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How Quickly Does Diet Make for Change? A Study of Electrocardiographic Heart Rate Findings

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ABSTRACT: As far as we can determine, this is the only double-blind controlled study in presumably healthy young persons showing the changes in heart rate following administration by mouth of glucose drinks.

Introduction

Three items serve as a justification for and prelude to this experiment. First, there is very little in the electrocardio-graphic standard textbooks regarding the possible effect of diet and nutrition upon heart rate. For practical purposes, the point is usually made that following a meal there may be an increase in heart rate. Second, we have been looking at a three-day period of diet therapy in young and presumably healthy men. Finally, there is some evidence to indicate that diet can indeed induce changes in the heart rate.

This is one of a series of reports dealing with the time element following diet therapy. Earlier reports have dealt with absolute weight,[1] height/weight ratios such as the ponderal index (PI)[2] and body mass index (BMI)[3], blood pressure,[4] as well as oral findings such as gingival inflammation,[5] periodontal sulcus depth,[6] and clinical tooth mobility.[7]

This and other reports deal with electrocardiographic evidence of

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diet therapy in presumably healthy young men over a matter of a few days. Specifically, this report concerns itself with the heart rate.

Method of Investigation

Two hundred and forty-six presumably healthy junior dental students participated in this six-year research/teaching program. On Monday of a week, at approximately 10:00 A.M., each student underwent a general and oral examination, a battery of biochemical, hematologic and urinary tests. Included in this study was an examination of the standard electrocardiographic three limbs leads. Immediately after the examination, the sample was divided into a series of therapeutic subsets (Table 1).

During the fifth year of the study, group 5 was separated into 5a (n = 23) and given a 50-gram sucrose drink twice daily while 5b (n = 16) received nothing. In the next school year, group 6a (n = 21) was provided with a 75-gram glucose drink thrice daily; the 21 subjects in group 6b were given an artificially sweetened drink indistinguishable from the glucose solution.

On Friday of the same week, each student underwent the same examination provided three days earlier by the same examiner with no knowledge of the earlier findings.

This unusual experimental design provided a singular opportunity to observe the clinical, physiologic, anthropometric and biochemical effects of different diets in young and presumably healthy students in a three-day experiment. This particular report deals exclusively with changes in heart rate under these conditions.

Results

Table 2 summarizes the heart rate findings as determined from Lead I. Included in this chart are the initial and final heart rate means as

TABLE 1

Experimental Design

Groups	Sample Size	Treatment
5a	23	sucrose 50 grams twice daily
5b	16	no supplement
6a	21	glucose 75 grams three times per day
6b	21	artificially sweetened drink indistinguishable from glucose

TABLE 2

Summary of Heart Rate Findings (Lead I)

Groups	Initial	Final	Difference	Significance of the difference of the Means t	Variances F
5a	66.7±10.7	67.3±10.7	+0.61	0.33	0.99
5b	67.0± 8.0	65.3± 5.7	−1.75	0.93	0.50
6a	62.8± 8.1	67.0± 6.8	+4.19	3.07*	0.71
6b	60.8± 7.6	61.3± 9.5	+0.53	0.39	1.56

*statistical significant difference of the means $p<0.01$

well as standard deviations along with the difference of the means and the significance of the difference of the means[8] and variances.[9]

It is abundantly clear that the only change, and it is one of an increase in heart rate, occurred in group 6a. Specifically, those subjects provided with the glucose drink showed a statistically significant increase of 4.19 heart beats per minute. Tables 3 and 4 confirm the findings in Lead II and III.

TABLE 3

Summary of Heart Rate Findings (Lead II)

Groups	Initial	Final	Difference	Significance of the difference of the Means t	Variances F
5a	65.4± 9.7	67.1± 9.7	+1.65	0.81	0.99
5b	66.1± 6.8	65.2± 5.7	−0.90	0.40	0.69
6a	62.5± 8.3	67.3± 6.0	+4.86	3.83*	0.51
6b	59.8±11.7	62.2± 9.5	+2.48	1.33	0.66

*statistically significant difference of the means $p<0.01$

TABLE 4

Summary of Heart Rate Findings (Lead III)

Groups	Initial	Final	Difference	Significance of the difference of the Means t	Variances F
5a	67.6± 9.9	68.3±10.9	+0.69	0.29	1.20
5b	64.8± 8.2	65.6± 4.0	+0.75	0.30	0.23
6a	62.1± 8.8	67.9± 6.4	+5.76	3.45*	0.52
6b	61.5± 9.2	61.9± 8.8	+0.38	0.32	0.92

*statistically significant difference of the means $p<0.01$

Discussion

This simple experiment demonstrates several points. First, there is no question but that, under the doubleblind conditions cited here in presumably healthy young men, it is possible to statistically significantly increase heart rate in a relatively short period of time. Second, this experiment also suggests that glucose, under these conditions, apparently initiates the depolarization process. Third, apparently the observations reported here must be dosage-dependent, at least in part. This is so because similar changes were not observed with sucrose in amounts of 50 grams twice daily which, as is generally known, breaks down, in part, to glucose.

Finally, but not evident from the earlier discussions but nonetheless a fact, of all of the 13 different parameters studied in each of the three standard limb leads, the changes in heart rate are the most consistent and dramatic.

Earlier mention was made that there is only perfunctory reference in the scientific literature to food and heart rate. The general statement appears in the literature that, following a standard meal, heart rate may be increased. This area has been studied uniquely and reported originally in 1956.[10] Coca makes two very cogent statements early in his book.

> The pulse-rate in the normal person is not affected at all by digestion, nor by ordinary physical activity, nor by normal emotional influence. It

> is remarkably stable . . . The pulse, then may be considered a dependable first watch-dog of our health-citadel, telling us promptly whenever we are in possiby injurious contact with our allergic enemies.

While Coca makes the point that an increase in pulse-rate following a specific food is a measure of allergy, it might well be better to think of the speeding up of the pulse as one measure of a lack of homeostasis. Viewed in this light, one would have to conclude that glucose provided under the circumstances spelled out in this experiment obviously encourages nonhomeostasis.

Summary and Conclusions

A simple study of 81 healthy young subjects suggests that one can effect a statistically significant increase in heart rate in a matter of three days with the addition of glucose drinks under the conditions outlined. This same heart rate phenomenon is not demonstrated with placebo supplementation nor with surcrose solutions. A report to follow will outline changes in repolorization following the same diet regime.[11]

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