Relation between overweight, diabetes, stress and hypertension: 
A case–control study in Yarumal – Antioquia, Colombia

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Abstract. Aims: The aim of this study was to assess the association between overweight, diabetes, stress and other postulated risk factors for a high blood pressure, on the risk of hypertension. Methods and Results: This matched case–control study included 228 cases randomly selected in a rural adult population in Yarumal – Antioquia, Colombia. For every case, one control, individually matched by age (±5 years), sex and residence, was selected from the general population. Conditional logistic regression was used to estimate odds ratios (OR). Obese people (body mass index (BMI) ≥ 30 kg/m²) showed an increased OR of hypertension compared to those with a BMI < 25 kg/m², OR: 3.83 [95% confidence interval (CI): 1.83–8.00]. A high level of psychological stress was associated with hypertension (measured on a tension–anxiety scale), OR: 5.02 (95% CI: 2.25–11.19). A positive association was also observed for diabetes although it was of borderline significance, OR: 2.58 (95% CI: 0.88–7.55). Having a family member with hypertension or myocardial infarction was related to a higher risk of hypertension (p < 0.05). Conclusions: This study provides evidence that BMI, stress (feelings of anxiety or tension), and diabetes are independently associated with an increased risk of hypertension in a rural area of Colombia.

Key words: Body mass index, Case–control study, Diabetes, Hypertension, Stress

Introduction

In a recent report [1], the non-communicable diseases were presented as the first cause of death in the world. In developing regions, one in every two deaths now occurs from non-communicable diseases with cardiovascular diseases (CVDs), mainly coronary heart disease and stroke, as the leading conditions of this group of causes. In recent years, a change in the cause-of-death pattern has emerged in Antioquia, Colombia, with a decline in communicable diseases and a rapid increase in deaths from violence and CVDs [2]. In 1986, ischaemic heart disease, heart failure and cerebrovascular disease became the second, forth and ninth cause of death in Antioquia, respectively [3].

A high blood pressure (BP) is the single most important risk factor for stroke and a major risk factor for coronary heart disease and heart failure [4]. The World Health Organisation has acknowledged that the prevalence of hypertension in adult population older than 15 years of age could be as high as 12%, although in some populations up to 35% of adult population could be affected [5]. In spite of the magnitude of these figures, and that hypertension has been related to obesity, stress (tension–anxiety), sodium and alcohol intake among other very prevalent risk factors mainly in developed countries, there is little information on whether these associations are replicated in other populations with low to medium levels of development.

The aim of this study was to assess the influence of body mass index (BMI), diabetes, stress and other postulated risk factors for a high BP, on the risk of hypertension in an adult population in Yarumal – Antioquia, Colombia.

Methods

Subjects

The source population for this study was the adult population aged 15 years or more, from Yarumal in Antioquia (Colombia), a village of approximately 25,471 inhabitants in 1993. Cases were randomly selected from 639 hypertensive patients enrolled in a program for hypertension control at the Hospital San Juan de Dios and four associated primary health care centres in Yarumal in 1994. Hypertensive patients were those people with systolic blood pressure (SBP) ≥ 140 mmHg or diastolic blood pressure (DBP) ≥ 90 mmHg or with pharmacological antihypertensive treatment [6]. Selected patients were invited to participate, and 100% participation rate was reached. Of the 228 selected cases, 82 were male and 146 female; 183 cases came from patients enrolled in
the hospital program and 45 cases from the four primary health care centres. Of the cases, 49% had been in the hypertension program for at least 3 years, and 28%, for 1–3 years. No significant differences were observed between selected and unselected patients.

Controls were randomly selected from the source population which gave rise to the cases. For each case, a control was selected with the same sex, age (±5 years) and residence (neighbourhood) as the corresponding case. No control were selected from among first-degree relatives of the cases. Controls were normotensive, with no personal history of hypertension or CVD. In this way, 228 controls were selected. Once the cases and controls were identified by one of the researchers, another one, blinded to the case/control status, performed the home interviews.

**Blood pressure and exposure measurement**

All factors were measured at the time of the interview, unless otherwise noted. Before completing the interview, BP was taken on each control to confirm his/her normotensive status. In the present study, a single BP reading on the day of the interview was used. BP was measured with a standardised procedure [7], on the subject’s right arm after 15 min rest in a sitting position using a standard sphygmomanometer. The first and fifth Korotkoff phases were recorded as the SBP and the DBP respectively.

Controls with a DBP of 90 mmHg or higher, and/or a SBP of 140 mmHg or higher, were excluded from the study and referred to their health care centre for control of BP.

A structured questionnaire was used to collect data on sociodemographic characteristics, anthropometric factors, tobacco use, alcohol consumption, and personal and familiar history of selected medical conditions.

Height and weight were measured in standardised fashion using a stadiometer and a weighing scale, which was calibrated daily against known weights. BMI was obtained using the weight in kilograms divided by height in metres squared (kg/m²). Persons with BMI values over 25 were considered as overweight, and those over 30 as obese.

Drinking habits were assessed firstly by asking the subjects whether they had ever drunk at least once per week over a period of 1 year or longer, and if so, they were then asked whether they currently drank in such frequency. Lifelong non-drinkers were thus those who had never had the habit of drinking at least once a week over a period of 1 year or longer. Former drinkers were those who did not currently drink once a week or more frequently. In the current drinkers, usual alcohol intake was estimated from reported consumption frequency and quantity for available alcoholic beverages, mainly beer and local liquor (aguardiente). Likewise, former smokers were separated from lifelong non-smokers.

Cases and controls were categorised into two groups according to their regular exercise in the past, as yes (at least three times a week during 30 min each time) or no.

Subjects were asked about their past intake of salt added to meals (yes/no), and animal foods with a high fat content (pork lard, butter, local sausages, beef and pork meats, and other animal products). Thus, people were grouped in five categories of consumption: never, low (1–7 times/week), moderate (8–14 times/week), high (15–21 times/week) and very high (>21 times/week).

Reported diabetes in cases was verified by investigating medical records at the corresponding health care centre. In addition, a fasting blood sample was drawn for the determination of serum glucose which was accepted by 67% of controls (n = 153) and 83% of cases (n = 191). When basal glycemia was considered to be elevated (>120 mg/dl), controls were referred to their health care centres for control.

Family history (FH) of hypertension, stroke, myocardial infarction and heart failure were collected from the patients and not from the relative's assessment. Persons were classified as FH+ if they had at least one family member affected (parents, brothers, sisters or grandparents).

Nine specific questions (Appendix) were used to collect information on psychological factors potentially related to hypertension, mainly those related to anxiety and anger. Questions explored feelings of anxiety and anger, including somatic symptoms potentially related to both, such as headaches, feeling weak, or getting tense or worried. Questions about sleeping well, consumption of stimulants and how others considered them were also included. Each question had four possible responses ranging from never (1) to always (4). Using a tension–anger scale subjects were grouped in three categories as non-stressed (9–15), moderately stressed (16–20) and very stressed (20–36).

**Statistical analysis**

The statistical analyses included descriptive statistics, univariate and multivariate analyses using the conditional logistic regression method [8]. To estimate odds ratios (OR) of hypertension associated with each study variable, OR and 95% confidence intervals (CI) were calculated using the EGRET computer program. Crude OR and OR adjusted for potential confounders were estimated taking into account age and sex as the matching variables. The final model presented in Table 2 included only those explanatory variables with statistically significant effects (Table 2).

**Results**

The mean age of cases was 54.0 years (standard deviation, SD ± 12.4), very similar to the mean age of