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Blood Pressure Changes and Weight Changes in Hypertensive Patients in an Inner-City Clinic

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The association of obesity and hypertension has been clearly established. Despite evidence that weight loss reduces blood pressure, this aspect of treatment is often not stressed. We studied the effects of nutritional intervention in a group of inner-city, predominantly black, hypertensive patients to determine resultant blood pressure changes. Weight reduction was achieved by 57% of the patients, with a loss of more than 4.5 kg (10 lb) in 18%. Changes in weight were highly correlated with blood pressure changes. Correlations were greater for systolic than diastolic pressures, for pressure measured in the standing than the supine position, and for men than for women. A weight loss of over 4.5 kg was associated with significant blood pressure reduction in all patients. We conclude that weight reduction is feasible in more than half of this population and that weight loss is associated with significant reduction in blood pressure. (Henry Ford Hosp Med J 1988;36:88-91)

A considerable body of evidence relates obesity with hypertension. Several studies have observed reduction of blood pressure levels in obese hypertensive patients with dietary manipulation. We assessed whether blood pressure levels could be reduced by dietary modification in an inner-city, predominantly black, hypertensive population.

This is a retrospective study of the changes in blood pressure in mild and moderate essential hypertensive patients who followed for more than six months a salt-restricted, low calorie diet, without change in medication.

Patients and Methods

Patients included in the study had uncomplicated essential hypertension with blood pressure levels greater than 140 mm Hg systolic or 90 mm Hg diastolic on two occasions. We reviewed the charts of more than 400 patients treated at the East Side Hypertension Clinic in Cleveland from February 1977 to February 1980 and found 45 who were followed without medication for more than three months and 82 who attended the clinic regularly for more than six months with no change in their medication. These 127 patients, 57 men and 70 women ranging in age from 20 to 71 years (mean, 48.8 ± 10.3 years), constituted the study population. Thiazides were the only medication in 57 patients, thiazide and propranolol in 18 patients, thiazide and hydralazine in four patients, and triple therapy in three patients. All but ten patients were black, and 96 (76%) of the 127 patients were more than 10% overweight according to the Metropolitan Life Insurance tables of desirable weights.

All patients were seen first by a nurse who recorded their weight and blood pressure levels. Blood pressure was measured in the supine position after five minutes rest and in the standing position after two minutes standing. Each patient was then seen by a physician who encouraged compliance with dietary restriction and medication. Increased physical activity and elimination of tobacco products were also encouraged. Each patient then met with a dietitian who obtained a dietary history and recommended modifications. The objective was to reduce the patients' sodium intake to below 4 g/day and to reduce their weight to the ideal level if they were greater than 10% above ideal. Additional information was given to the patients by means of videotapes, which were shown in the waiting room, and literature supplied by the American Hospital Association and other organizations. Patients were followed up at two- to six-week intervals and were encouraged at each review for weight loss and for blood pressure reduction.

Analysis was performed using simple and multiple regression with presence of medication, sex, weight change, and systolic versus diastolic blood pressure as the independent variables. For those patients on medication, correlations were made between weight changes and blood pressure changes from the visit one month after starting that medication and the most recent visit. For those patients not on medication, the comparison was between the third clinic visit and the most recent visit. The mean interval between measurements was 13.1 ± 5.6 months. Significance was taken at $P < 0.05$.

Results

Weight loss occurred in 71 patients, weight gain in 55 patients, and no change in one patient. The mean weight change

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Table 1
Mean Blood Pressure and Changes During Study

Blood Pressures	Baseline	Final	Change	P Value
Supine systolic	136.0 ± 14.4	134.6 ± 15.5	−1.4	0.31
Supine diastolic	87.9 ± 8.1	87.3 ± 8.1	−0.6	0.47
Standing systolic	134.7 ± 15.3	131.4 ± 16.6	−3.26	0.04
Standing diastolic	94.4 ± 9.6	93.0 ± 8.6	−1.4	0.16

Table 2
Regression Values for Changes in Blood Pressure and Body Weight

Blood Pressures	R Value	Slope	Significance
Supine systolic	0.454	0.644	0.0001
Supine diastolic	0.384	0.315	0.0001
Standing systolic	0.556	0.866	0.0001
Standing diastolic	0.395	0.382	0.0001

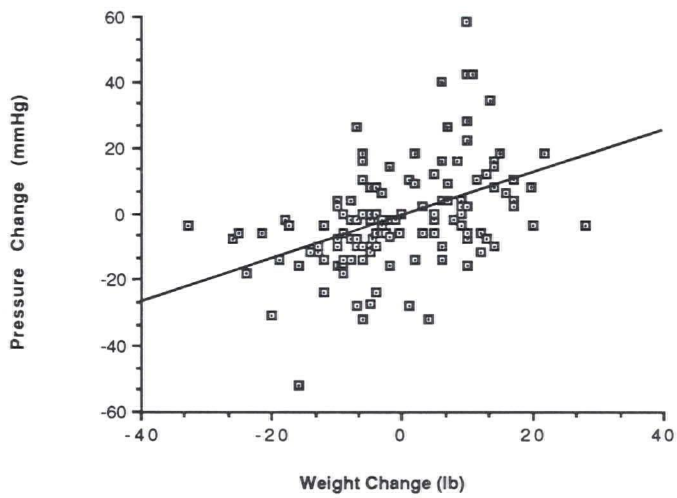

Fig 1—Weight change and supine systolic blood pressure change.

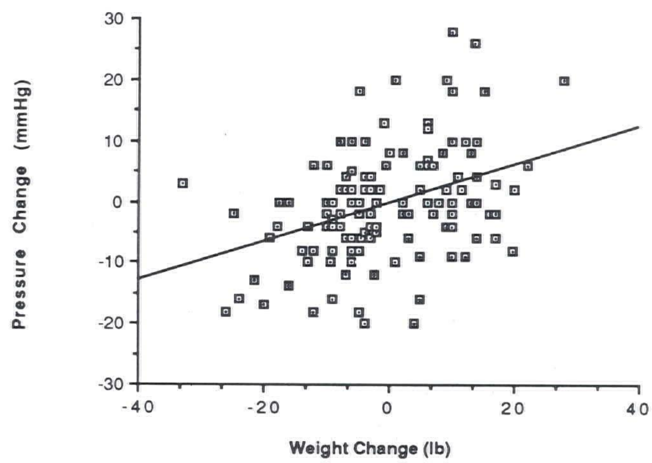

Fig 2—Weight change and supine diastolic blood pressure change.

was −0.28 kg ± 5.0 kg (−0.62 lb ± 11.15 lb) with a range of +12.6 to −14.9 kg (+28 to −33 lb). No significant difference in weight change was seen between men and women. Little change occurred in mean blood pressure in the patient population (Table 1).

Highly significant correlations were observed between weight changes and blood pressure changes for both systolic and diastolic pressures in the supine (Figs 1 and 2) and standing positions (Table 2). The effect was greater for systolic pressure than for diastolic pressure.

Some differences occurred in responses between men and women (Table 3) which was confirmed by multiple regression analysis ($P < 0.02$). There was a better relationship between weight and blood pressure changes in men than in women which applied to both the supine and standing positions as well as to systolic and diastolic pressures.

Differences were also noted between those patients who were on medication and those who were not ($P < 0.0001$) (Table 4). Those patients already on medication to control their hypertension had a larger change in blood pressure per weight change than those not being treated with medication.

The effects were most striking in patients who had a weight change of more than 4.5 kg (10 lb) (Table 5). All patients who lost more than 4.5 kg had reduced blood pressure levels, and 23 of 28 who gained more than 4.5 kg had increased blood pressure levels.

Table 3
Regression Values for Changes in Blood Pressure and Body Weight Comparing Males and Females

Blood Pressures	Sex	R Value	Slope	Significance
Supine systolic	Male	0.578	0.876	0.0001
	Female	0.348	0.458	0.0031
Supine diastolic	Male	0.493	0.379	0.001
	Female	0.348	0.263	0.0031
Standing systolic	Male	0.642	1.124	0.0001
	Female	0.481	0.671	0.0001
Standing diastolic	Male	0.526	0.564	0.0001
	Female	0.283	0.249	0.0176

Discussion

Overwhelming evidence relates obesity to hypertension. As early as 1923, Larimore (1) demonstrated that sthenic factory workers had the highest blood pressures compared to asthenic workers who had the lowest blood pressures. In 1969, Chiang et al (2) reviewed numerous studies which documented a correlation between weight, obesity, or skinfold thickness and blood

Table 4
Regression Values for Changes in Blood Pressure and Body Weight Comparing Patients With and Without Medication

Blood Pressures	Therapy	R Value	Slope	Significance
Supine systolic	No Medication	0.467	0.636	0.0012
	Medication	0.441	0.632	0.0001
Supine diastolic	No Medication	0.339	0.285	0.0228
	Medication	0.405	0.328	0.0002
Standing systolic	No Medication	0.556	0.756	0.0001
	Medication	0.557	0.904	0.0001
Standing diastolic	No Medication	0.303	0.257	0.0463
	Medication	0.436	0.431	0.0001

Table 5
Blood Pressure Changes in Patients with Weight Changes Greater than 4.5 kg (10 lb)

	Weight Loss > 4.5 kg (n = 22)	Weight Gain > 4.5 kg (n = 28)
Mean weight change		
kg	−7.4 ± 2.8	6.4 ± 1.9
(lb)	(−16.5 ± 6.3)	(14.2 ± 4.3)
Supine systolic change	−13.3 ± 11.2	9.1 ± 17.1
Supine diastolic change	−7.0 ± 7.7	3.6 ± 10.0
Standing systolic change	−17.4 ± 9.6	14.0 ± 16.7
Standing diastolic change	−9.1 ± 7.8	5.5 ± 12.7

pressure levels. In the initial examination of the Framingham study (3), there was an increase in prevalence of hypertension in the obese. During the study's 12-year follow-up, both an overall increase in blood pressure and of relative weight were demonstrated. Men whose weight changed had a significantly correlated change in blood pressure; however, this trend did not reach statistical significance in women.

In a screening of 1 million Americans, Stamler et al (4) found the prevalence of hypertension in young, overweight subjects triple to that of young, underweight subjects. In the older groups, the incidence of hypertension doubled with obesity. This relationship between obesity and hypertension starts early in life. In 1,692 North Carolina elementary school children (from kindergarten to sixth grade), obesity was three times more common in those with elevated systolic or diastolic blood pressure levels than in the general population (5). A study of 3,525 children in Bogalusa, Louisiana, demonstrated a coefficient of correlation between body weight and blood pressure of 0.54 and 0.48 for systolic and diastolic pressures, respectively (6). In a study of adolescents and young adults from age 15 to 29 in Evans County, Georgia, a strong correlation existed between the Queltelat index (weight/height × 100) and blood pressure levels (7).

Studies from other countries have reported a significant improvement in blood pressure levels with weight reduction. In a Tel Aviv study by Reisen et al (8), 24 patients had significant reductions both in weight (8.8 kg [19.4 lb]) and blood pressure levels (37.4 and 23.3 mm Hg for systolic and diastolic, respectively) with a significant correlation between these changes ($r = 0.42$, systolic; $r = 0.56$, diastolic). Similar changes were found by Ramsey et al (9) who reported on 27 patients from the Glasgow Blood Pressure Clinic whose treatment was unaltered for one year. Their correlations were 0.54 for systolic and 0.57 for diastolic blood pressure levels.

In the United States, however, Dahl et al (10) failed to find a significant reduction in blood pressure levels in obese hypertensive patients who followed a weight-reduction diet without concomitant salt restriction.

Our study was performed in a hypertension clinic in the inner city of Cleveland. Unlike previous studies, we examined the relationship of blood pressure change to weight change in all patients in whom therapy was unchanged regardless of their original weight. We noticed considerable weight fluctuations in our patients, with weight loss achieved in 71 patients and weight gain in 55 patients. Although this demonstrated an overall failure of patient compliance with dietary advice, we had the opportunity to analyze a more typical hypertensive population.

Definite correlations existed between weight changes and blood pressure changes which were greater for systolic than for diastolic pressures. A statistical difference in response occurred between the sexes, with a greater effect seen in the men. This applied to blood pressure measured in both the supine and standing positions and to systolic and diastolic levels. The relationship was greater for those on antihypertensive medication throughout the time of observation compared to those who received no medication.

Dunne (11) reported that blood pressure measurements vary greatly in patients attending clinics, with a tendency toward a reduction in blood pressure during the first three visits. To avoid this bias we did not include information from the first two visits in our data.

Although weight control has been previously recommended to obese hypertensive patients, most clinicians consider the effort excessive for the minimal results achieved due to poor patient compliance. As can be seen in our group, patient compliance with dietary advice was not universal. However, of the 22 patients who lost at least 4.5 kg (10 lb), all had reductions in blood pressure.

In those patients who are able to lose weight, there is a significant reduction in blood pressure equivalent to introducing an additional medication. This aspect of therapy should be stressed to the overweight hypertensive patient as much as dietary control is to the diabetic patient. By applying nonpharmacologic interventions (dietary modification, increased physical activity), many patients can be saved from the side effects and cost of additional medications.

Acknowledgments

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