ORIGINAL ARTICLES

Effect of weight-loss on the reduction of blood pressure in overweight and obese hypertensive patients

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Abstract: Study objectives – Our objective was to analyze the effect of body weight reduction on blood pressure in elderly hypertensive subjects. **Methodology applied** – A cross survey was conducted in 2015 on a random sample of the resident population in Tiaret (West of Algeria). Hypertensive patients (aged 53-70) were divided according to their body weight (underweight, normal weight, overweight including obesity) into three groups (N=120). Weight, height and Body mass index (BMI) were measured (calculated as weight in kilograms divided by the square of height in meters) to estimate the various categories of body weight. The blood pressure (systolic and diastolic) and the biochemical parameters were also measured. We have proposed a program for enrolled subjects including a reduced calorie diet and adequate and regular physical activity in order to reduce their body weight. After completing the program, subjects were classified according to amount of weight lost over 6 months: (1) weight changed by less than 3 %, (2) lost 3 % to less than 5 %, (3) lost 5 % or more. **Study results** – Our results show significant difference between body weight and blood pressure. A significant increase in blood pressure is observed in patients with overweight including obesity. **Conclusions** – We found that hypertensive patients who have a normal weight or even underweight represent lower blood pressure. This confirms the need for weight loss in the process of struggle against this public health problem or even prevention.

Keywords: blood pressure, weight-loss, overweight, obesity.

INTRODUCTION

Hypertension affects 972 million people worldwide[1-3]. In the majority of cases, no cause is identified and there is talk of essential hypertension. Secondary hypertension represents 9.1% of cases[4]. Hypertension is a major risk factor for cardiovascular and renal diseases, its prevalence is increasing worldwide[5,6]. Algeria is not immune from this scourge; in 1993 the national health survey placed hypertension as the first cause of consultation (17.2%). In the Step Wise 2003 study by the *Ministry of Health* in collaboration with WHO, the prevalence of hypertension was 29.1%. An epidemiological investigation by the *Algerian Society of Hypertension* (SAHA) in 2004 revealed a prevalence of 35%. Hypertension is known as a complication of overweight[7]. Several studies have shown a strong link between body weight and blood pressure. Hypertension is a multifactorial disease resulting from the interaction of genetic and environmental factors including nutritional factors.

The approach today is totally treatment by drug in Algeria, the *Ministry of Health* considers hypertension a chronic disease, which entitles them to have hypertensive medication free of charge through the *National Fund of Social Insurance*. However, this is a burden on the state and also an economic burden on the uninsured hypertension which are forced to pay a processing bill which sometimes exceeds their income. All these considerations lead us to think of other non-drug treatment against this disease initiatives such as physical activity and especially weight loss, whose effectiveness is already shown in several studies[8]. In a non-traditional approach, we analyzed the effect of weight loss on the evolution of the disease in hypertensive Algerian by observing changes in biochemical parameters and blood pressure. To do so, we conducted a cross-survey by questionnaire to first identify the weight status of patients and Secondly estimate body weight and basic biochemical parameters. We have prepared a program that includes a reduced calorie diet and adequate and regular physical activity to reduce body weight of the patients.

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Subjects and methods

The study focused on 120 patients (58 men and 62 women) aged 53-70 years admitted to the hospital of Tiaret for hypertension into 20 February and 15 December 2015. We worked with hypertensive patients who come for consultation at the hospital. All subjects were hypertensive and they had no chronic diseases. Anthropometric and taking blood pressure measurements are made by us even with the presence of the attending physician. Early-morning venous blood samples had been obtained from each participant for biochemical tests, following a twelve-hour overnight fasting. Blood had been centrifuged for plasma separation at the hospital where the actual biochemical analyses were performed. Then a questionnaire was distributed to patients in order to learn about their socio-economic and physical as well as their usual feeding activity. We used a reminder 24h to estimate dietary intake of the subjects surveyed. After collecting the data from our study, we opted for the division of the population into three groups according to body weight: underweight (BMI: <18.5 kg m^2), normal weight (BMI: 18.5-24.9 kg m^2) and overweight (BMI: 25.0–29.0 kg m^2) including obesity (BMI >30 kg m^2)[9]. The blood pressure (systolic and diastolic) with validated electronic device (OMRON 705CP) and biochemical parameters (HbA1c, fasting glycaemia, total cholesterol (TC), high-density lipoprotein cholesterol (HDL-c), low-density lipoprotein cholesterol (LDL-c) and triglycerides (TG) were analyzed. The course of the study consisted of a questionnaire completed by a clinical examination including epidemiological parameters (age, occupation, gender, address). The weight and height were also measured the same day. Measuring the blood pressure was measured twice at two-minute intervals after five minutes rest. The average of the last two measurements was used in the statistical analysis. A program with the main objective the reduction of body weight in overweight people including obesity was carried out for six months. All overweight and obese patients (n = 55; 45.83% of the study population) participated in this program who had two objectives, first, the study of the response and implementation, and also, analyzes the effect of weight loss on many biochemical parameters including the blood pressure. None of the participants used any vitamins, mineral supplements or oral contraceptives. None of the females were pregnant or breast-feeding. The participants were informed about the subject, purpose and rules of the research. Each participant signed a voluntary participation form.

Statistical analyses

Statistical tests are used: univariate statistical analysis: frequency, mean, range, median. bivariate analysis: comparison test variables: Chi2, Student's t test comparing two means (quantitative). Data was expressed as mean ± S.D. We used SPSS 20.0 for Windows (SPSS Inc., Chicago, IL, USA) for statistical analyses. A p-value <0.05 was considered statistically significant.

Results

Table 1 shows the general characteristics of the patients.

The average age of the surveyed population is 56.65±10.65 years with a minimum age of 53 years and a maximum age of 70 years. The average systolic blood pressure of the population is 12.39±1.87 cmHg,

Table 1. Characteristics of the patients, n=120

Variables, mean±S.D.	Total	Men	Women	P-value (men vs. women)
N	120	58	62	-
Age (year)	56.65±10.65	55.76±11.76	56.86±10.85	0.043
Weight (Kg)	81.33±12.34	76.86±12.85	85.96±11.76	0.012
Height (cm)	164.76±8.75	176.86±7.86	160.76±10.86	0.075
BMI (Kg m^2)	27.76±8.98	26.86±6.97	27.67±9.02	0.016
Systolic pression (cmHg)	12.39±1.87	12.76±1.22	12.86±1.11	0.086
Diastolic pression (cmHg)	7.76±1.65	7.58±1.73	7.62±1.74	0.067
Underweight patients, n (%)	35 (29.16)	20 (57.14)	15 (42.85)	0.011
Normal weight patients, n (%)	30 (25)	18 (60)	12 (40)	0.089
Overweight/Obese patients, n (%)	55 (45.83)	20 (36.36)	35 (63.63)	0.037
HbA1c (mmol/mol)	58.35±8.65	57.85±6.96	56.75±9.64	0.098
Fasting glycaemia (g/L)	1.11±0.43	1.08±0.34	1.10±0.33	0.023
Total cholesterol (g/L)	1.23±0.22	1.33±0.45	1.23±0.34	0.087
HDL-c (g/L)	0.34±0.10	0.35±0.18	0.33±0.18	0.681
LDL-c (g/L)	1.22±0.23	1.25±0.22	1.23±0.11	0.029
TG (g/L)	1.23±0.45	1.19±0.54	1.20±0.56	0.786

Table 2. Biochemical parameters according weight status of the patients, mean±S.D

	Underweight patients n=35	Normal weight patients n=30	Overweight/Obese patients n=55	P-value
Systolic pression (cmHg)	12.22±1.33	12.18±1.22	12.87±1.02	0.043
Diastolic pression (cmHg)	7.34±1.64	7.11±1.34	7.98±1.39	0.054
HbA1c (mmol/mol)	54.33±8.75	54.41±8.42	54.91±8.23	0.062
Fasting glycaemia (g/L)	1.10±0.54	1.12±0.34	1.19±0.24	0.014
Total cholesterol (g/L)	1.16±0.64	1.17±0.52	1.23±0.50	0.035
HDL-c (g/L)	0.33±0.13	0.32±0.18	0.29±0.16	0.075
LDL-c (g/L)	1.20±0.25	1.22±0.26	1.31±0.20	0.863
TG (g/L)	1.19±0.49	1.20±0.37	1.28±0.30	0.374

with a maximum value of 16 cmHg and a minimum value of 11 cmHg. Mean systolic blood pressure was 12.76±1.22 cmHg in men, with 16 cmHg as the upper limit and 11 cmHg as the lower limit. The average systolic blood pressure for women is 12.86±1.11 cmHg. Table 2 summarizes the biochemical parameters according weight status of the patients, we recorded 30 subjects (25%) were with a normal weigh (18 men and 12 women), 45.83 % of the total population, 55 subjects (20 men and 35 women) were in overweight including obesity.

Table 2 shows the biochemical parameters depending on the weight of the patients. We found that hypertensive patients with normal weight have lower values of the biochemical parameters including the blood pressure compared to overweight patients including obesity. We disclosed that hypertensive patients who have a normal weight or who suffer from underweight figures have very low blood pressure. Blood pressure was significantly higher in patients who are overweight including obesity. This confirms that body weight has a very close relationship with blood pressure.

Table 3 shows the biochemical parameters of the patients before and after weight loss. The study of the effect of weight loss on the biochemical parameters and especially the blood pressure was made based on the percentage of weight loss relative to the initial weight of the patient. Therefore, we concluded three groups of patients after completion of the weight loss program, (1) patients who have lost 1 to 3% of their initial weight, (2) those who have lost 3 to 5% of their initial weight and (3) with hypertension who lost more than 5% of their initial weight.

Patients who have lost more than 5% of their initial weight had lower values for the blood pressure compared to those who have lost less than 5%. We noticed that we have a more significant weight loss, the more the numbers of blood pressure decrease. We observed statistical significance in all three groups between weight loss and blood pressure on the one hand, and with the majority of biochemical parameters on the other.

DISCUSSION

The objective of this investigation is to evaluate the association between weight loss and blood pressure in a hypertensive population. We have broadened the spectrum of the study to other biochemical parameters in addition to blood pressure (systolic and diastolic) to further study the relationship between weight loss and high blood pressure. Our results showed close links between body weight and blood pressure of hypertensive patients. This link is expressed in the fact that we noticed in people with a normal weight, blood pressure, lower figures compared to those suffering from overweight or obesity. The association between body weight and blood pressure cited by many

Table 3. Biochemical parameters before and after weight-loss, mean±S.D.

	[1-3[%, n=18			[3-5] %, n=8			> 5%, n=4		
weight-loss (%/initial weight)	before	After	P-value	Before	After	P-value	before	After	P-value
Systolic pression (cmHg)	12.97±1.22	12.53±1.12	0.042	12.57±1.32	12.27±1.42	0.084	12.68±1.40	12.08±1.30	0.033
Diastolic pression (cmHg)	8.32±1.34	8.03±1.36	0.052	8.52±1.35	8.11±1.43	0.046	8.47±1.30	8.22±1.35	0.024
HbA1c (mmol/mol)	55.45±8.26	55.05±8.23	0.062	55.65±8.27	55.05±8.25	0.075	55.84±8.28	55.04±8.26	0.055
Fasting glycaemia (g/L)	1.23±0.28	1.11±0.26	0.063	1.26±0.24	1.20±0.27	0.083	1.24±0.27	1.10±0.23	0.075
Total cholesterol (g/L)	1.27±0.43	1.20±0.39	0.013	1.25±0.46	1.22±0.48	0.043	1.29±0.40	1.20±0.46	0.065
HDL-c (g/L)	0.32±0.19	0.36±0.15	0.053	0.30±0.13	0.36±0.15	0.046	0.36±0.10	0.37±0.17	0.068
LDL-c (g/L)	1.37±0.23	1.30±0.26	0.058	1.36±0.27	1.31±0.28	0.025	1.33±0.27	1.30±0.24	0.075
TG (g/L)	1.29±0.34	1.24±0.35	0.835	1.24±0.37	1.22±0.34	0.024	1.26±0.31	1.25±0.22	0.456

authors[10] is also present when we studied the effect of weight loss on blood pressure; we found that more weight loss is great as we observe a reduction in the pressure blood. Cross-sectional and prospective epidemiological studies have shown that blood pressure increases significantly with higher BMI and waist circumference (WC)[11,12]. Hypertension is also positively associated with a cluster of risk factors characteristic of the metabolic syndrome, of which overweight/central obesity could be the cornerstone. Indeed it is recommended that management of arterial hypertension should focus both on lowering high BP and correcting associated lipid disorders[13]. There is much evidence showing that being overweight and having hypertension are positively associated in developed countries[14-16]. But only a few published data analyzing the relationship between being overweight and hypertension[17-18] are available in developing countries, which have relatively lower overweight rates. Cross-sectional and prospective epidemiological studies have shown that BP and hypertension risk increase significantly with higher BMI[19-21]. The relation between BP and BMI is explained by an increase in body weight and thus BMI is related to increases in body fluid volume, peripheral resistance, and cardiac output[21].

CONCLUSIONS

The prevalence of hypertension is higher in obese subjects. The effect of weight occurs for moderate overweight and considerably increased in obesity in abdominal distribution. Weight loss may be sufficient to normalize the blood pressure. We concluded that in addition taken by hypertensive medication should be added nutritional discipline that takes first position in the process of weight loss. Having a normal weight is a solution to this serious public health problem, we urge health authorities to launch a national program for good control of body weight in hypertensive patients.

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