Effect of weight on prevalence of hypertension, and its interaction with the arm circumference: Belgian Hypertension Committee Epidemiological Study

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Summary

1. A first sample of a cross-section of the Belgian population was studied.
2. The presence of hypertension or borderline hypertension was established on the basis of two examinations at 1–3 weeks intervals, during which the blood pressure was measured four times after 10 min rest.
3. The prevalence of both hypertension and borderline hypertension increased with age in the two sexes and, independently of age, with the relative weight.
4. The probable effect of arm circumference in overestimation of blood pressure in heavy subjects was analysed by multivariate correlations. It was concluded that if the influence of arm circumference is excluded, the effect of relative weight on blood pressure is less marked but still present.

Key words: arm circumference, hypertension, weight.

Introduction

In 1972, the Belgian Hypertension Committee promoted an inquiry that aimed at studying the blood pressure of a cross-section of the Belgian population as representative as possible of every age and professional and social class. The collaborative study, based upon several university centres interested in hypertension, was also carried out as a preliminary trial of screening for hypertension in Belgium. A first evaluation of this inquiry was made at the beginning of 1975 (Demanet, Samii, Rorive, Carlier, Van Cauwenberge & Smets, 1976). A further investigation of the first sample of the population bears on the relation between the prevalence of hypertension and the weight of the subjects. The effect of arm circumference upon determination of blood pressure was also studied.

Methods

Each individual was allowed to lie in a quiet room for 10 min, after which four consecutive determinations of blood pressure were recorded (two in each arm) by a trained technician, with a standard mercury manometer and a cuff 22 cm × 13 cm wide. A centimetric scale attached to the cuff gave the arm circumference. The pulse rate, weight and height were also recorded. This examination was followed by an interview with a doctor.

The sample studied comprised 3133 persons (1072 men and 2061 women) aged from 16 to more than 80 years. Many different social classes were represented: workers and employees from official administrations, large stores and factories, students, and non-invalid boarders of homes for aged persons. Of the individuals, 61% were urban citizens, 22% lived in the country and 17% in the suburbs.

For analysing the weight distribution in the sample each individual was evaluated in relation to his ideal weight, using the formulae of Potton. In males: ideal weight = 0.95 (H – 100); in females: ideal weight = 0.9 (H – 100); ideal weight is expressed in kg and H represents the height in cm.

The percentage 'relative weight' was calculated as follows:

\[
\frac{\text{real weight} - \text{ideal weight}}{\text{ideal weight}} \times 100
\]
Four classes of relative weight were established: (1) less than $-10\%$ (thin persons); (2) from $-10\%$ to $+10\%$ (normal persons); (3) from $+10\%$ to $+20\%$ (heavy persons); (4) more than $+20\%$ (obese persons).

The four determinations of blood pressure obtained in each person were recorded by taking the first Korotkoff sound for the systolic value and fifth (last sound) for the diastolic value. The mean of the four determinations was calculated for the systolic and the diastolic pressure and considered as representative for each individual.

Every subject with a blood pressure of less than 140/190 mmHg and without a history of previously elevated blood pressure was considered as normotensive, irrespective of age. All those who did not meet these criteria were seen again during a second session, 1–3 weeks later, and pressures were deter-

Fig. 1. Influence of age and weight on the prevalence of hypertension (solid columns) and borderline hypertension (stippled columns) in males and females. Each age category is divided into four classes of weight (see the text).
Weight, arm circumference and hypertension

mined again by the same schedule as at the first visit.

After this second determination, the persons with blood pressure equal to, or in excess of, 160/95 mmHg on both visits were considered as hypertensive. In this category was also included every person being treated with drugs for hypertension at the moment of the screening, irrespective of his blood pressure.

All other subjects were classified in a third group, as 'borderline hypertensive'.

Results

The prevalence of hypertension as well of borderline hypertension increases with age in both men and women. This phenomenon is even more marked in women than in men, owing to a greater age-related increase of blood pressure in women (Fig. 1).

Fig. 1 also illustrates the strong relation between relative weight and the prevalence of borderline hypertension and hypertension within each age and sex group.

With the aim of distinguishing the factor 'arm circumference' from the factor 'weight' in our population sample, we performed an analysis of multivariate correlations between blood pressure (systolic and diastolic pressure separately) and these two factors (Snedecor & Cochran, 1967).

In the whole sample, we estimated the partial correlation between blood pressure and relative weight, arm circumference being held constant, and also between blood pressure and arm circumference, the relative weight being held constant. The partial correlation coefficients between blood pressure and relative weight were 0.130 and 0.123 respectively for systolic and diastolic pressure, and between blood pressure and arm circumference were 0.157 and 0.197. Owing to the very large number of subjects included in the sample, these coefficients, although low, are statistically very significant ($t > 6.6$ in all four).

Discussion

These results, as expressed in Fig. 1, are particularly revealing for the influence of weight on blood pressure. They clearly demonstrate that this relation exists independently of the age factor (which is in close correlation with the weight when the population is taken as a whole).

In view of the fact that the arm circumference has been shown to influence the determination of blood pressure by the indirect method (Pickering, Fraser Roberts & Sowry, 1954; Holland & Humefelt, 1964), one can expect a slightly excessive value for indirect blood pressure as compared with direct intra-arterial measurement in heavy and obese subjects.

The analysis of multivariate correlations demonstrates an independent relationship between blood pressure and both weight and arm circumference, and indicates that the increase of blood pressure with weight appears less marked when the factor arm circumference is eliminated. These results are in good accordance with previous studies (Chiang, Perlman & Epstein, 1969).

From a practical point of view this study indicates that if direct measurement of blood pressure could be used, the observed increase in the prevalence of hypertension and borderline hypertension with weight excess would become less evident, although it would still be present.

References


