Associations of body mass index and waist:hip ratio with hypertension

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Canada Fitness Survey data for people aged 20 to 69 years were analysed by means of linear discriminant analysis to determine the effect of age, weight relative to height (body mass index) and weight distribution (waist:hip ratio) on hypertension (defined as diastolic blood pressure of 90 mm Hg or more) for both sexes separately. All three variables had independent effects on hypertension, but partial correlation coefficients indicated that the contribution of waist:hip ratio was secondary to that of body mass index. The association of measurements of body fat (five skinfold measurements) with hypertension was also examined; overall these measurements gave no advantage over the more simply measured body mass index. The results confirm the importance of assessing the predominant location of body fat and the body mass index when examining excess weight in relation to disease.

On fait l'analyse discriminante linéaire des données de l'Enquête condition physique Canada, chez les sujets âgés de 20 à 69 ans de l'un et l'autre sexe, à la recherche de liens entre l'hypertension artérielle (pression diastolique d'au moins 90 mm de Hg) d'une part et l'âge, l'indice de masse corporelle (poids en rapport avec la taille staturale) et la distribution du poids (rapport entre le tour de taille et le tour de hanches) d'autre part. Si chacun de ces trois paramètres est relié à l'hypertension, les coefficients partiels de corrélation montrent que l'importance du rapport taille:hanches est secondaire à celle de l'indice de masse corporelle. L'épaisseur du pli cutané prise à cinq endroits n'offre dans l'ensemble aucun avantage sur l'indice de masse corporelle, qui est plus simple à mesurer. Le tout confirme l'importance de connaître l'endroit du corps où le tissu adipeux prédomine, aussi bien que l'indice de masse corporelle, si on veut apprécier la signification pathogénique d'un poids excessif.

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Both cross-sectional and longitudinal studies have shown a significant association between relative weight and hypertension.[1-5] Although the exact cause of essential hypertension is unknown, follow-up studies have shown that even those with mild hypertension are at greater risk than the normotensive population for congestive heart failure, stroke and coronary artery disease.[6-8]

Since most surveys have shown the correlation between relative weight and hypertension to be significant but low (0.20 to 0.30),[9] it is important to determine the risk of hypertension associated with overweight for subgroups by age and sex. The anatomic distribution of weight has also been shown to be a factor in determining which people are more susceptible to hypertension.[10,11] We carried out a study to provide a greater understanding of the relation of age, relative weight, location of body fat and weight distribution to hypertension in men and women in Canada.

Methods

The Canada Fitness Survey[12] was initiated by Fitness and Amateur Sport Canada in 1981. It was designed to determine activity patterns and assess

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fitness levels in a representative cross-section of the Canadian population. The survey consisted of a self-administered questionnaire, anthropometric measurements and a standardized test of fitness. By means of a stratified random sample, 13 440 households in the 10 provinces were selected for study. Data were collected by study personnel from February to July 1981. Two-person teams of testers visited each household to administer the fitness tests and perform the anthropometric measurements. Many of the 30 652 people aged 7 years or over eligible for testing declined to participate in one or the other of the examinations, and only 16 027 agreed to undergo anthropometric measurements. Of the 16 027, 10 724 were aged 20 to 69 years, and the data for this subsample were used for analysis.

Subjects were weighed and measured for height wearing light clothing and no footwear. Five skinfold measurements were taken: biceps, triceps, subscapular, suprailiac and medial calf. Skinfold thickness was measured at least twice with a Harpenden caliper (British Indicators Ltd., England) at each site to ensure accuracy. In addition, six girth measurements were taken with a steel tape: upper arm, chest, abdomen, hips, right thigh and right calf. Before blood pressure was measured there was a 5-minute rest period with no postural change. Blood pressure measurements were taken in 10 405 men and women aged 20 to 69 years.

Body mass index, now accepted as the best measure of relative weight,[13] was calculated according to the formulas used in the US Health and Nutrition Examination Survey:[14] weight $\div$ height^2 for men, and weight $\div$ height$^{1.5}$ for women, where weight is expressed in kilograms and height in metres.

As measurements of body fat, all five skinfold measurements, separately and summed, were examined in relation to hypertension. Skinfold measurements were included in the US Health and Nutrition Examination Survey[14] and the Framingham[15] and Seven Countries[16] studies of cardiovascular disease as a more direct measure of body fat than relative weight since it is assumed that excess fat presents a greater risk to health than does excess weight.

Waist:hip ratio was calculated with the formula waist girth $\div$ hip girth, both expressed in centimetres. This measure of centrally located body fat was used by Hartz and colleagues[10] in analysing obesity and disease prevalence among women attending a US weight reduction organization.

For analysis of the Canada Fitness Survey data on hypertension, diastolic blood pressure readings were divided into two categories: less than 90 mm Hg (normotensive population) and 90 mm Hg or more (borderline and hypertensive population). This cutoff point was selected because it has been adequately shown by the Hypertension Detection and Follow-Up Program Cooperative Group[7] that even borderline hypertension contributes to both coronary and cerebrovascular disease. The group, which defined hypertension by diastolic measurements only, has provided evidence of the efficacy of antihypertensive treatment in lowering mortality rates among those with a diastolic blood pressure of 90 mm Hg or more.

A weight (greater or less than one) was assigned to each record by the Canada Fitness Survey to adjust the record for sampling design, age and sex within each province and urban/rural location so that the data would agree with the proportions observed in the 1981 census of Canada. These weights were adjusted so that the sum of the record weights equalled the total number of subjects in the (meaurement) sample. The Canada Fitness Survey recommended that all interpretations of the measurement observations be based on these weights. We followed this recommendation in our study.

For each of 12 age/sex groups, we calculated correlation coefficients for diastolic hypertension treated as a dichotomous variable with body mass index, all five skinfold measurements separately and the sum of all five measurements to determine whether measurements of body fat or of relative weight were more closely associated with hypertension. Prevalence rates of hypertension were calculated for six age groups, four categories of body mass index and four categories of waist: hip ratio (the categories of waist:hip ratio for women corresponded to those used by Hartz and colleagues[10]). Discriminant analysis was performed to determine the relative contributions of age, body mass index, skinfold measurements and waist:hip ratio to the presence of diastolic hypertension.

Results

The prevalence rates of diastolic hypertension for the six age groups are shown in Table I. The rate for men under 50 years was significantly higher than the rate for women under 50 years ($p < 0.001$). The prevalence of hypertension greatly increased among women aged 50 to 69. The rates increased consistently with age except for a slight decrease in men aged 60 to 69.

Correlations of body mass index, waist:hip ratio and skinfold measurements with diastolic hypertension varied with age and sex (Tables II and III). For men, hypertension was more highly correlated with body mass index than with any of the skinfold measurements in almost every age group. For some age groups of women, the subscapular skinfold measurement was more highly correlated with hypertension than was body mass index, but overall it was a somewhat less useful measure of the relation of excess fat or excess weight to hypertension in women. The triceps measurement showed the second lowest correlation with hypertension (only the calf measurement was lower), and the sum of the five skinfold measurements showed no superiority over the subscapular measurement alone for both men and women.

Figs. 1 and 2 show the prevalence rates of diastolic hypertension at increasing levels of body mass index by age group for men and women. Since very few men over age 59 or women over age 49 had a low body mass index, data points based on fewer than 25 people were not plotted (this also applies to Figs. 3 and 4). There was a steady rise in the rate of hypertension among men as body mass index increased. The highest prevalence rate (46.1%) was among men aged 50 to 59 years with a body mass index of 28 or more. There was no rise in the rate of hypertension with increasing weight among women except when the index was 35 or more. The highest prevalence rate of hypertension among women (41.7%) was for those aged 60 to 69 years with a body mass index of 35 or more.

Figs. 3 and 4 show the prevalence rates of hypertension at increasing levels of waist:hip ratio by age group for men and women. For men, the rates increased at each level of the ratio; the greatest increases were in those aged 40 to 59. For

Table I — Prevalence rates of diastolic hypertension* for men and women tested during the Canada Fitness Survey,[12] by age (based on weighted data)

	Men		Women	
Age, yr	Total no.	Rate, %	Total no.	Rate, %
20–24	1131	11.0	1131	3.9
25–29	1060	15.5	1047	3.9
30–39	1789	18.2	1742	8.6
40–49	1264	30.5	1211	13.5
50–59	1131	35.8	1166	23.7
60–69	797	27.3	880	32.2
20–49	5244	19.1	5131	7.7
50–69	1928	32.3	2046	27.4
Total	7172	22.6	7177	13.3

*Defined as diastolic blood pressure of 90 mm Hg or more.

Table II — Correlation coefficients* between diastolic hypertension and body mass index, skinfold measurements and waist:hip ratio for men, by age (based on weighted data)

		Skinfold measurements						
Age, yr	Body mass index	Triceps	Subscapular	Biceps	Suprailiac	Calf	Sum of all five	Waist:hip ratio
20–24	0.07	0.04	0.13	0.07	0.04	0.00	0.05	0.05
25–29	0.17	0.09	0.13	0.08	0.12	0.05	0.12	0.05
30–39	0.13	0.05	0.10	0.10	0.12	0.06	0.11	0.11
40–49	0.18	0.07	0.16	0.08	0.16	0.04	0.16	0.28
50–59	0.19	0.06	0.18	0.10	0.21	0.06	0.18	0.16
60–69	0.12	0.06	0.10	0.00	0.06	0.05	0.06	0.09
Total	0.20	0.09	0.18	0.10	0.14	0.03	0.14	0.21

*All correlation coefficients above 0.07 proved to be statistically significant; this was partly owing to the large samples.

Table III — Correlation coefficients* between diastolic hypertension and body mass index, skinfold measurements and waist:hip ratio for women, by age (based on weighted data)

		Skinfold measurements						
Age, yr	Body mass index	Triceps	Subscapular	Biceps	Suprailiac	Calf	Sum of all five	Waist:hip ratio
20–24	0.06	0.04	0.08	0.09	0.07	0.02	0.06	0.05
25–29	0.09	0.09	0.14	0.09	0.14	0.10	0.14	0.07
30–39	0.19	0.10	0.13	0.12	0.15	0.08	0.12	0.10
40–49	0.24	0.18	0.24	0.17	0.23	0.14	0.24	0.18
50–59	0.15	0.13	0.15	0.14	0.14	0.03	0.13	0.14
60–69	0.12	0.10	0.16	0.10	0.16	0.02	0.15	0.14
Total	0.23	0.18	0.21	0.17	0.21	0.09	0.21	0.19

*As in Table II.

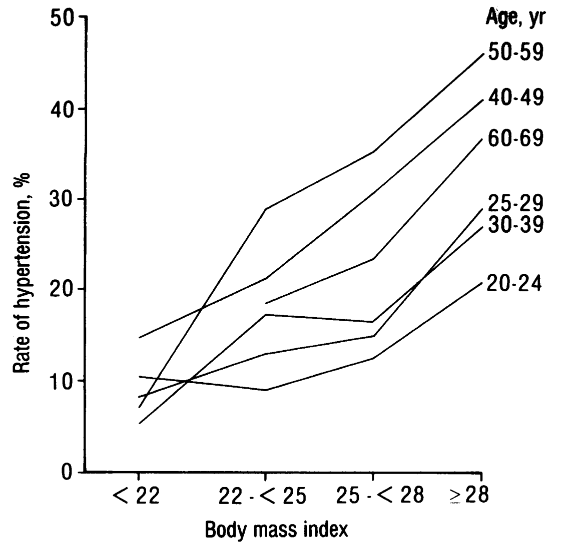

Fig. 1 — Prevalence rates of diastolic hypertension at increasing levels of body mass index for men, by age. Body mass index of 22 = approximately ideal weight; 22–< 25 = 0% to 15% over ideal weight; 25–< 28 = 15% to 30% over ideal weight; and ≥ 28 = 30% or more over ideal weight.[17]

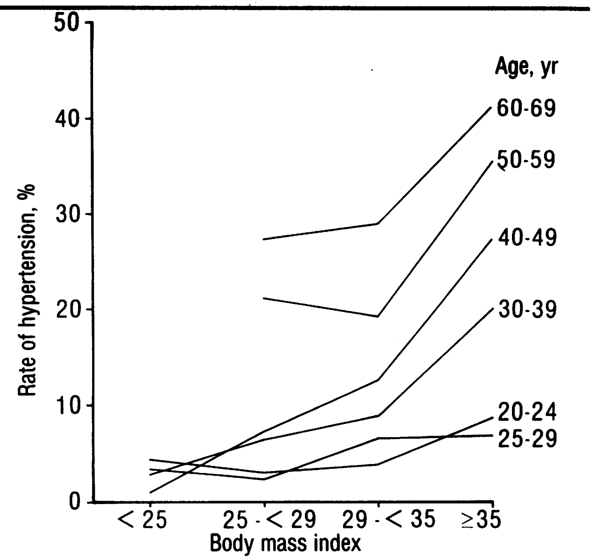

Fig. 2 — Prevalence rates of diastolic hypertension at increasing levels of body mass index for women, by age. Body mass index of 25 = approximately ideal weight; 25–< 29 = 0% to 12% over ideal weight; 29–< 35 = 12% to 35% over ideal weight; and ≥ 35 = 35% or more over ideal weight.[17]

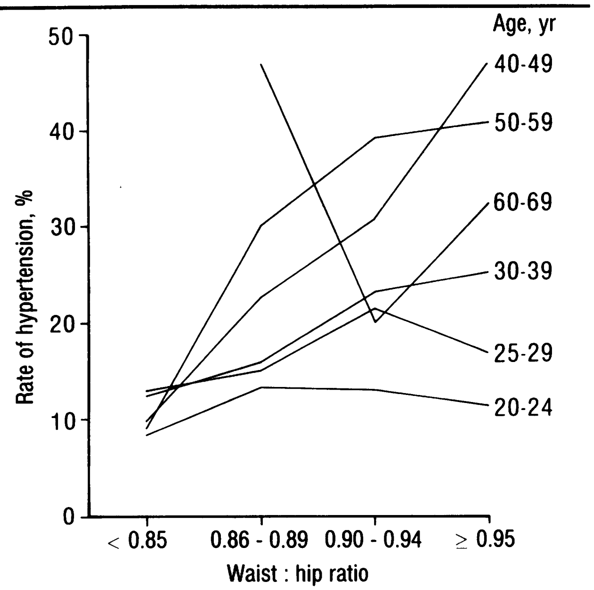

Fig. 3 — Prevalence rates of diastolic hypertension at increasing levels of waist:hip ratio for men, by age.

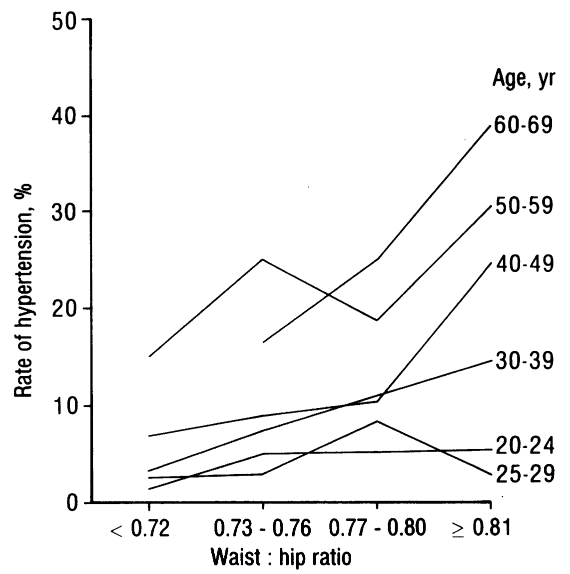

Fig. 4 — Prevalence rates of diastolic hypertension at increasing levels of waist:hip ratio for women, by age.

Table IV — Mean age, body mass index and waist:hip ratio for men and women with or without diastolic hypertension (based on weighted data)

Sex; group	Mean age (and standard deviation [SD]), yr	Mean body mass index (and SD)	Mean waist:hip ratio (and SD)
Men			
Diastolic blood pressure < 90 mm Hg (n = 5407)	38.0 (13.7)	24.9 (3.36)	0.889 (0.064)
Diastolic blood pressure ≥ 90 mm Hg (n = 1574)	44.0 (12.9)	26.6 (3.37)	0.923 (0.067)
Women			
Diastolic blood pressure < 90 mm Hg (n = 5992)	38.3 (13.6)	29.6 (4.65)	0.766 (0.068)
Diastolic blood pressure ≥ 90 mm Hg (n = 918)	50.0 (13.0)	33.0 (5.99)	0.805 (0.070)

women, the greatest increases in prevalence rates were in those aged 40 to 69 with a waist:hip ratio of 0.81 or more.

Linear discriminant analysis was applied to the presence or absence of hypertension, with the variables age, body mass index, waist:hip ratio and the subscapular skinfold measurement as potential discriminators. All four variables were found to be correlated with diastolic hypertension ($p < 0.0001$). Since the subscapular measurement did not further discriminate between those with or without hypertension after the other three variables had been controlled for, it was excluded from analysis. The mean values, based on weighted data, of the remaining three variables for the two groups, by sex, are given in Table IV. Table V shows the correlations between these variables for men and women separately.

Three discriminant analyses were done for men and women separately: analysis with a linear combination of age, body mass index and waist:hip ratio on all the observations; analysis with the same variables but including all six second-order (quadratic) combinations; and analysis with a lin-

Table V — Correlation coefficients between age, body mass index and waist:hip ratio (based on weighted data)

	Men		
Women	Age	Body mass index	Waist:hip ratio
Age	–	0.26	0.48
Body mass index	0.28	–	0.53
Waist:hip ratio	0.27	0.40	–

Table VI — Estimated relative risks* for hypertension for men, by age, body mass index and waist:hip ratio

	Body mass index								
	21			25			30		
	Waist:hip ratio			Waist:hip ratio			Waist:hip ratio		
Age, yr	0.85	0.94	1.03	0.85	0.94	1.03	0.85	0.94	1.03
22.5	0.26	0.42	0.68	0.45	0.71	1.10	0.85	1.28	1.82
	0.25	0.27	0.29	0.40	0.52	0.66	0.42	0.68	1.03
27.5	0.30	0.48	0.77	0.51	0.81	1.22	0.95	1.42	1.98
	0.34	0.39	0.43	0.59	0.78	1.00	0.68	1.08	1.60
35	0.36	0.58	0.91	0.62	0.96	1.43	1.13	1.64	2.23
	0.46	0.55	0.64	0.87	1.18	1.54	1.12	1.73	2.42
45	0.47	0.75	1.14	0.79	1.20	1.72	1.39	1.95	2.56
	0.51	0.66	0.81	1.09	1.53	2.02	1.59	2.38	3.12
55	0.61	0.95	1.41	0.99	1.47	2.04	1.69	2.28	2.87
	0.40	0.56	0.74	1.01	1.51	2.09	1.71	2.60	3.38
65	0.78	1.18	1.71	1.24	1.77	2.37	2.00	2.61	3.16
	0.22	0.33	0.48	0.68	1.14	1.73	1.43	2.39	3.28

*In each cell the upper value corresponds to the linear estimate and the lower to the quadratic. To obtain absolute estimated probabilities multiply the value by 0.220.

Table VII — Estimated relative risks* for hypertension for women, by age, body mass index and waist:hip ratio

	Body mass index								
	25			30			35		
	Waist:hip ratio			Waist:hip ratio			Waist:hip ratio		
Age, yr	0.72	0.80	0.90	0.72	0.80	0.90	0.72	0.80	0.90
22.5	0.22	0.28	0.38	0.32	0.42	0.57	0.48	0.62	0.83
	0.30	0.32	0.32	0.37	0.40	0.42	0.50	0.55	0.59
27.5	0.27	0.35	0.48	0.41	0.53	0.71	0.61	0.78	1.04
	0.33	0.37	0.41	0.41	0.47	0.53	0.56	0.66	0.75
35	0.39	0.51	0.68	0.59	0.75	1.00	0.87	1.09	1.44
	0.40	0.50	0.62	0.50	0.63	0.80	0.69	0.88	1.13
45	0.63	0.81	1.08	0.93	1.17	1.55	1.35	1.67	2.16
	0.55	0.78	1.12	0.70	1.00	1.45	0.97	1.39	2.01
55	1.00	1.26	1.65	1.44	1.79	2.30	2.03	2.47	3.09
	0.83	1.30	2.08	1.06	1.66	2.63	1.47	2.27	3.47
65	1.54	1.91	2.44	2.16	2.61	3.25	2.92	3.46	4.17
	1.33	2.24	3.70	1.70	2.81	4.45	2.32	3.66	5.42

*As in Table VI, except to obtain absolute estimated probabilities multiply the value by 0.111.

ear model for each of the six age groups separately. The last analysis gave no advantage to compensate for its complexity and is not presented.

A table of estimated relative risks for hypertension based on both the linear and the quadratic analyses is presented in Tables VI and VII. The relative risks are based on an absolute probability of 0.220 for men and 0.111 for women. These probabilities are estimates based on the simple linear (first-order) discriminant analysis for a typical man aged 45 with a body mass index of 25 and a waist:hip ratio of 0.90 and for a typical woman aged 45 with an index of 29 and a ratio of 0.77. When the results in Tables VI and VII are compared with those in Figs. 1 to 4 it can be seen that the linear discriminant analysis with quadratic terms mirrors the data somewhat more faithfully. The actual and estimated classification of sample members is given in Table VIII. The simple linear function gives more misclassifications for men and fewer misclassifications for women, but for both sexes it is less successful at correctly classifying those with hypertension. Although the quadratic function gives a statistically better fit than the linear function, this significance is partly a function of a very large sample size. The same improvement in fit would be statistically significant at the 5% level for a sample size of 1054 for men and 1591 for women.

The linear discriminant functions are presented partly for their simplicity and partly because they may be more reproducible:

- Men: $\ln p \div (1 - p) = -11.63 + 0.029$ age $+ 0.149$ BMI $+ 5.94$ WHR
- Women: $\ln p \div (1 - p) = -9.29 + 0.050$ age $+ 0.084$ BMI $+ 3.25$ WHR

where p is the probability that a person has a diastolic blood pressure greater than 90 mm Hg, ln is natural logarithm, BMI is body mass index and WHR is waist:hip ratio. The simple and partial correlation coefficients between diastolic hypertension and age, body mass index and waist:hip ratio when the other two independent variables are controlled for are given in Table IX. These coefficients show that there is statistical justification for the inclusion of all three variables. (The smallest partial correlation coefficient given, 0.064, would be statistically significant at the 5% level with a sample size of 939.)

Discussion

Surveys in California,[18] Connecticut[19] and Maryland[20] and the nationwide Community Hypertension Evaluation Clinic Program[21] in the United States all showed that the prevalence of hypertension (both borderline and definite) was higher in men than in women under the age of 50. After the age of 50 the prevalence rates for men and women were similar. This trend was apparent both in surveys in which hypertension was defined with diastolic pressure only[21,22] and in those that included both diastolic and systolic readings.[18,23] The Hypertension Detection and Follow-Up Program Cooperative Group[22] found no difference in the prevalence of hypertension between men and women overall when the definition of hypertension was extended to include cases controlled by medication. This group and other investigators[19,20,24] have determined that women are more likely than men to have their hypertension detected, treated and controlled.

The low participation rate in the Canada Fitness Survey[12] with respect to blood pressure and anthropometric measurements could have resulted in a selection bias. The decision to refuse to participate may have been based on excess weight or ill health. Therefore, our prevalence rates of hypertension cannot be generalized to the Canadian population. However, the prevalence rates of those with hypertension and high body mass index values were likely underestimated from our sample. Inclusion of the population that refused to participate would more likely have strengthened than weakened our findings.

Since both weight and amount of body fat tend to increase with age, it is relevant to compare

Table IX — Correlation coefficients of age, body mass index and waist:hip ratio with diastolic hypertension (and partial correlation coefficients when the effects of the other two predicting variables are controlled for) (based on weighted data)

Variable	Men (n = 6981)	Women (n = 6910)
Age	0.181 (0.088)	0.281 (0.206)
Body mass index	0.207 (0.107)	0.232 (0.118)
Waist:hip ratio	0.214 (0.075)	0.190 (0.064)
Combined	0.254 –	0.322 –

Table VIII — Classification of sample by first-order and second-order discriminant functions (based on weighted data)

Predicted diastolic blood pressure, mm Hg	No. of men: Observed diastolic blood pressure, mm Hg		No. of women: Observed diastolic blood pressure, mm Hg	
	< 90	≥ 90	< 90	≥ 90
< 90				
Linear function	5029	1323	5892	860
Quadratic function	5058	1267	5823	799
≥ 90				
Linear function	378	251	100	58
Quadratic function	349	307	169	119

the strengths of the association of body mass index and skinfold measurements with hypertension. In this sample of Canadians, body mass index proved overall to be more closely related to hypertension than did skinfold measurements. The subscapular measurement was more highly correlated with hypertension than were the other measurements in men and had the same correlation with hypertension as the suprailiac measurement and the sum of the five measurements in women. Analysis of the data in the US Health and Nutrition Examination Survey[11] also showed the subscapular measurement to be more closely related to hypertension than was the commonly used triceps measurement. When they compared body density (as a measure of body fat) with relative weight as predictors of systolic and diastolic blood pressure in a group of young men followed for 32 years, Gillum and colleagues[4] found that body density was not superior to weight measurements. They suggested that weight may be a more reliable measurement and that overweight may measure some physiologic changes consistent with higher blood pressure that are not as closely associated with measurements of body fat.

When our sample was divided into four levels of body mass index, moderate increases in the index were found to be associated with increases in the prevalence of diastolic hypertension in men of all ages. Among women, a notable increase was found only for those with an extremely high body mass index. Waist:hip ratio appeared to be closely associated with hypertension in men aged 40 to 59 years and in women aged 40 to 69.

Discriminant analysis that included age, body mass index and waist:hip ratio confirmed the strength of the association between body mass index and hypertension. After we controlled for the effects of weight (as measured by body mass index and waist:hip ratio), age remained an important predictor of hypertension. The subscapular skinfold measurement, which has been shown to be an indicator of body fat distribution,[11] did not add to the prediction of hypertension after we adjusted for body mass index and waist:hip ratio. Since the index and the ratio are simpler and more precise measurements, skinfold measurement appears to be unnecessary in the assessment of a person's risk for hypertension.

The contribution of waist:hip ratio to the prevalence of hypertension has previously been assessed only in women.[10,25] We found the ratio to be a strong independent predictor of hypertension in both men and women, although its importance is secondary to that of body mass index.

As has been suggested by Hartz and associates,[10] investigation of the effect of excess weight or excess fat on disease should include an assessment of the predominant location of body fat together with a measure of total body mass. Our analysis shows that for men, no less than for women, excess weight and centrally located fat are independent predictors of hypertension, and therefore the concurrence of these two factors increases the overall risk.

In light of the concerns about the side effects of long-term drug therapy for reducing blood pressure, as well as about its effectiveness in some cases, there have been a number of studies of dietary approaches to the control of elevated blood pressure.[26-28] Findings of these studies suggest that not only is weight loss an effective means of lowering blood pressure, but also that it may not be necessary to achieve "ideal weight" to reduce blood pressure to normal levels.

In our study we focused on people with hypertension for whom weight control may be most efficacious. In evaluating the appropriateness of prescribing weight loss as a treatment for hypertension, age, sex, body mass index and predominant location of body fat should all be taken into account.

We thank Wayne Millar, for providing preliminary data, and Dr. Heather Stockwell, for assisting in the assessment of the literature.

This study was partially funded by the Health Promotion Directorate, Department of National Health and Welfare.

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Meetings
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Mr. Chuck Shields, Canadian College of Health Service Executives, 201-17 York St., Ottawa, Ont. K1N 5S7; (613) 235-7218 or Mr. Joe Chouinard, Canadian Medical Association, 1867 Alta Vista Dr., Ottawa, Ont. K1G 3Y6; (613) 731-9331

Sept. 28-30, 1986

Tri-Disciplinary Conference for the Senior Management Team: Physician, Nurse & Administrator
Delta Airport Inn Resort, Vancouver
Canadian College of Health Service Executives, 201-17 York St., Ottawa, Ont. K1N 5S7; (613) 235-7218

Sept. 28-Oct. 1, 1986

Sixth International Seminar on Terminal Care
Montreal
Dr. Balfour M. Mount, director, Palliative Care Service, Royal Victoria Hospital, 687 Pine Ave. W, Montreal, PQ H3A 1A1; (514) 842-0863

October

Oct. 3, 1986

University of Western Ontario Research Day in Family Medicine
Park Lane Hotel, London
Dr. J.F. Sangster, 1228 Commissioners Rd. W, London, Ont. N6K 1C7

Oct. 5-8, 1986

Physician Manager Institute 1986: the Foundations of Management
Deerhurst Inn & Country Club, Huntsville, Ont.
Mr. Chuck Shields, Canadian College of Health Service Executives, 201-17 York St., Ottawa, Ont. K1N 5S7; (613) 235-7218 or Mr. Joe Chouinard, Canadian Medical Association, 1867 Alta Vista Dr., Ottawa, Ont. K1G 3Y6; (613) 731-9331

November

Nov. 2-6, 1986

15th Annual Educational & Scientific Meeting of the Canadian Association on Gerontology
Quebec Hilton International, Quebec City
Canadian Association on Gerontology, 238 Portage Ave., 2nd Floor, Winnipeg, Man. R3C 0B1; (204) 944-9158

Nov. 8, 1986

Canadian Society of Vascular Technology education day
Shangrila Hotel, Montreal
Margaret Lacoste, Vascular Lab, Montreal General Hospital, 1650 Cedar Ave., Montreal, PQ H3G 1A4