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The Effects of Swimming vs Running on Weight Loss in Small Mammals

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The Effects on Weight Loss Due to Swimming vs. Running in Small Mammals.

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OBJECTIVES

For years, it has been said that swimming is a better exercise than running because the muscle groups do not have to endure the high impact forces that are produced by running (Winters 1987).

But recent studies suggest that swimming may not be anymore beneficial to the body than running in terms of weight control. In fact, swimming may cause the participant to gain a layer of fat just under their skin in order to insulate the body against the cold water (Garver, Personal Interview. 1993). We will attempt to show that swimming is as effective for losing weight as running.

MATERIALS AND METHODS

We set up four random groups of five young, female hamsters each. The first set was the control group and was not subjected to exercise. The second set exercised by running. And the third and fourth sets of hamsters exercised by swimming; one group in cold water, and the other in warm water. All of the hamsters had their cages cleaned weekly and received identical care. They were supplied with as much food and water as they wanted. For housing, we placed the hamsters in cages by groups.

The initial weights of the hamsters were recorded. To distinguish the animals from each other, a small dab of stain

from the microbiology laboratory (methylene blue, and cobalt fuschia) were used. The animals were exercised at approximately the same time every day for five days a week, their intake of food was monitored, and they were weighed every 3-4 days. The food intake was measured every day as a group.

RUNNING GROUP

We placed the running hamsters into plastic balls and let them run as continuously as possible for ten minutes the first day, increasing the exercise time every other day five minute until the hamsters were exercising thirty minutes a day.

CONTROL GROUP

During the exercise time, the control group remained in their cages. They remained in their cages continuously except for when they were weighed or their cages were cleaned.

SWIMMING GROUPS

A trash can was used for the swimming group of hamsters. We placed warm water, about 37°C, in one can, and 27°C in the other can. The hamsters were placed into their respective tubs and forced to swim for ten minutes the first day increasing by five minute intervals every other day until the length of thirty minutes was reached. Afterwards, the animals were dried and returned to their respective cages.

The results were tabulated at the end of three weeks and again at the end of six weeks. To analyze the data, the weight gain percentage per week was averaged (Table 1) and graphed on a computer (Fig 1). Then the weekly food intake was recorded

(Table 1) and graphed on a computer (Fig 2).

RESULTS

Since we used young hamsters, they all gained weight through normal growth; but weight loss also can be determined by the amount of weight gained by each hamster. The runners gained on average a full six grams more than the cold swimmers, which gained five grams more than the warm swimmers.

The average weight percentage of the hamsters tended to drop from the first to the second weeks, rise until the third week, drop drastically until the fourth week, and then begin to slowly rise again until the sixth week (Fig 1).

The food intake per week tended to decrease steadily until third week, increase briefly for a week, and then decrease more rapidly until the end of the experiment (Fig 2).

The data was statistically analyzed using a two way Analysis of Variance (AOV) test.

DISCUSSION

Throughout the experiment the warm water swimmers consistently gained less weight than the other groups. Phil Garver, a physical education professor at Southern College, hypothesized that the cold water swimmers developed a layer of fat as insulation from the cold water (Phil Garver-Personal Interview, 1993). A way to test this in future experiments would be to measure the fat of all the hamsters after the experiment was completed.

Another possible explanation for why the runners gained more

weight than the other groups could be that the runners were not forced to run consistently the entire amount of time. Future experiments where the running hamsters were forced to run the entire time should hypothetically give lower weight gains.

The most difference seemed to occur in the first three weeks, or the first half of the experiment. At the midway point, the runners had gained, on average, seven grams more than the cold swimmers, who had gained nine grams more than the warm swimmers (or the runners gained sixteen grams, on average, more than the warm swimmers). We are not sure why the groups all lost a lot of weight in the fourth week.

The statistical tests showed that there was a significant difference between the groups and weight change; and a highly significant difference between the weight change per week (Fig 3). The statistical test done on the food mass consumed per group per week showed a significant difference between the food consumed per week and an almost significant difference between the food consumed per group (Fig 4). We believe that a larger population size would allow there to be a significant difference.

Recent tests have suggested that heart rates in swimmers reach a lower peak value while exercising than those in runners (Anonymous 1994). Future experiments could attempt to determine how accurate this study is. If this is true, then the results of weight gain/loss would also be skewed. Animals that reach a higher peak heart rate consequently burn calories faster.

Table 1:

GROUP	PERCENT INCREASE BY MASS			
Run	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Tan/Wht. (bl)	31.270823	24.498429	22.434715	2.7830637
Tan	30.443262	13.755607	23.539252	2.3793404
Brwn/Wht	24.001459	21.356082	17.416071	3.9946325
Tan/Wht. (red)	22.688942	23.472961	18.643	3.4171388
Tan/Wht.	17.247994	16.852596	23.11609	11.600496
Average	25.196128	20.166016	21.014493	4.6486466
FOOD EATEN IN GRAMS	50.81	46.1	39.43	49.58
Cold Water				
Tan/Wht.	26.723029	22.929659	21.696555	7.1352399
Brwn/Wht.	20.958678	11.847499	19.682346	1.1024908
Dk. Grey	42.636557	11.556157	21.858321	6.0222974
Tan	17.36411	9.6434463	17.405393	6.8506654
Lt. Grey	19.341756	13.383871	17.544669	3.1283711
Average	24.622458	13.695974	19.606357	4.8773243
FOOD EATEN IN GRAMS	43.64	43.65	43.79	49.58
Warm Water				
Tan/Wht	26.687598	12.053622	20.076405	9.4608171
Tan/Wht (red)	28.400909	17.308544	11.735849	12.901047
Tan/Wht (bl)	16.488186	17.277105	13.077019	-6.9542254
White	17.148114	-2.5757814	10.897953	5.1751708
Brwn/Wht	15.688386	9.7750194	19.957597	6.9871568
Average	21.063276	11.022396	15.477405	5.7264636

Table 1:

WEEK 5	WEEK 6	Total % Weight Change	% Wt Change Mid
5.8011263	9.1578564	137.521815	78.20396731
12.782239	18.973027	151.8262411	67.73812132
3.4739454	13.496403	115.7942732	62.77361161
8.7741825	10.624065	123.6595068	64.80490232
18.445433	2.3777865	128.2699686	57.2166796
9.752402	10.690271	131.4552556	66.37663675
40.95	36.31		
8.6327029	7.2303207	136.5925381	71.34924301
-1.4741519	13.968026	83.81818182	52.48852276
9.3042907	7.6447346	141.8838062	76.05103482
5.6273063	9.5895197	86.8652271	44.41294936
1.4073792	6.7704426	77.60099828	50.27029633
4.8279899	8.899656	102.8995235	57.92478906
41.05	30.33		
15.488756	7.7091198	132.096475	58.81762478
10.679031	7.0720721	125.1799924	57.4453021
10.938978	5.276623	67.87353391	46.84231001
6.3441603	10.384715	56.2649494	25.47028531
12.19163	7.7058997	96.94848322	45.42100285
11.670218	7.5344644	97.05559745	47.56307627

Fig 1:

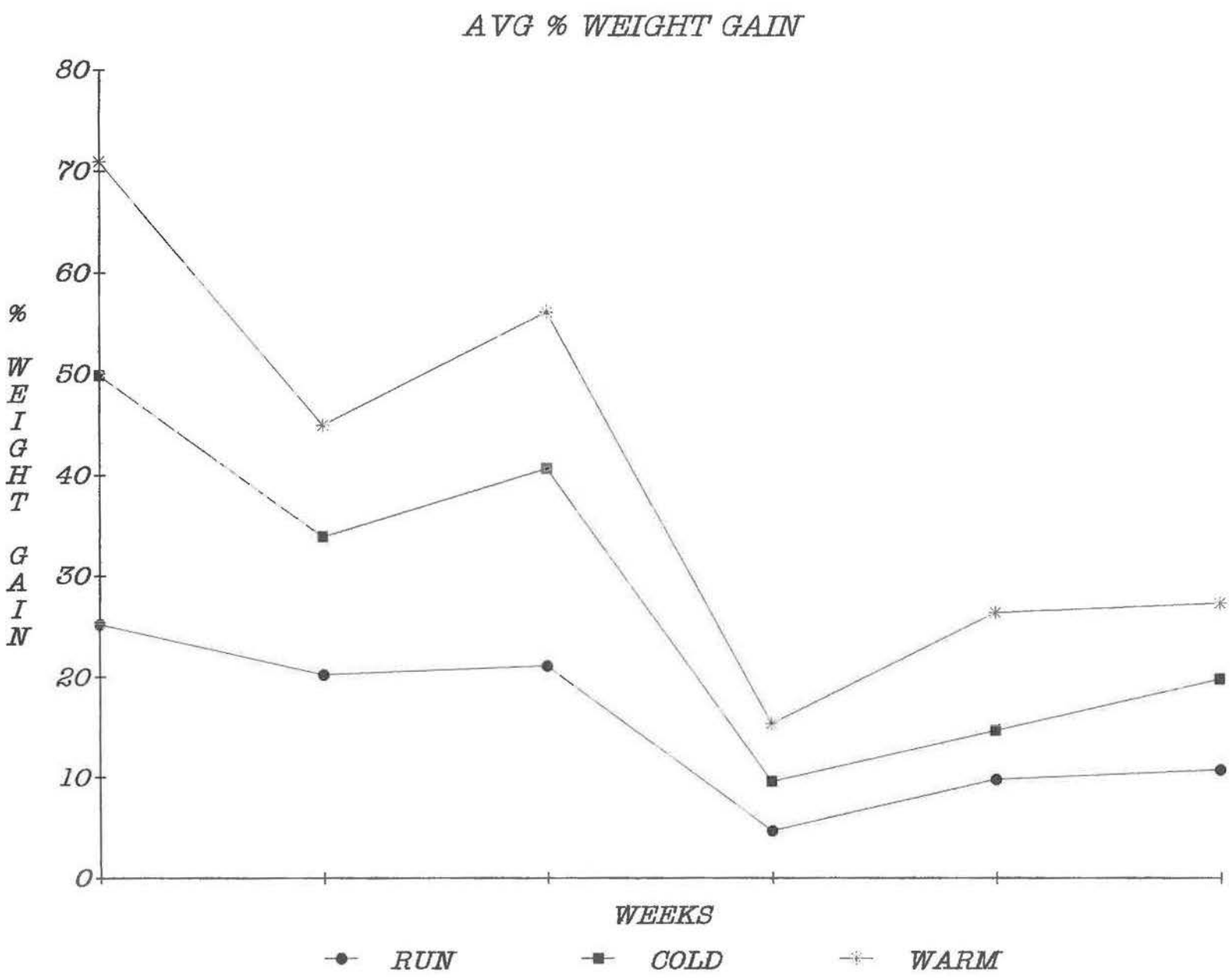
AVG % WEIGHT GAIN
80
70
60
50
40
30
20
10
0
% WEIGHT GAIN
WEEKS
RUN
COLD
WARM

Fig 2:

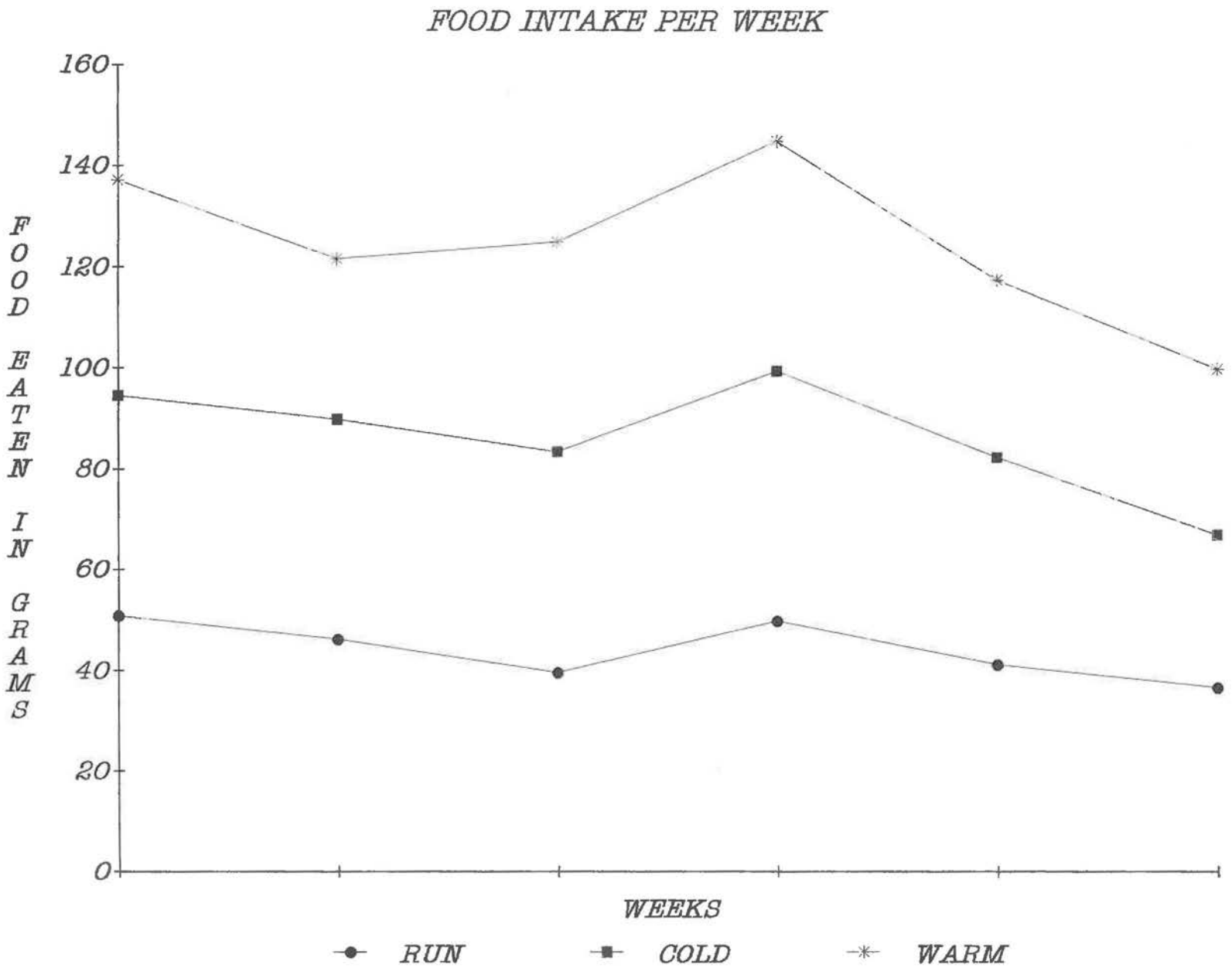
FOOD INTAKE PER WEEK
160
140
120
100
80
60
40
20
0
FOOD EATEN IN GRAMS
WEEKS
RUN
COLD
WARM

Fig 3:

ANALYSIS OF VARIANCE TABLE

% Weight Change

SOURCE	DF	SS	MS	F	P
GROUP	2	$1.9X10^{-2}$	$9.6X10^{-3}$	3.37	0.039
WEEK	5	$3.8X10^{-1}$	$7.7X10^{-2}$	26.84	0.000
INTER	10	$3.5X10^{-2}$	$3.5X10^{-3}$	1.21	0.300
ERROR	68	$2.5X10^{-1}$	$3.6X10^{-3}$		

There is a significant difference between weight gain and the groups. And there is a highly significant difference displayed in weight gain per week. There is no interaction displayed between the groups and the weeks. In a Muntiple Comparisons Scheffe test, It was shown that the significant difference was between the running group and the warm swimming group. The running group was similar to the cold swimming group, and the cold swimming group was similar to the warm swimming group.

Fig 4:

ANALYSIS OF VARIANCE TABLE

For Food Mass Consumed

SOURCE	DF	SS	MS	F	P
GROUP	2	95.83	47.92	3.96	0.054
WEEK	5	421.1	84.22	6.97	0.0048
ERROR	10	120.91	12.091		

There is almost a significant difference between food mass consumed per group. There is a highly significant difference between food mass consumed per week.

Works Cited

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