

## 2. Recommendations on obesity and weight loss

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### Abstract

**Objective:** To provide updated, evidence-based recommendations concerning the effects of weight loss and maintenance of healthy weight on the prevention and control of hypertension in otherwise healthy adults (except pregnant women).

**Options:** The main options are to attain and maintain a healthy body weight (body mass index [BMI] 20–25 kg/m<sup>2</sup>) or not to do so. For those at risk for hypertension, weight loss and maintenance of healthy weight may prevent the condition. For those who have hypertension, weight loss and maintenance of healthy weight may reduce or obviate the need for antihypertensive medications.

**Outcomes:** The health outcome considered was change in blood pressure. Because of insufficient evidence, no economic outcomes were considered.

**Evidence:** A MEDLINE search was conducted for the years 1992–1996 with the terms hypertension and obesity in combination and antihypertensive therapy and obesity in combination. Other relevant evidence was obtained from the reference lists of the articles identified, from the personal files of the authors and through contacts with experts. The articles were reviewed, classified according to study design and graded according to level of evidence.

**Values:** A high value was placed on the avoidance of cardiovascular morbidity and premature death caused by untreated hypertension.

**Benefits, harms and costs:** Weight loss and the maintenance of healthy body weight reduces the blood pressure of both hypertensive and normotensive people. The indirect benefits of a healthy body weight are well known. The negative effects of weight loss are primarily the frustrations associated with attaining and maintaining a healthy weight. The costs associated with weight loss programs were not measured in the studies reviewed.

**Recommendations:** (1) It is recommended that health care professionals determine weight (in kilograms), height (in metres) and BMI for all adults. (2) To reduce blood pressure in the population at large, it is recommended that Canadians attain and maintain a healthy BMI (20–25). (3) All overweight hypertensive patients (BMI greater than 25) should be advised to reduce their weight.

**Validation:** These recommendations are similar to those of the World Hypertension League, the National High Blood Pressure Education Program Working Group on Primary Prevention of Hypertension, the Canadian Hypertension Society and the Canadian Coalition for High Blood Pressure Prevention and Control. They have not been clinically tested.

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Weight loss is often considered for the treatment of hypertension, yet the specifics of the responses to treatment are not well known. In 1989 a consensus conference sponsored by the Canadian Coalition for High Blood Pressure Prevention and Control and the Canadian Hypertension Society recommended that weight loss may help in both the prevention and the treatment of hypertension.<sup>1</sup> Those recommendations were based on relatively sparse data. Since then, a number of new studies have been published on the relation between hypertension and obesity, as well as on the relation between weight loss and blood pressure.

In 1992 the Canadian Heart Health Survey highlighted the importance of obesity as a public health problem.<sup>2</sup> At that time in Canada 35% of men and 27% of women were obese (body mass index [BMI] greater than 27). Guidelines for BMI (which is calculated by dividing body weight, in kilograms, by the square of height, in metres) have been published for Canada.<sup>3</sup> A BMI above 27 is associated with increased health risks, including hypertension.<sup>4</sup> The causes of the higher blood pressure associated with obesity are likely multiple<sup>5</sup> and include insulin resistance or hyperinsulinemia,

### Special supplement

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overactivity of the sympathetic nervous system and alterations in the renin-angiotensin system.

The primary objective of these guidelines is to identify the evidence for and provide evidence-based recommendations to health care professionals about the relation between obesity and hypertension and the response of blood pressure to weight loss.

## Methods

A complete description of the methods for these guidelines is given in part 1 of this supplement.<sup>6</sup>

The chair and members of the panel were selected by the Organizing Committee for the lifestyle modification recommendations to obtain a spectrum of health care professionals and scientists with expertise and interest in the areas of hypertension, obesity and heart health.

The initial MEDLINE search was performed using the terms hypertension and obesity in combination and antihypertensive therapy and obesity in combination for English-language studies published between 1992 and 1996. Another search was performed just before publication using the terms hypertension, obesity and controlled clinical trial in combination for the years 1996–1998. Additional articles and articles published before 1992 were identified by reviewing the reference lists of the identified articles, were found in the personal files of the panel members and were suggested by other experts. For the primary recommendations regarding the efficacy of weight loss, the results of randomized controlled trials were used. However, epidemiologic studies and nonrandomized intervention trials were also reviewed. The data from the randomized controlled trials were interpreted in the context of the more extensive data obtained from studies with these other designs, which were used for the secondary recommendations. The principles for grading the evidence and the recommendations were based on those previously used by the Canadian Hypertension Society<sup>7</sup> and are summarized in part 1 of this supplement.<sup>6</sup> An attempt was made to reach a consensus on all recommendations. The evidence and the recommendations were presented for comment to the other expert panels for this guidelines series, submitted for review to major Canadian organizations and presented at an international conference on preventive cardiology, to allow further national and international input. All revisions were reviewed and assessed by the panel before incorporation into the final document.

## Results

### Observational data

Extensive epidemiologic data support a positive association between body weight and blood pressure. Cross-sectional studies have demonstrated the association in both sexes, for people of different ages and in several ethnic groups. Among Canadian adults younger than 55 years of age, the prevalence of hypertension is at least 5-fold higher for those with a BMI greater than 30 than for those whose BMI is less than 20.<sup>4</sup> The association is similar but less pronounced in older Canadians. In another study of one million North American subjects<sup>8</sup> the odds ratio for hypertension (in comparisons of obese and non-obese subjects) was 2.42 for those aged 20–39 years and 1.54 for those aged 40–64 years.

Similarly, when subjects in the Framingham study<sup>9</sup> were grouped in BMI quintiles, both systolic and diastolic blood pressure increased progressively; the mean difference between the first and fifth quintile was 16 mm Hg for systolic blood pressure and 9 mm Hg for diastolic blood pressure. The Nurses Health Study<sup>10</sup> reported that hypertension was 2 to 6 times more prevalent among heavier women (BMI of 29 or above) than among less heavy women (BMI less than 22). Other studies have indicated that the association is even stronger for people with relatively higher abdominal fat.<sup>11</sup>

Prospective cohort studies have also shown a correlation between weight gain and increases in blood pressure.<sup>12</sup> In the Framingham study, for each 4.5 kg of weight gain there was an associated increase in systolic blood pressure of 4 mm Hg in both men and women.<sup>9</sup>

To facilitate the identification of a risk of having hypertension or cardiovascular disease due to obesity or of these conditions developing, a reliable objective assessment is required. BMI is simple to calculate, is based on readily available clinical data and provides a basis for both assessing cardiovascular prognosis and monitoring change. BMI has been used extensively to generate prognostic cardiovascular data and is superior to body weight alone for the assessment of obesity. Other measures of obesity may predict cardiovascular disease more accurately than BMI but require measurements not performed routinely in clinical practice. Therefore, BMI is currently the most useful clinical assessment on which to base recommendations for weight loss, to assess cardiovascular risk, to establish therapeutic goals and to monitor change.

### Recommendation

- Body mass index should be routinely assessed for all adult patients (grade D recommendation).

### Randomized controlled trials

Several randomized controlled trials of weight loss have demonstrated that a reduction in weight is associated with a reduction in blood pressure. Table 1 summarizes the data from randomized controlled trials of weight reduction in overweight hypertensive patients.<sup>13–20</sup> In all of the trials except one,<sup>15</sup> weight reduction was associated with a reduction in mean blood pressure (level II evidence), although the lack of an appropriate statistical analysis was a limitation for some of the studies<sup>13,17,18</sup> (Table 1). For overweight patients, the efficacy of weight loss in reducing blood pressure is similar to that of single antihypertensive drug therapy.<sup>16,17</sup>

The Treatment of Mild Hypertension Study provides level II evidence that the effect of antihypertensive medications on blood pressure is additive to that achieved by weight loss alone.<sup>21</sup> However, patients randomly assigned to receive  $\beta$ -blocker therapy lost less weight than those receiving other drug therapies. The Trial of Antihypertensive In-

terventions and Management<sup>22</sup> (TAIM) revealed an additive effect of chlorthalidone therapy and weight loss on blood pressure in obese subjects.

## Recommendations

- Overweight hypertensive patients (BMI greater than 25) should be advised to reduce their weight (grade B recommendation).
- Overweight hypertensive patients receiving antihypertensive drugs should be advised to lose weight for additional antihypertensive effect (grade B recommendation).

Table 2 summarizes the data from randomized controlled trials of weight reduction in overweight normotensive people.<sup>23-25</sup> In this population weight reduction is associated with a reduction in blood pressure, which indicates the potential

utility of weight reduction in preventing hypertension (level II evidence). The phase I study of the Trials of Hypertension Prevention<sup>24</sup> showed that weight reduction was more effective than other lifestyle strategies in preventing hypertension.

## Recommendation

- Adults should be encouraged to attain and maintain a healthy body weight (BMI of 20–25) to prevent or forestall the development of hypertension (grade B recommendation).

## Nonrandomized trials and post hoc analysis of intervention trials

Evidence from nonrandomized trials and from post hoc analysis of intervention trials constitutes level III evidence.

**Table 1: Studies including effects of weight loss on blood pressure (BP) in hypertensive people**

Study design	Subjects	Intervention	Duration	Change in body weight, kg	Change in BP, mm Hg
RCT <sup>13*</sup>	49 hypertensive patients	Dietitian counselling = 15 Diet sheet = 14 MD advice = 20	1 yr	-5.1 -2.6 -2.2	-11.9/6.9 -5.7/3.0 -11.2/5.3
RCT <sup>14</sup>	107 overweight, hypertensive patients	No antihypertensives, weight reduction program = 24 Antihypertensives, weight reduction program = 57 Antihypertensives, no dietary program = 26	6 mo	-8.8 -9.8† -0.7	75% achieved normal BP 61% achieved normal BP† 0% achieved normal BP
RCT <sup>15</sup>	54 mildly hypertensive, obese people	Behaviourally oriented hypocaloric diet	6 mo	-3.3‡	+5.0/1.5 NS
RCT <sup>16</sup>	56 overweight patients, < 55 yr	Hypocaloric diet = 20 Metoprolol = 18 Placebo = 18	21 wk	-7.4§ +2.0 +0.5	-13.3/9.8‡ -9.9/6.2 -7.4/3.1
RCT <sup>17*</sup>	163 of 692 overweight, mildly hypertensive patients, 21–65 yr	Usual care and placebo = 79 Weight reduction program and placebo = 84	6 mo	-3.5	-10.5/8.2 -11.9/9.5
RCT <sup>18*</sup>	30 obese hypertensive patients	16 dexfenfluramine 14 placebo	3 mo	-6.0‡ -1.4	-11.0/4.0 -9.0/5.1
RCT <sup>19</sup>	61 mildly hypertensive, overweight men	31 hypocaloric diet 30 drug therapy, no diet restriction	1 yr 6 mo	-8.8§	-4/3 -15/11 ¶
RCT 2 × 2 factorial <sup>20</sup>	585 obese patients, 60–80 yr	Behaviourally oriented weight loss program v. usual care Sodium restriction, group counselling v. usual care Weight loss and sodium restriction v. usual care	29 mo	-3.8§	RR of drug treatment or a cardiovascular event = 0.64‡ RR of drug treatment or a cardiovascular event = 0.60 RR of drug treatment or a cardiovascular event = 0.47

Note: RCT = randomized controlled trial, BP = blood pressure, NS = nonsignificant, RR = relative risk.

\*Statistics not provided.

† $p < 0.05$  compared with group treated with antihypertensives and no dietary program.

‡ $p < 0.05$  compared with placebo.

§ $p < 0.001$ .

¶ $p < 0.002$ .

The TAIM study<sup>22</sup> examined the response of diastolic blood pressure to various combinations of dietary and pharmacologic interventions in 879 mildly hypertensive subjects (baseline weight 88.0 kg, mean BMI 30.4). Over 6 months, the mean weight loss was 4.7 kg, which was associated with an improvement in diastolic blood pressure in all groups. In patients receiving placebo who lost 4.5 kg or more, diastolic blood pressure declined by 11.6 mm Hg. For those who lost less than 4.5 kg, the decrease in diastolic blood pressure was not significantly different from the decrease in those receiving a placebo and eating their usual diet. Over the subsequent 4.5 years of follow-up, those following the weight-loss diet lost 2–3 kg, whereas those eating their usual diet lost no weight. Among those who were able to maintain their weight loss, the 5-year incidence of treatment failure (defined as not remaining on the initial drug therapy) was 23% lower than among those who did not maintain their weight loss.

### Recommendation

- In overweight patients with high blood pressure it should be emphasized that even 4.5 kg of weight loss may reduce their blood pressure (grade C recommendation).

The recommendations on weight loss and hypertension are summarized in Table 3.

### Interpretation

The attainment and maintenance of a healthy body weight can prevent hypertension and can be used as the primary treatment for mild hypertension or as an adjunct to pharmacologic therapy. Weight reduction may also reduce other cardiovascular risk factors, although there are no data from long-term randomized controlled trials demonstrating that weight reduction decreases morbidity and mortality rates. Although the long-term effectiveness of weight loss in the management of hypertension has been questioned, some studies using a multifactorial approach

involving nutrition education, alcohol reduction and physical activity have demonstrated long-term weight and blood pressure reduction.<sup>17,21,24</sup> However, knowledge that even modest weight loss (4.5 kg) can result in improvement in blood pressure and other metabolic abnormalities should help to emphasize the potential important role of weight reduction in blood pressure control.

Unfortunately, the overall results of lifestyle modification to reduce obesity are poor and lead to frustration and pessimism for both the patient and the health care provider.<sup>26</sup> Most long-term trials of weight reduction have found that weight returns to baseline levels after several years, although a few people are able to maintain their reduced weight.<sup>26</sup> Pharmacotherapy for obesity also has substantial problems. Two drugs (fenfluramine and dexfenfluramine) used to assist in weight reduction have recently been withdrawn from the market because they were associated with valvular heart lesions and pulmonary hypertension.<sup>27</sup> Sympathomimetic appetite suppressants are still available but may be associated with increased blood pressure<sup>21</sup> and have limited effectiveness in reducing weight.

Strategies for weight reduction in a hypertensive obese person are no different from those for any other obese person. According to the Canadian Task Force on the Treatment of Obesity, a comprehensive, multifactorial approach is preferred.<sup>26</sup> The approach should employ instruction about diet, increased physical activity and behaviour modification techniques. Among those receiving antihypertensive medications, weight loss may be more difficult in those treated with  $\beta$ -blocking antihypertensive drugs. The selection of initial antihypertensive drug therapy for an obese person should follow the guidelines of the Canadian Hypertension Society<sup>7</sup> (new guidelines will be available later in 1999).

### Validation

These recommendations are similar to those of the World Hypertension League,<sup>28</sup> the National High Blood Pressure Education Program Working Group on Primary

**Table 2: Studies including effects of weight loss on BP in normotensive people**

Study design	Subjects	Intervention	Duration	Change in body weight, kg	Change in BP, mm Hg
RCT <sup>23</sup>	841	Moderate caloric restriction; group meetings	6 mo	-5.8*	-5.1/2.8†
			3 yr	-3.5*	-2.4/1.8†
RCT <sup>24</sup>	Weight loss intervention 308; usual care 256	Moderate caloric restriction; group meetings	18 mo	-3.9*	-2.9/2.4*
RCT, 2 × 2 factorial <sup>25</sup> Weight loss v. control Sodium restriction v. control	2382	Moderate caloric restriction; behavioural change; group counselling	6 mo	-4.5*	-3.7/2.7*
			18 mo	-2.7*	-1.8/1.3*
			36 mo	-1.9*	-1.3†/0.9†

\* $p < 0.001$ .

† $p < 0.05$ .



Prevention of Hypertension,<sup>29</sup> the Canadian Hypertension Society and the Canadian Coalition for High Blood Pressure and Control.<sup>1,30</sup>

### Future research

Several issues remain to be addressed:

- Strategies to promote and sustain long-term weight loss must be developed and tested.
- Long-term studies relating weight loss to cardiovascular morbidity and mortality rates must be undertaken.
- More information must be gathered on the predictors of blood pressure response to weight loss, including patient characteristics, metabolic data and relation between degree of weight loss and blood pressure response.
- Data on the prevalence of hypertension among aboriginal populations in Canada and the response to treatment in these groups are needed.
- The utility of visceral fat as a predictor of blood pressure must be confirmed, and improved, simpler methods of quantifying visceral fat should be developed.
- More information must be gathered on the interactions between weight loss and specific antihypertensive drugs in controlling blood pressure.
- Trials comparing blood pressure responses to specific antihypertensive drugs in obese and non-obese people must be undertaken.

### Conclusion

An increased awareness of the benefits of attaining and maintaining a healthy body weight for overall health and specifically for the prevention and treatment of hypertension is indicated. Future efforts must be geared to better understanding this phenomenon, disseminating and implementing this information and finding the most effective means of sustaining weight loss.

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**Table 3: Recommendations for weight loss to control and prevent hypertension**

Recommendation	Grade
Height and weight should be measured and body mass index (BMI) calculated for all adults	D
A healthy BMI (20-25) is recommended for all adults to prevent hypertension	B
All overweight hypertensive people (BMI > 25) should be advised to reduce their weight	B
Overweight patients (BMI > 25) should be advised to lose a minimum of 4.5 kg to reduce blood pressure	C
A multifactorial approach to weight loss, incorporating diet instruction, increased physical activity and behaviour modification techniques, should be used	D

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