0.5	0.5	1.1	1.8	R5	2.15
7.2 (24)						0.1	0.3	0.4	0.4	1.0	1.7	R6	2.19
7.3 (96)							0.2	0.3	0.3	0.9	1.6	R7	2.21
7.5 (144)								0.1	0.1	0.7	1.4	R8	2.24
7.6 (168)									0.0	0.6	1.3	R9	2.25
7.6 (36)										0.6	1.3	R10	2.27
8.2 (48)											0.7	R11	2.28
	(0)	(12)	(192)	(120)	(24)	(96)	(144)	(168)	(36)	(48)	(72)		

under the null hypothesis.

Water intake during the consumption period. The water intake function, presented in Figure 3, roughly parallels the food intake function (Figure 2) in its rise to a peak at 72 hours and subsequent decrease for the higher deprivation periods. This finding is to be expected on the basis of the known positive relationship between food and water intake.

From Table 6 it can be seen that the analysis of variance applied to this measure attained a high level of significance ($P < .001$). The Duncan test for this measure is presented in Table 7. The major findings for this test are that: (1) the 12-hour and 24-hour deprived groups differ significantly as do the 48-hour and 72-hour deprived groups, and all other adjacent group comparisons fail to attain significance; (2) the 0-hour and 12-hour food deprived groups are significantly different from all points except each other.

Weight gain during the consumption period. Reference to Figure 4 denotes the close similarity between this function and the functions for the two intake measures. Inspection of this curve reveals a general increase up to 72 hours followed by a subsequent decrease. The resemblance of this function to the food and water functions is understandable because of the dependency of this measure on intake.

Analysis of variance (Table 8) indicated that the overall differences among groups reached a high level of significance ($P < .001$). An analysis of individual inter-group differences by Duncan's test is presented in Table 9. This test shows that the 0-hour and 12-hour

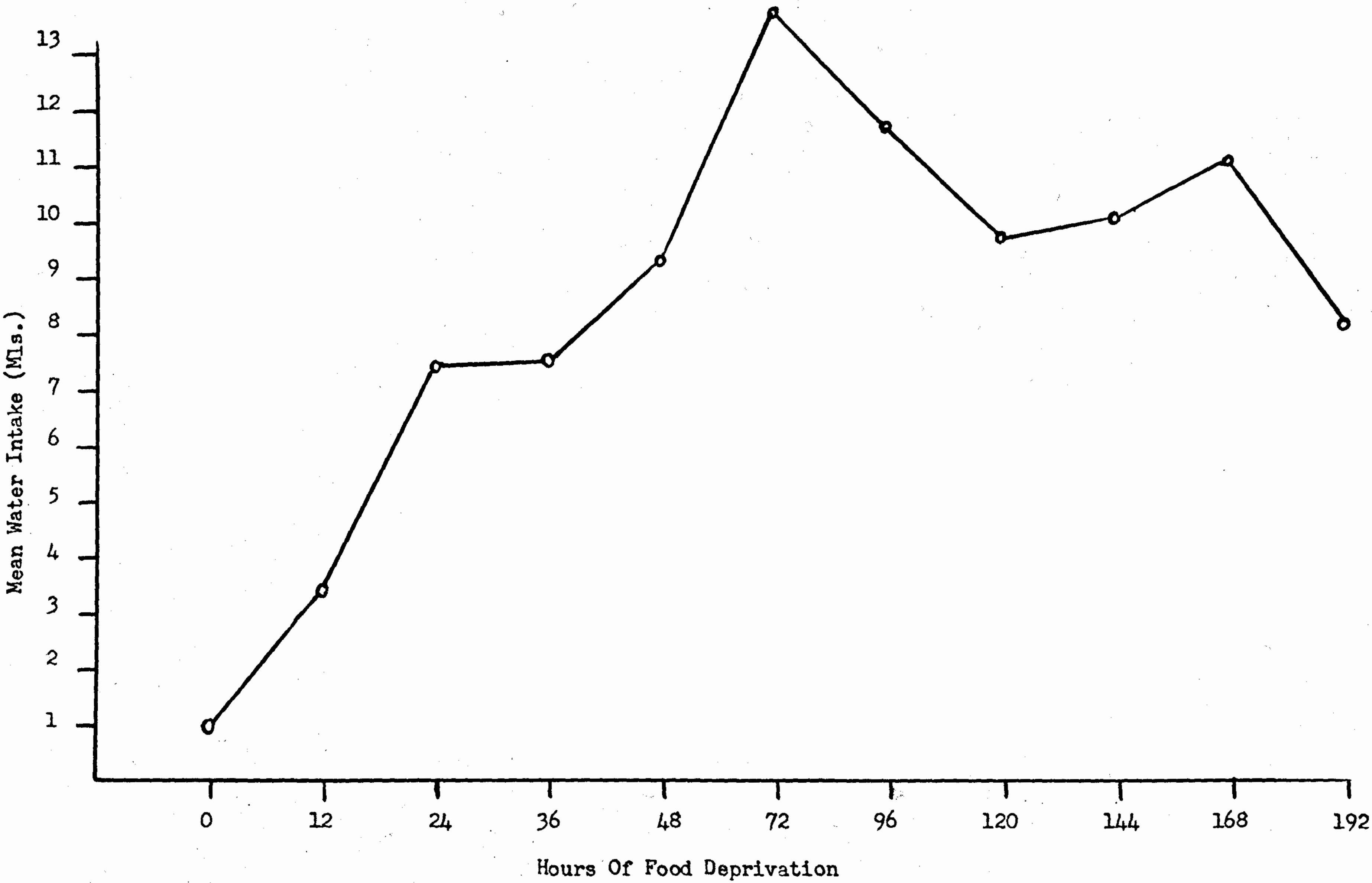

Fig. 3. Mean water intake as a function of hours of food deprivation.

Table 6

Analysis of Variance of Water Intake
During the Consumption Period

Source	df	ss	ms	F	P
Treatments	10	531.29	53.13	9.68	<.001
Blocks	3	10.42	3.47		
Residual	30	164.59	5.49		
Total	43	706.30			

Table 7

Duncan's Test of Water Intake During the Consumption Period

Differences in Means

Means	(0) 1.0	(12) 3.4	(24) 7.4	(36) 7.5	(192) 8.1	(48) 9.3	(120) 9.7	(144) 10.0	(168) 11.0	(96) 11.6	(72) 13.7	Shortest Significant Ranges	
1.0 (0)		2.4	6.4	6.5	7.1	8.3	8.7	9.0	10.0	10.6	12.7	R2	3.38
3.4 (12)			4.0	4.1	4.7	5.9	6.3	6.6	7.6	8.2	10.3	R3	3.56
7.4 (24)				0.1	0.7	1.9	2.3	2.6	3.6	4.2	6.3	R4	3.67
7.5 (36)					0.6	1.8	2.2	2.5	3.5	4.1	6.2	R5	3.75
8.1 (192)						1.2	1.6	1.9	2.9	3.5	5.6	R6	3.81
9.3 (48)							0.4	0.7	1.7	2.3	4.4	R7	3.86
9.7 (120)								0.3	1.3	1.9	4.0	R8	3.89
10.0 (144)									1.0	1.6	3.7	R9	3.93
11.0 (168)										0.6	2.7	R10	3.95
11.6 (96)											2.1	R11	3.97

(0) (12) (24) (36) (192) (48) (120) (144) (168) (96) (72)

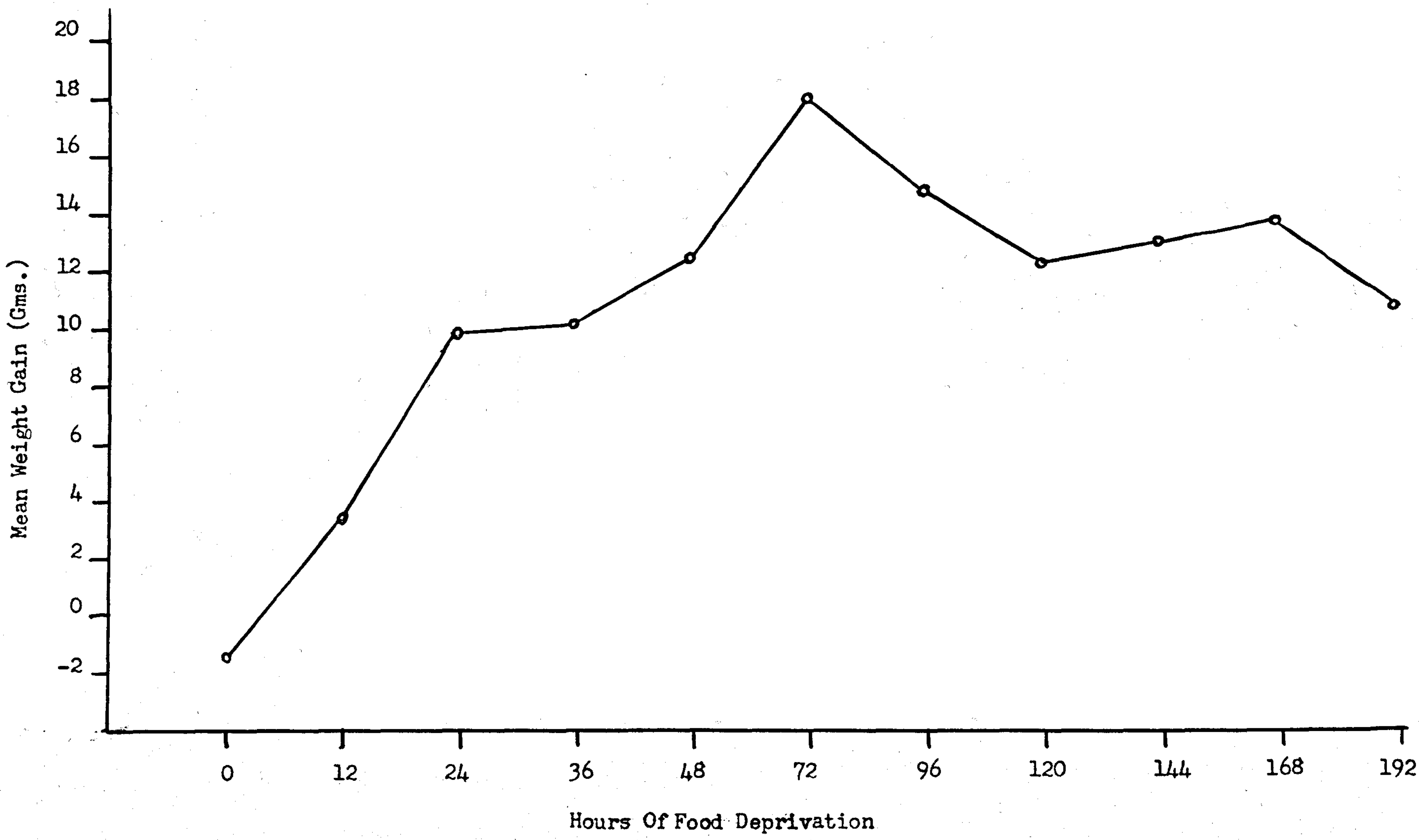

Fig. 4. Mean weight gain during consumption period as a function of hours of food deprivation.

Table 8

Analysis of Variance of Weight Gain
During the Consumption Period

Source	df	ss	ms	F	P
Treatments	10	1,138.73	113.87	12.88	$<.001$
Blocks	3	52.06	17.35		
Residual	30	265.08	8.84		
Total	43	1,455.87			

Table 9

Duncan's Test of Weight Gain During the Consumption Period

Differences in Means

Means	(0) -1.4	(12) 3.4	(24) 9.9	(36) 10.1	(192) 10.6	(120) 12.1	(48) 12.4	(144) 12.9	(168) 13.6	(96) 14.7	(72) 17.9	Shortest Significant Ranges	
-1.4 (0)		4.8	11.3	11.5	12.0	13.5	13.8	14.3	15.0	16.1	19.3	R2	4.30
3.4 (12)			6.5	6.7	7.2	8.7	9.0	9.5	10.2	11.3	14.5	R3	4.52
9.9 (24)				0.2	0.7	2.2	2.5	3.0	3.7	4.8	8.0	R4	4.67
10.1 (36)					0.5	2.0	2.3	2.8	3.5	4.6	7.8	R5	4.77
10.6 (192)						1.5	1.8	2.3	3.0	4.1	7.3	R6	4.84
12.1 (120)							0.3	0.8	1.5	2.6	5.8	R7	4.90
12.4 (48)								0.5	6.2	2.3	5.5	R8	4.95
12.9 (144)									0.7	1.8	5.0	R9	4.99
13.6 (168)										1.1	4.3	R10	5.02
14.7 (96)											3.2	R11	5.05

(0) (12) (24) (36) (192) (120) (48) (144) (168) (96) (72)

points are significantly different from all subsequent points and from each other. In addition to the significant differences between the 0-hour and 12-hour and the 12-hour and 24-hour groups, the difference between the 48-hour and 72-hour deprived groups is the only other significant adjecent difference. It may be noted that the 0-hour group exhibited a weight loss during the consumption period.

DISCUSSION

The food intake function in Figure 2 generally confirms the results reported by Miller (1955-56, 1956-57). It shows an initial increase for the shorter lengths of deprivation followed by a failure to exhibit any further increase for the longer deprivation values. It should be noted, however, that the curve does not show a statistically significant decrease for the severe deprivation values. The increase in food intake for deprivations up to 24 hours is also in general agreement with Horenstein's results (1951).

There is some lack of agreement between the present results for food intake and the results obtained by Stellar and Hill (1952) for water intake. The major discrepancy lies in the failure of the food intake curve to continue to rise throughout the entire deprivation range; the water intake curve of Stellar and Hill continued to rise progressively as hours of water deprivation increased. Thus the evidence from this and previously mentioned studies indicates that the two intake measures as functions of hours of deprivation of their respective deprived substances are not comparable.

It should be kept in mind that the results presented for food intake here are for a single deprivation experience. A number of investigators (Baker, 1955; Ghent, 1957; Hebb, 1949; Lawrence and Mason, 1955) have emphasized the role of learning in determining intake when animals are given repeated experiences with deprivation. These studies show that under those conditions intake shows a gradual increase with repeated deprivations. Thus there is the possibility that animals maintained on cycles of severe deprivation values such as the ones used in the present study might increase their intakes above the amounts obtained here. The same might also occur, of course, for animals given repeated deprivations of less severe duration.

In connection with the food intake measure, it might be noted that some years ago Bousfield (1933, 1934, 1935) presented an analysis of eating rates and the effects of deprivation on eating. Bousfield showed that for cats and for chickens, and by extension also for rats, amount of food eaten is a negatively accelerated increasing function of the time spent eating, i.e.,

$$f = c\,(1 - e^{-mt}) \qquad \text{(Equation 1)}$$

where: f = amount of food eaten, the dependent variable.

c = a constant, the asymptote of the amount eaten measure-- designated as the physiological limit of food consumable by the animal.

e = base of natural logarithms.

m = a constant, the rate of approach to the asymptote (c)-- designated as the coefficient of voracity.

t = time spent eating, the independent variable.

Bousfield further shows (1935) that the effect of deprivation on the eating function is to (1) reduce the physiological limit (c), presumably because of "atrophy of the alimentary canal," and (2) increase the coefficient of voracity (m). This latter results in the animal's approaching his reduced limit (c) of food intake more rapidly.

More recent suggestions have been advanced that may be used to explain the failure of the food intake measure to vary directly with hours of food deprivation (Figure 2). Yamaguchi (1951) has postulated an inanition factor which combines in a multiplicative fashion with drive, as determined by particular maintenance schedule employed, to produce effective drive which in turn determines behavior potential. Effective drive is assumed to increase with hours of deprivation up to approximately 60 hours. Although Yamaguchi assumes that drive (i.e., hunger) increases continously with increasing hours of deprivation, at the higher deprivation levels beyond 60 hours he assumes that inanition causes effective drive to become progressively weaker. It is effective drive which is assumed to multiply the habit factor (i.e., habit of eating) to produce behavior potential. If consummatory activity might be assumed to be synonymous with behavior potential, then the inanition factor might be invoked to explain the results obtained here. According to this analysis the animal's behavior potential to eat would be reduced because of reduced effective drive as deprivation becomes severe and continuous increases in amount eaten would not be expected.

Miller (1955-56) and Bousfield and Elliott (1934) offer an explanation in terms of stomach factors. According to Miller the volume of the stomach and the animal's ability to deal with the food limit food intake. This limit is assumed to decrease under severe deprivation. Bousfield and Elliott refer to changes in tonicity of the stomach as responsible for reducing food capacity after severe deprivation.

Both the water intake and weight gain measures do not reach maximum values at 24 hours as did the food intake measure. The water intake and weight gain measures increase gradually after 24 hours up to 72 hours before exhibiting a subsequent decline. However, the close correspondence in shape of Figures 2, 3, and 4 is additional evidence of the close relationship between water and food intake and their joint determination of weight gain.

The weight loss measure (Figure 1) shows the most direct relationship to hours of food deprivation. This finding is related to Ehrenfreund's (1959) analysis of the effects of food deprivation. This investigator concluded that for a 23-hour deprivation schedule weight loss during the 23-hour period was perhaps the best way to specify hunger drive. The present study at least shows that the weight loss measure varies consistently with deprivation.

Clearly if one defines hunger drive with reference to hours of food deprivation it would appear that food intake does not vary beyond 24 hours deprivation and does not constitute a satisfactory measure of hunger drive. While the results of this study must be regarded as tentative because of the small number of Ss in each group, it may be concluded that the search for a fully adequate measure of hunger must continue. Perhaps the best strategy at present is to use a number of different measures, a procedure for which Miller (1957a) has presented a convincing argument.

SUMMARY

The present study was an investigation of food intake as a function of hours of food deprivation. Four groups of male albino rats matched on mean daily food intake during an habituation phase were randomly assigned, one from each group, to one of the eleven food deprivation conditions. These conditions were 0, 12, 24, 36, 48, 72, 96, 120, 144, 168, and 192 hours of food deprivation. Animals were deprived the appropriate number of hours before a two-hour eating period; this period was at the same time for all groups. All Ss had free access to water throughout the entire experiment.

The measures taken in the experiment were: weight at the time food was removed from each group; weight just before the eating period; weight immediately after the eating period; amount of food consumed during the eating period; and amount of water consumed during this period. From the weight measures taken, weight loss during deprivation and weight gain during the intake period were computed and these two measures, in addition to the consumption measures, were the four measures of primary interest.

Analyses of variance for these measures yielded highly significant results. The principal findings with regard to each measure were:

1. Weight loss during deprivation was a generally increasing function of hours of food deprivation throughout the entire range.
2. Food intake increased rapidly up to 24 hours and thereafter

remained relatively constant as a function of hours of food deprivation.

3. Both water intake and weight gain during the consumption period increased rapidly up to 24 hours deprivation followed by a more gradual increase up to 72 hours deprivation and then exhibited a general decline as functions of hours of food deprivation.

Possible suggestions to account for the failure of food intake to increase with corresponding increases in length of food deprivation were discussed.

APPENDIX

Table 10

Amount Weight Lost During Deprivation *

S	(192)	S	(168)	S	(144)	S	(120)	S	(96)	S	(72)	S	(48)	S	(36)	S	(24)	S	(12)	S	(0)
20	115.6	28	92.3	17	90.7	27	79.6	39	72.7	16	62.9	19	48.2	1	45.3	33	30.7	38	12.3	10	0.0
23	105.2	21	104.7	8	105.5	32	74.0	9	69.2	18	65.0	40	44.1	43	43.2	12	33.5	41	22.8	7	0.0
13	92.0	46	99.8	6	96.2	34	83.1	30	68.9	25	63.2	36	38.8	11	40.7	5	31.0	15	21.3	31	0.0
2	102.8	45	99.8	26	87.0	24	69.8	35	64.6	37	50.7	44	36.8	22	38.6	3	22.3	42	10.3	4	0.0
Ms	103.9		99.2		94.8		76.6		68.8		60.4		42.0		42.0		29.4		16.6		0.0

* As in this and in subsequent Tables, Rows 1, 2, 3, and 4 correspond to Blocks 1, 2, 3, and 4 respectively.

Table 11

Amount Weight Gained During Intake Period

S	(192)	S	(168)	S	(144)	S	(120)	S	(96)	S	(72)	S	(48)	S	(36)	S	(24)	S	(12)	S	(0)
20	14.9	28	10.0	17	10.9	27	14.7	39	16.0	16	20.5	19	5.9	1	12.2	33	11.8	38	1.7	10	-1.6
23	10.7	21	15.6	8	15.5	32	11.2	9	17.5	18	17.1	40	15.6	43	10.0	12	14.0	41	4.7	7	-1.7
13	8.0	46	14.2	6	13.7	34	11.4	30	10.1	25	20.5	36	13.9	11	10.7	5	12.6	15	4.3	31	0.7
2	8.8	45	14.4	26	11.6	24	11.0	35	15.1	37	13.4	44	14.0	22	7.5	3	1.3	42	3.1	4	-3.0
Ms	10.6		13.6		12.9		12.1		14.7		17.9		12.4		10.1		9.9		3.4		-1.4

Table 12

Amount Food Consumed During Intake Period

S	(192)	S	(168)	S	(144)	S	(120)	S	(96)	S	(72)	S	(48)	S	(36)	S	(24)	S	(12)	S	(0)
20	9.2	28	8.6	17	6.4	27	7.4	39	9.6	16	9.5	19	7.4	1	7.8	33	7.3	38	3.9	10	3.4
23	6.5	21	6.6	8	8.2	32	7.6	9	6.9	18	9.9	40	9.0	43	7.5	12	9.4	41	3.0	7	0.2
13	6.0	46	7.9	6	8.2	34	5.7	30	6.1	25	9.5	36	8.1	11	7.9	5	8.5	15	5.1	31	0.2
2	5.3	45	7.1	26	7.1	24	7.7	35	6.5	37	6.7	44	8.1	22	7.1	3	3.6	42	5.8	4	1.8
Ms	6.8		7.6		7.5		7.1		7.3		8.9		8.2		7.6		7.2		4.4		1.4

Table 13

Amount Water Consumed During Intake Period

S	(192)	S	(168)	S	(144)	S	(120)	S	(96)	S	(72)	S	(48)	S	(36)	S	(24)	S	(12)	S	(0)
20	11.5	28	7.5	17	11.0	27	14.0	39	13.5	16	14.0	19	7.0	1	10.5	33	10.0	38	3.5	10	0.5
23	8.5	21	11.0	8	11.0	32	8.5	9	11.5	18	15.0	40	10.0	43	7.5	12	8.0	41	5.0	7	1.0
13	6.5	46	10.5	6	11.0	34	9.5	30	12.0	25	16.5	36	11.0	11	9.0	5	11.0	15	3.0	31	3.0
2	8.0	45	17.0	26	9.0	24	9.0	35	11.5	37	11.5	44	11.0	22	5.0	3	2.5	42	4.0	4	1.5
Ms	8.6		11.5		10.5		10.2		12.1		14.2		9.8		8.0		7.9		3.9		1.5
*	8.1		11.0		10.0		9.7		11.6		13.7		9.3		7.5		7.4		3.4		1.0

* Means minus control bottle correction.

Table 14

Amount Food Consumed During Habituation Period

S	(192)	S	(168)	S	(144)	S	(120)	S	(96)	S	(72)	S	(48)	S	(36)	S	(24)	S	(12)	S	(0)
20	27.3	28	28.1	17	27.1	27	26.3	39	27.3	16	26.8	19	28.1	1	26.2	33	27.7	38	26.7	10	28.1
23	25.9	21	26.1	8	25.7	32	26.2	9	26.2	18	25.7	40	25.5	43	25.9	12	26.2	41	25.6	7	25.0
13	24.4	46	24.5	6	24.8	34	24.6	30	24.6	25	24.0	36	24.2	11	24.1	5	24.9	15	24.7	31	24.1
2	23.7	45	23.2	26	21.2	24	22.7	35	21.3	37	23.3	44	23.4	22	21.8	3	22.4	42	22.3	4	21.6
Ms	25.3		25.5		24.7		25.0		24.8		25.0		25.3		24.5		25.3		24.8		24.7

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