How Quickly Does Diet Make For Change?

A Study of Blood Pressure

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Until very recently, patients with mild to moderate hypertension have been treated with pharmacologic antihypertensive therapy. The evidence is now clear that the introduction of lifestyle changes may serve as a satisfactory nonpharmacologic alternative therapeutic regimen. This has been very clearly summarized[1] in the findings of the Hypertension Control Program by means of a reduction in calories, sodium, and alcohol.

This report deals with the changes in blood pressure in so-called normotensive subjects by means of simple changes in diet under reasonably controlled conditions. Additionally, it, for the first time, demonstrates the speed of change in blood pressure with these minimal lifestyle alterations.

Method of Investigation

Two hundred and forty-six presumably healthy junior dental students participated in this teaching/research experiment which extended over a six-year period. On Monday of a week, at approximately 10:00 a.m., each student underwent a general and oral examination, electrocardiography, a battery of biochemical, hematologic and urinary tests including a measure of systolic and diastolic blood pressure. Immediately after, the sample was divided into six therapeutic subsets (Table 1).

The first year, group 1 (40 subjects) was instructed to avoid, to the extent possible, all refined carbohydrate foods. During the second academic year, group 2 was divided into group 2a (n=22) and provided an over-the-counter multivitamin/trace mineral tablet on a daily basis; group 2b (n=22) was administered an indistinguishable (lactose) placebo. The third year, group 3 was also divided into group 3a (n=22) and prescribed a 40-gram protein (amino acid) supplement; group 3b (n=22) was given an indistinguishable (methylcellulose) placebo. The following year, group 4 was divided into subsets with 4a (n=18) receiving a 40-gram tripe flour supplement daily while group 4b (n=19) was provided with an indistinguishable (methylcellulose) placebo. The succeeding year, group 5 was separated into 5a (n=23) and given a 50-gram sucrose drink twice daily while 5b (n=16) received nothing. And the last year of the experiment, group 6a (n=21) was provided with a 75-gram glucose drink thrice daily; the 21 subjects in 6b were given an artificially sweetened drink indistinguishable from the glucose solution.

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

This then allowed a singular opportunity to observe the clinical, physiologic, anthropometric and biochemical effects of different diets in young and presumable healthy students following a three-day period of dietary changes. This particular report deals exclusively with changes in systolic and diastolic blood pressure under these unusual conditions.

Results

Table 2 summarizes the systolic blood pressure findings. Included are the initial and final readings, the difference in systolic pressure and the significance of the difference of the means[2] and variances[3]. It is obvious that there are considerable variations in blood pressure in the different subsets. In an attempt to simplify these materials, the data have been rearranged.

Table 3 simply summarizes the distribution of systolic blood pressure changes in decreasing order with the different therapeutic regimes. It is clear that there is considerable variation. For example, there is a 6 mmHg decline in group 5b (those subjects provided nothing). At the other end of the scale, there is a 1.9 mmHg rise in group 6a (those given a 75-gram

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glucose drink thrice daily). Overall, on a purely mean basis, there is a reduction in systolic pressure in 10 of the 11 subsets; a rise in only one.

The data have been restructured in Table 4 to emphasize the changes in systolic blood pressure in decreasing order of statistical significance of the means after the various therapeutic regimes. It is noteworthy the greatest change occurred in group 3a (provided with an amino acid supplement). It is in this group that one finds a 5.37 mmHg decline in systolic blood pressure. Additionally, it is evident from Table 4 that there are statistically significant declines in systolic blood pressure associated with the group supplied nothing (5b), group 1 characterized by a reduction in refined carbohydrate foodstuffs, group 3b provided with a methylcellulose supplement, group 4a given the tripe flour supplement and group 5a provided with a sucrose drink twice daily.

Table 5 summarizes the initial and final means and standard deviations for the diastolic blood pressures, the differences, and the significance of the differences of the means[2] and variances[3]. Once again, in the interest of simplification, the material ha been restructured.

Table 6 describes the distribution of mean diastolic pressures in decreasing order with the different therapeutic regimes. It is abundantly clear that the greatest decline (4.7 mmHg) occurred in group 1 characterized by the recommendation to eliminate, to the extent possible, refined carbohydrate foodstuffs. The changes in diastolic pressure ranged down to a reduction of 0.3 mmHg in group 2a (the subjects provided with a multivitamin/trace mineral supplement). It is noteworthy that, in every instance, there was a mean decline in diastolic blood pressure.

Table 7 views the same data in a somewhat different light by examining the changes in diastolic pressure in decreasing order of statistical significance of the differences of the means with the different therapeutic regimes. It is evident that, of the 11 subsets, 5 show a statistically significant difference of the means.

The greatest reduction in diastolic blood pressure occurred in group 1 (those individuals who were recommended to reduce refined carbohydrate foodstuffs). The second greatest decline occurred in group 3a (the subset characterized by the amino acid supplement).

Next in order, we note a significant decline in group 5a (the subjects given sucrose twice daily). And the last two groups provided with either nothing (group 5b) or a methylcellulose supplement (group 4b) are shown.

Discussion

A number of points deserve special mention. Firstly, it is interesting that, overall, the changes in systolic blood pressure are generally greater than those observed with diastolic blood pressure. This is generally known in physiologic circles and needs no additional comment. Secondly, the most consistent change (meaning that there was a decrease in both systolic and diastolic blood pressure) occurred in group 1, those subjects recommended to reduce refined carbohydrate foodstuffs. Thirdly, the greatest decline in systolic blood pressure was noted in those subjects provided with a protein supplement (group 3a). Next, in contrast, the second greatest decline on a statistical basis in diastolic blood pressure proved to be the protein supplement (group 3a). Fifthly, it should be pointed out that statistically significant changes occurred in both systolic and diastolic blood pressure when nothing was supplied (group 5b) and when a methylcellulose (placebo) supplement was given (group 3 b).

Precisely why this should be so is not clear from this experiment. There is, of course, the possibility that giving methylcellulose may actually be a hypotensive agent. Additionally, there is the likelihood that providing methylcellulose may so alter the diet as to exert a hypotensive effect. However, there is nothing in the literature or in this experiment to suggest that these are the likely reasons. Additionally, it is noteworthy that the group provided nothing showed a statistically significant reduction in both systolic and diastolic blood pressure which raises the interesting possibility of a psychologic effect. The final explanation for these changes will have to await additional study.

There is one additional point which deserves consideration for two reasons. Firstly, because it is seldom analyzed in studies of this type. Secondly, it should be looked at because of its potential physiologic and clinical import.

Traditional medicine has long held to the concept of *homeostasis*, a term coined by a nineteenth century French physician, Claude Bernard. He made the point "illnesses hover constantly above us, their seeds blown by the wind, but they do not set in the terrain unless the terrain is ready to receive them."[4] And so, it was Bernard who invented the term *homeostasis* to describe the efforts of the organism to maintain a stable internal environment (a suitable terrain) meaning, for example, a steady internal atmosphere of precise and optimal temperature, circulation, movement of energy sources, elimination of toxic wastes, etc.

In this connection, attention is directed to Tables 2 and 5 which describe the changes in systolic and diastolic blood pressure respectively. It will be noted that along with the means, there are standard deviations as well as the statistical significance of the differences of the variances. For example, in Table 2 it will be observed that in group 1 (provided with a reduction in refined carbohydrate foodstuffs) that the standard deviation declined from 10.0 to 4.7 during the 3-day experimental period. The statistical significance of the difference of the variances (F=-.223) is highly significant at the one percent confidence level. Translated into physiologic terms, this means that, with a reduction in refined carbohydrate foodstuffs, the relatively low systolic blood pressures rose while the relatively high pressures declined. In other words, suggested here is that under this particular regime, there is a trend to more desirable homeostasis. This is also shown in Table 5 where one notes that in the group who were told to reduce refined carbohydrate foodstuffs that the standard deviation declined from 7.6 to 4.0. Here again, this is statistically significant (F=0.277) at the one percent confidence level. In short, of all the subsets studied it is only in group 1 that one finds this remarkable pattern of homeostasis.

In contrast, Table 2 notes that group 5a (those subjects provided with sucrose twice daily) show an increase in standard deviation from 6.4 to 10.0. This is also statistically significant (F=2.421). This suggests that, under this therapeutic regime, one invites an unbalancing (namely a lack of homeostasis) by giving sugar. These findings are summarized in Table 8.

(Note: Conclusion and References follow tables on page 228.)

Table 1

experimental design

groups	**sample size**	**treatment**
I	40	relatively low refined carbohydrate high protein diet
2a	22	multivitamin supplement
2b	22	placebo indistinguishable from multivitamin supplement
3a	22	amino acid supplement
3b	22	placebo indistinguishable from amino acid supplement
4a	18	tripe flour supplement
4b	19	placebo indistinguishable from tripe flour supplement
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

changes in systolic blood pressure with different therapeutic regimes

Groups	Systolic initial	Pressure final	Difference	Sigificance of the difference of the means variances t	F
1	117.2+10.0	112.9+ 4.7	-4.3	3.880**	0.223**
2a	113.3+ 4.5	112.2± 4.6	-1.1	1.439	1.061
2b	114.4+ 6.4	112.4± 6.6	-1.9	1.470	1.060
3a	120.3+ 8.6	114.6+ 7.7	-5.6	5.370**	0.803
3b	120.9+ 7.8	117.3+ 9.1	-3.6	3.490**	1.360
4a	120.3+11.4	115.9+ 7.8	-4.4	2.990**	0.469
4b	124.4+ 8.8	122.2+ 9.9	-2.2	1.740	1.270
5a	117.8+ 6.4	113.3+10.0	-4.4	2.730*	2.421*
5b	120.5+10.0	114.5± 7.5	-6.0	4.450**	0.503
6a	116.2+10.7	118.1±10.8	+ 1.9	0.095	1.000
6b	112.0+10.0	110.0+ 7.5	-2.0	1.500	0.790

statistically significant difference *p<0.05 **p<0.01

Table 3

the distribution of systolic blood pressure changes in decreasing order with different therapeutic regimes

groups	systolic blood pressure changes
5b	-6.00
3a	-5.64
5a	-4.43
4a	-4.39
1	-4.28
3b	-3.59
4b	-2.21
6b	-2.00
2b	-1.90
2a	-1.14
6a	+ 1.90

Table 4

changes in systolic blood pressure in decreasing order of statistical significance with different therapeutic regimes

groups	significance of the difference of the means t
3a	5.370**
5b	4.450**
1	3.880**
3b	3.490**
4a	2.990**
5a	2.730**
4b	1.740
6b	1.500
2b	1.470
2a	1.439
6a	0.095

statistically significant difference of the means *<0.05 **<0.01

Table 5

changes in diastolic blood pressure with different therapeutic regimes

	diastolic pressure groups		difference	sigificance of the difference	
	initial	final		of the means	variances
				t	F
1	74.7± 7.6	69.9±4.0	-4.7	5.66**	0.277**
2a	69.2± 4.2	68.9±3.5	-0.3	0.39	0.676
2b	70.9+ 5.5	69.2±5.5	-1.7	1.21	1.000
3a	72.3± 6.2	68.5±4.3	-3.8	4.46**	0.485
3b	76.1± 6.6	74.6+6.9	-1.5	1.25	1.080
4a	72.8± 8.9	71.1+5.7	-1.8	1.31	0.410
4b	75.6+ 6.7	73.1+6.7	-2.5	2.32*	1.020
5a	71.6+ 6.5	68.5±8.2	-3.1	2.87*	1.605
5b	73.3+ 6.9	70.1+7.0	-3.2	2.74*	1.020
6a	67.8+12.7	67.1+6.4	-0.6	0.20	0.250
6b	67.9+ 6.3	67.2±5.8	-0.7	0.60	0.840

statistically significant difference *p<0.05 **p<0.01

Table 6

the distribution of diastolic blood pressure changes in decreasing order with different therapeutic regimes

groups	blood pressure changes
1	-4.7
3a	-3.8
5b	-3.2
5a	-3.1
4b	-2.5
4a	-1.8
2b	-1.7
3b	-1.5
6b	-0.7
6a	-0.6
2a	-0.3

Table 7

Diastolic changes in diastolic blood Pressure in decreasing order of statistical significance with different therapeutic regimes

groups	significance of the difference of the means t
1	5.66**
3a	4.46**
5a	2.87*
5b	2.74*
4b	2.32*
4a	1.31
3b	1.25
2b	1.21
6b	0.60
2a	0.39
6a	0.20

statistically significant difference of the means *p<0.05 **p<0.01

Table 8

statistical significant difference of the variances in systolic and diastolic blood pressure

groups	systolic	diastolic
1		0.277**
1	0.223**	
5a	2.421*	

statistically significant difference of the variances *p<0.05 **p<0.01

Summary and Conclusions

Perhaps the cardinal point in this experiment is the demonstration that lifestyle changes can indeed modify blood pressure. What is particularly exciting is that this can be accomplished using different dietary techniques not usually mentioned in the literature.[1] What is also noteworthy is that these changes can occur in young and presumably healthy normotensive individuals. Finally, the point should be underlined that the changes noted here can be accomplished in a matter of 72 to 96 hours.

References

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