



## Medically Supervised Water-only Fasting in the Treatment of Hypertension

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### ABSTRACT

**Background:** Hypertension-related diseases are the leading cause of morbidity and mortality in industrially developed societies. Although antihypertensive drugs are extensively used, dietary and lifestyle modifications also are effective in the treatment of patients with hypertension. One such lifestyle intervention is the use of medically supervised, water-only fasting as a safe and effective means of normalizing blood pressure and initiating health-promoting behavioral changes.

**Methods:** One hundred seventy-four consecutive hypertensive patients with blood pressure in excess of 140 mm Hg systolic, 90 mm Hg diastolic (140/90 mm Hg), or both were treated in an inpatient setting under medical supervision. The treatment program consisted of a short prefasting period (approximately 2 to 3 days on average) during which food consumption was limited to fruits and vegetables, followed by medically supervised water-only fasting (approximately 10 to 11 days on average) and a refeeding period (approximately 6 to 7 days on



average) introducing a low-fat, low-sodium, vegan diet.

**Results:** Almost 90% of the subjects achieved blood pressure less than 140/90 mm Hg by the end of the treatment program. The average reduction in blood pressure was 37/13 mm Hg, with the greatest decrease being observed for subjects with the most severe hypertension. Patients with stage 3 hypertension (those with systolic blood pressure greater than 180 mg Hg, diastolic blood pressure greater than 110 mg Hg, or both) had an average reduction of 60/17 mm Hg at the conclusion of treatment. All of the subjects who were taking antihypertensive medication at entry (6.3% of the total sample) successfully discontinued the use of medication.

**Conclusion:** Medically supervised water-only fasting appears to be a safe and effective means of normalizing blood pressure and may assist in motivating health-promoting diet and lifestyle changes. (*J Manipulative Physiol Ther* 2001;24:335-9)

**Key Indexing Terms:** Fasting; Hypertension; Vegetarian Diet; Complementary and Alternative Medicine

### INTRODUCTION

Hypertension-related diseases are the most common causes of morbidity and mortality among industrially advanced societies.<sup>1</sup> Each year in the United States, there are 500,000 victims of stroke. Hypertension is the major cause in these incidents, one third of which are fatal.<sup>2</sup> Hypertension also is thought to be the most easily controlled, preventable factor in congestive

heart failure, a disease involved in more than 400,000 deaths and 2 million events each year in the United States.<sup>3</sup> Given the magnitude of the causal role played by hypertension in these disease processes, it is not surprising that many treatment alternatives have received considerable research investigation.<sup>4</sup>

It is surprising that the effectiveness of drug interventions for hypertension has been relatively disappointing.<sup>5-10</sup> More encouraging are results from both epidemiologic and experimental studies suggesting that alteration of patient lifestyle practices may provide a more promising avenue of treatment (Table 1).<sup>11-16</sup>

Although medication may have a net positive benefit for certain patients, the more relevant message is disquieting: most people who die of coronary artery disease, congestive heart failure, or stroke do not have blood pressure (BP) in ranges sufficiently elevated to warrant drug treatment.<sup>4</sup> Given the current limitations of drug treatment, the exploration of alternative, noninvasive methods of BP control should be sought.

An impressive body of scientific literature indicates substantial effects of conservative health-promoting interventions on BP control.<sup>11-16</sup> These interventions include regular aerobic exercise, body weight reduction, smoking cessation,

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**Table 1.** Results of previous studies reporting blood pressure reductions associated with various intervention strategies

|  | Systolic (mm Hg) | Diastolic (mm Hg) | Source                                       |
|--|------------------|-------------------|--|
| Body weight loss*  | -1.6             | -1.3              | Staessen et al (1989 <sup>11</sup> )†        |
| Sodium restriction‡  | -16              | -9                | MacGregor et al (1989 <sup>12</sup> )        |
| Vegetarian/high-fiber diet                                 | -2.8             | -1.1              | Appel et al (1997 <sup>13</sup> )            |
| Alcohol intake§  | -4.8             | -3.3              | Puddey et al (1992 <sup>14</sup> )           |
| Exercise   | -6.0-7.0         | -6.0-7.0          | Arroll and Beaglehole (1992 <sup>15</sup> )† |
| Combination of low-fat, low-salt, vegan diet, and exercise | -17              | -13               | McDougall et al (1995 <sup>16</sup> )        |
| Effects of standard antihypertensive drug treatment        | -12              | -6                | Kaplan (1998 <sup>4</sup> )                  |

\*BP reduction per kilogram of body weight loss.

†Meta-analysis.

‡Sodium intake reduced from 200 mmol/d to 50 mmol/d.

§Reduction of alcohol intake from 440 mL to 66 mL/wk.

||Average of 3 times per week of aerobic activity.

increased dietary fiber intake, alcoholic beverage restriction, consumption of a vegan-vegetarian diet, and sodium intake restriction. The advantages of these interventions are three-fold. First, there are virtually no iatrogenic effects. Second, the degree of BP reduction is in some cases greater than the average reduction of 12/6 mm Hg commonly obtained by drug therapies.<sup>4</sup> Third, not only are these approaches typically devoid of iatrogenic effects, but each is associated with known comprehensive health benefits.

Although the modification of a single lifestyle variable might not result in BP reductions comparable to those expected with medication, the use of multiple modifications undertaken simultaneously has greater promise.<sup>16</sup> This article reports the results of such an effort, wherein multiple lifestyle variables were controlled in an inpatient environment. Suspension of smoking and alcoholic beverage use, body weight loss, sodium restriction, and dietary modifications were simultaneously applied in a short-term inpatient experience that also included a period of medically supervised water-only fasting.

The purpose of this investigation was to document the effects on BP of water-only fasting together with multiple lifestyle modifications in a medically supervised, controlled environment. The water-only fast also facilitated body weight reduction. After the fasting process was completed, a low-fat, vegan diet was provided. It was our expectation that the reduction in BP obtainable with this safe noninvasive approach might exceed the results typically demonstrated by drug intervention or by any single lifestyle modification used independently.

## METHODS

Patients were 174 self-referred adults consecutively admitted for inpatient care for the management of essential hypertension and other health problems over a period of 12 years (1985 to 1997). A presenting systolic BP of at least 140 mm Hg, diastolic BP of at least 90 mm Hg, or both were required for inclusion. Initial mean BP levels were 159.1/89.2 mm Hg (Table 2). All patients who met these specific inclusion criteria during this 12-year period were included in the study.

BP measurements were made by staff doctors using standard recommended procedures.<sup>17</sup> A single BP measurement was taken daily at morning rounds between 7:30 AM and 9:00 AM with a portable Baumanometer mercury sphygmomanometer,

with the patients in the supine position. Pulse and BP were measured with the same arm, recording Korotkoff sounds 1 and 5.

For at least 2 full days before (or in some cases after) their arrival at the clinic, patients were instructed to eat a diet consisting exclusively of fresh raw fruits and vegetables and steamed vegetables. Once the transition diet program and examination procedures were completed, patients began the water-only fasting program. BP medications used at entry were phased down gradually. Diuretics were discontinued when BP levels dropped to less than 160/104 mm Hg. Dosages for  $\beta$ -blockers, angiotensin-converting enzyme inhibitors, and calcium channel blockers were reduced by approximately 50% every 3 days. When possible, medications were phased out before the water-only fasting process was initiated. BP medications for all subjects were successfully discontinued with this protocol.

## Therapy

Patients were administered the water-only fasting regimen in an inpatient environment for periods ranging from 4 to 28 days. Water-only fasting is the complete abstinence from all substances—food, tea, juice, noncaloric beverages, etc, with the sole exception of distilled water ad libitum (with a minimum of 40 ounces daily). Patients' activities were restricted, because even moderate activity during a water-only fast can double energy use.<sup>18</sup> We have observed, after supervising the fasts of more than 4000 patients, that restricted activity appears to minimize the frequency of orthostatic hypotension, arrhythmia, dehydration, and electrolyte disturbances, side effects reported by others who have encouraged unrestricted activity during fasting.<sup>19</sup> Allowable quiet activities included reading, listening to music, and watching instructional videos. Patients were also allowed to participate in group lectures, food preparation demonstrations and classes, and individual medical and psychologic consultations.

Water-only fasting periods were terminated during periods of relative symptom stability and after BP normalization. In a few cases nonclinical issues such as limited time available precipitated the premature termination of fasting. The water-only fasting period was followed by a period of supervised refeeding initiated by the consumption of juices made from fresh raw fruits and vegetables. Patients received 12 ounces of fresh juice

**Table 2.** Average blood pressure, weight, and body mass index for a sample of 174 hypertensive patients measured at 4 time points through a water-only fasting treatment program

| Variable             | Time point                                     |   |  |  |
|----------------------|--|---|--|--|
|                      | Baseline<br>(prefasting period<br>2.8 ± 4.8 d) | Start of water-only<br>fasting (fasting period<br>10.6 ± 5.6 d) | End of water-only<br>fasting (postfasting refeeding<br>period 6.8 ± 3.3 d) | End of supervised refeeding<br>(end of treatment program)<br>(duration of total treatment<br>program 20.2 ± 4.6 d) |
| Systolic BP (mm Hg)  | 159.1 ± 19.4*                                  | 148.5 ± 18.7†   | 127.4 ± 16.1‡  | 121.9 ± 17.8§  |
| Diastolic BP (mm Hg) | 89.2 ± 10.2*                                   | 85.9 ± 11.0†  | 77.7 ± 8.8‡  | 75.7 ± 8.7‡  |
| Weight (kg)          | 78.4 ± 17.2*                                   | 78.0 ± 17.4*  | 72.1 ± 16.1†   | 71.7 ± 16.6†   |
| Body mass index      | 28.9 ± 5.9*                                    | 28.7 ± 5.9*   | 26.5 ± 5.5†  | 26.5 ± 5.8†  |

Patients' mean age (± SD) was 58.6 ± 14.0 years. Values are expressed as mean ± SD.

\*, †, ‡, § Comparable means in each of the 4 time periods were tested for statistical significance with the analysis of variance procedure based on Duncan's multiple range test. Means with a different symbol are significantly different ( $P < .05$ ) for each variable of interest across each of the 4 time points.

**Table 3.** Effects of water-only fasting and supervised refeeding on subjects by stage of hypertension at start of treatment

| Hypertension category* | N   | Baseline<br>SBP/DBP<br>(mm Hg) | Start of fasting<br>SBP/DBP<br>(mm Hg) | End of fasting<br>SBP/DBP<br>(mm Hg) | End of refeeding<br>SBP/DBP<br>(mm Hg) | Total change<br>SBP/DBP<br>(mm Hg) |
|------------------------|-----|--------------------------------|--|--------------------------------------|--|------------------------------------|
| Stage 1                | 92  | 145.5/85.7                     | 139.0/82.2                             | 121.9/75.7                           | 116.1/74.3                             | -29.4/-11.4                        |
| Stage 2                | 57  | 165.8/91.7                     | 154.1/88.9                             | 130.9/79.1                           | 125.9/76.9                             | -39.9/-14.7                        |
| Stage 3                | 25  | 193.8/96.4                     | 170.9/92.4                             | 140.0/81.9                           | 134.2/79.4                             | -59.6/-16.9                        |
| Total                  | 174 | 159.1/89.2                     | 148.5/85.9                             | 127.5/77.7                           | 121.9/75.9                             | -37.1/-13.3                        |

SBP, Systolic blood pressure; DBP, diastolic blood pressure.

\*Stages as defined by JNC VI. Stage 1 is defined by systolic blood pressure of 140 to 159 mm Hg, diastolic blood pressure of 90 to 99 mm Hg, or both. Stage 2 is defined by systolic blood pressure of 160 to 179 mm Hg, diastolic blood pressure of 100 to 109 mm Hg, or both. Stage 3 is defined by systolic blood pressure >180 mm Hg, diastolic blood pressure >110 mm Hg, or both. When the systolic and diastolic BP fall into different categories, the higher category defines BP status.

every 3 hours during the juice phase (approximately 1 day of juices only for each week of water-only fasting). The juice phase was then followed by a diet of fresh raw fruits and vegetables (approximately 1 day for each week of water-only fasting). Subsequent to these transitional regimens, a diet of whole natural foods was introduced. This diet included fresh fruits and vegetables, steamed and baked vegetables, whole grains and legumes, and very small quantities of raw unsalted nuts and seeds. The diet specifically excluded any meat, fish, fowl, eggs, dairy products, or added oil, salt, or sugar. Bread products and other processed foods were also excluded. Cooked meals were prepared with recipes exclusively from the *Health Promoting Cookbook*.<sup>20</sup> After the juice phase, patients were allowed gradual reintroduction of moderate exercise.

### Safeguards

Patients were cautioned throughout the water-only fasting period regarding orthostatic hypotension. Patients received twice-daily consultations with a staff doctor. All fasting protocols were carried out according to the standards set forth by the International Association of Hygienic Physicians.<sup>21</sup> The study was approved by the Human Subjects Committee of the International Association of Hygienic Physicians.

### Additional Measures

Patients were also monitored with at least twice-weekly urinalyses and once-weekly blood tests including a complete blood count with differential and a multiple clinical chemistry panel including electrolytes, liver enzymes, serum proteins,

creatinine, uric acid, bilirubin, glucose, lipids, and erythrocyte sedimentation rate. Patients with arrhythmias were monitored with electrocardiography. Additional testing was performed when clinically indicated.

### Statistical Analysis

Descriptive statistics including means and SDs for the outcome variables of interest were computed for the 174 eligible inpatients at 4 relevant time points: (1) baseline, (2) start of water-only fasting, (3) end of water-only fasting, and (4) end of supervised refeeding (Table 2). The last measurement at the end of the supervised refeeding denoted the conclusion of treatment for each subject. Exploratory analyses revealed no significant differences in systolic or diastolic BP values by sex or age group; hence results are not shown separately for age or sex. In addition, study subjects were classified by Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure criteria into stages of hypertension at baseline.<sup>22</sup> The mean BP was computed for each stage of hypertension (Table 3). In addition to analyzing the total treatment response, that is, the response from baseline to the end of treatment, patient responses to the fasting process alone also were analyzed. The daily fasting response was computed by dividing the total fasting response by duration of fast for each patient. Analyses of variance procedures were used to test statistical significance of the effect of fasting on BP. The probability levels of significance reported are based on the 2-tailed  $t$  test. These results are presented in Table 2. All statistical analyses were conducted with SAS version 6.1.<sup>23</sup>

## RESULTS

The substantial effects of medically supervised water-only fasting and refeeding on BP were statistically significant. The water-only fasting period was preceded by a variable period (average of 2.8 days) of feeding with a low-fat, plant-based diet and was followed by a supervised refeeding period for a length of time (average of 6.8 days) of at least one half as long as the water-only fasting period (average of 10.6 days). The average length of treatment from admission to discharge was less than 3 weeks (20.2 days). A small percentage of patients (6.3%) were taking antihypertensive drugs on entry into the program; all subjects suspended their use of these drugs during the fast and throughout the supervised refeeding. Body weight over the entire treatment period (prefasting supervised diet, water-only fasting period, and supervised refeeding period) decreased by an average of 6.9 kg. During the water-only fasting period, body weight declined an average of 5.9 kg, and mean body mass index declined from 28.7 to 26.5.

BP dropped during the prefasting, water-only fasting, and postfasting (supervised refeeding) periods (Table 2). Most of the decrease occurred during the water-only fasting period. The overall mean drop of 37.1/13.3 mm Hg is substantially in excess of the combined effects either of a "vegetarian diet," alcohol restriction, sodium restriction, or exercise (Table 1). Moreover, it is also in excess of the combined 17/13 mm Hg decrease observed in a study with a vegan, low-fat, low-sodium diet with exercise.<sup>16</sup>

The extent of the drop in BP was strongly dependent on the baseline BP reading at entry, with more severe cases demonstrating the most striking results (Table 3). When the responses are grouped according to the traditional classification<sup>22</sup> of hypertension, 89% of subjects achieved normotensive status. The final mean BP of these 154 subjects was 117.5/78.7 mm Hg.

## DISCUSSION

These findings document the effectiveness of water-only fasting and dietary restriction for the treatment of patients with hypertension. Nearly 9 (89%) of 10 patients who were hypertensive at entry were normotensive by the conclusion of their supervised refeeding period. All patients who were initially taking antihypertensive medication were not taking medication by the conclusion of their fast and remained off medication throughout the supervised refeeding period.

Previous investigations have also noted short-term positive effects of diet and lifestyle modifications. McDougall et al<sup>16</sup> reported average BP reductions of 17/13 mm Hg for hypertensive patients in a 12-day inpatient program with a vegan-vegetarian diet and daily exercise, whereas MacGregor et al<sup>12</sup> found average BP reductions of 16/9 mm Hg for hypertensive patients on a very low-sodium diet. The present treatment produced an average diastolic BP reduction of 13 mm Hg, which is consistent with the previous studies. More notable, however, was the 37 mm Hg decrease in mean systolic BP. The mean systolic BP for patients with stage 3 hypertension was reduced from 194 to 134 mm Hg, a remarkable 60 mm Hg decrease. The results also suggest

that this intervention is relatively safe: no morbidity was observed at any point in the study for any subject, except for occasional mild nausea and orthostatic hypotension during the water-only fasting period. It is interesting that hunger was not reported to be a problem after the second or third day of water-only fasting.

Twenty (11%) of the patients, although exhibiting substantial decreases in BP, nonetheless remained hypertensive at the conclusion of treatment. These partially responsive patients fasted somewhat fewer days than the 154 fully responsive subjects (8.9 vs 10.8 days), although this difference did not reach statistical significance. These partial responders also had a significantly higher average systolic BP at entry, although during the fasting period, the rate of systolic and diastolic reductions actually exceeded (but not significantly) the reductions of fully responsive subjects. This finding suggests that if these partial responders had extended their fasts, some or all may have become normotensive. For some patients with very high initial BP, it may be necessary to conduct longer fasts or multiple fasts to obtain the desired results.

Another notable result is the 5.5/1.8 mm Hg reduction in BP observed during the supervised refeeding period (average of 6.8 days). This finding suggests that the rapid normalization of BP possible with this intervention strategy may be indefinitely sustainable with a low-sodium vegan diet. This possibility is consistent with epidemiologic findings suggesting that elevated BP is by no means inevitable for most people.<sup>24</sup> In fact, such findings suggest that a blood pressure-normalizing diet and lifestyle modifications, if sustained indefinitely, might be expected to have indefinitely protective effects. Although no longitudinal studies have examined whether the effects of diet and lifestyle methods for normalizing BP are as ultimately protective as drug treatment, there are no in-principle reasons to suspect that they would be less effective. On the contrary, provided that such behavioral modifications can be sustained, the protective effects of diet and lifestyle interventions might be expected to be at least as effective as current drug treatments, given the absence of iatrogenic effects.

## CONCLUSION

Despite the encouraging results of this study, many questions remain unanswered. Further investigation of the long-term effectiveness of this strategy on hypertension and its disease sequelae will be required. At present, we can only offer a limited follow-up report suggesting that the effect may not be transient. We have collected follow-up data on 42 of our original 174 subjects after an average post-treatment period of 27 weeks. The mean BP for these subjects was 123/77 mm Hg. Although no generalizations can be made from these limited data, the results are nonetheless suggestive that this approach may have some sustainable benefits. We believe that further research efforts may be useful in determining whether medically supervised water-only fasting and other diet and lifestyle-oriented interventions can be useful adjunctive treatment strategies for the management of clinical hypertension.

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