BLOOD PRESSURE AND CARDIOVASCULAR RISK PROFILES OF AFRICANS WHO MIGRATE TO A WESTERN COUNTRY

Objectives: Africans who live in Western countries have a higher prevalence of hypertension and other cardiovascular risk factors than do age-matched Africans who live in Africa. We conducted a community survey to evaluate cardiovascular risk in Africans who recently migrated to Italy.

Methods: Participants (*N*=83) from sub-Saharan Africa were recruited from an outpatient clinic for immigrants. Information on immigration date, family history of cardiovascular disease, physical activity, and smoking was obtained for all participants. Anthropometric parameters, blood pressure measurements, and laboratory analyses—including lipid profiles, plasma glucose, renal function, and serum and urinary electrolytes—were performed.

Results: Although participants who had recently arrived in Italy had a low cardiovascular risk, the correlations were significant between the length of time in Italy and body weight (r=.47, P<.001), body mass index (r=.59, P<.001)P < .0001), waist circumference (r = .54, P<.0001), total cholesterol (r=.41, P<.001), low-density lipoprotein cholesterol (r=.46, P < .0001), systolic blood pressure (r = .31, P<.01), and diastolic blood pressure (r=.23, P<.05). The rise in systolic and diastolic blood pressure was positively correlated with body weight, body mass index, and waist circumference (P<.05 for all) and inversely correlated with 24-hour urinary potassium (systolic blood pressure, r=-.35, P<.01; diastolic blood pressure, r = -.42, P < .0001).

Conclusions: The length of residence in Italy is associated with progressive modifications in cardiovascular risk even in a relatively short period of time. The inverse correlation between blood pressure and urinary potassium may reflect dietary changes, with a possible reduction in fruit and vegetable consumption compared with their original diet. (*Ethn Dis.* 2008;18:512–518)

Key Words: Cardiovascular Risk, Hypertension, Migration, African Race, Lifestyle

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INTRODUCTION

Numerous epidemiologic studies have confirmed the influence of lifestyle on cardiovascular risk.1 Westernized lifestyle, ie, a diet rich in total calories, saturated fat, salt, sugar, and refined foods, accompanied by reduced physical activity, smoking, and increased mental stress, is related to a high incidence of cardiovascular disease (CVD).^{1,2} Africans who live in Western countries have a higher prevalence of hypertension and other cardiovascular risk factors than do Caucasians² and age-matched Africans who live in Africa.³ This trend may be because a genetic trait is expressed when these individuals are exposed to a new environment associated with profound modifications in lifestyle. A number of candidate genes have been investigated (renin-angiotensin-aldosterone system, sodium epithelial channel, catecholaminergic/adrenergic function, renal kallikrein system, alpha-adducin).⁴ However, besides abnormalities in epithelial sodium channel and in angiotensinogen and aldosterone synthase genes reported in Black but not White South African hypertensives,⁵ no major genetic differences have been found; therefore, genetic predisposition may be permissive rather than deterministic.

Most countries in sub-Saharan Africa are undergoing epidemiologic transition, although infectious diseases The relatively new and rising phenomenon of African migration to Italy allowed us to evaluate cardiovascular risk in persons who immigrated from sub-Saharan countries relative to the time of residence in Italy.

are still present.^{6,7} As these countries become industrialized, the incidence and prevalence of CVD grows, and hypertension is a strong contributor for Black Africans.⁸ Urbanization, which is associated with increased access to mass media, better transportation systems, and large, modern supermarkets, may be a contributor to the CVD epidemic.¹ Migration of people from sub-Saharan countries into Western societies is steadily increasing,9 and the relatively slow changes seen in Africa may occur at an accelerated pace in Africans who migrate to more affluent societies. Even in their home nations, higher income makes Black Africans more susceptible to myocardial infarction compared with higher-income Europeans who live in Africa and to other non-Black Africans (mixed-race ancestry including Khoi, San, and Maly descent), perhaps because they are at different stages of epidemiologic transition.8 If low birthweight is a risk factor for noncommunicable diseases according to Barker's hypothesis,¹⁰ fetal malnutrition among

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Africans may contribute to CVD increasing trends in these countries.⁸

Current immigration rates to Italy are $\approx 150,000$ persons/year. Five percent of residents were immigrants in 2006, of which $\approx 8\%$ were African; 10% of residents are expected to be descended from immigrants in the future since fertility rate is doubled among immigrants compared with Italians.¹¹ The relatively new and rising phenomenon of African migration to Italy allowed us to evaluate cardiovascular risk in persons who immigrated from sub-Saharan countries relative to the time of residence in Italy.

Subjects and Methods

We recruited 60 men and 23 women (mean age 28.1±.6.3 years) from the Immigration Outpatient Clinic of the University of Palermo, Italy (a special program dedicated to non-Italian residents of Palermo, sponsored by the Italian National Health Service) if they came from sub-Saharan countries (Côte d'Ivoire [n=59], Ghana [n=17], Nigeria [n=3], Mali [n=2], Benin [n=2]). Participants signed informed consent after being informed of the details of the study that was approved by the ethics committee of our institution. All completed a detailed questionnaire regarding medical history, date of entrance to Italy, family history of CVD, physical activity (moderate or strenuous exercise [sufficient to induce sweating], including practicing any sport, brisk walking, or doing housework at least once per week for >30 minutes), and smoking, defined as smoking any tobacco in the previous 12 months. Participants also underwent a complete physical examination which included anthropometric and blood pressure measurements (average of three values, measured while sitting, with a standard sphygmomanometer), had blood drawn, and conducted a 24-hour urine collection (instructions were verbal and written in different languages [English, Italian, French] to assure the adequacy of urine collection).

Weight and height were measured by standard techniques; waist (at the midpoint between the lower rib margin and the iliac crest) and hip (at the widest point that included the buttocks) circumferences were measured with a nonelastic plastic tape to the nearest .5 cm while the participant was standing upright.

Laboratory Methods

Blood was drawn in the morning after an overnight fast. Plasma glucose, triglycerides, total and high-density lipoprotein (HDL) cholesterol were measured by using an automated chemistry analyzer (Modular Analytics SWA Roche Diagnostics Italia, Monza, Italy). Low-density lipoprotein (LDL) cholesterol was calculated according to Friedewald's formula.¹² Serum and 24-hour urinary electrolytes were measured with ISE 900/ISE 1800 modules of Modular Analytics SWA.

Statistical Analysis

Statistical analyses were performed by using GraphPad software version 4.0 (GraphPad Software, Inc, San Diego, Calif). Differences between groups were assessed by Student *t* test for continuous variables and χ^2 test for categorical variables. Linear regression analysis and Pearson correlation coefficients were used to analyze the correlations between variables. Statistical significance was considered for *P* values <.05.

RESULTS

Clinical characteristics of studied subjects are shown in Table 1. African men and women who had recently arrived in Italy (3–96 months) were at low risk for CVD; 3 women and 4 men had hypertension (blood pressure >140/ 90 mm Hg), and none was on antihypertensive medications. Most participants were physically active; 87% of women and 91.7% of men exercised more than three times a week. Only 2.2% of women and no men were obese, and none of the participants had diabetes. Metabolic syndrome¹³ was present only in two women and two men, and no one had total cholesterol >250 mg/dL (Table 2). Women tended to have higher cholesterol levels and higher BMI than men.

Correlations between the length of stay in Italy and different parameters are shown in Figure 1. The length of time in Italy correlated significantly (P < .05) with body weight, BMI, waist circumference, total and LDL cholesterol, systolic blood pressure, and diastolic blood pressure. Figure 2 shows how the rises in systolic and diastolic blood pressure were positively and significantly (P < .05) correlated with body weight, BMI, and waist circumference; 24-hour urinary potassium, which decreased significantly with the length of time in Italy, was significantly (P < .01)and inversely correlated with systolic and diastolic blood pressure, which may reflect a lower potassium intake with dietary changes. The 24-hour urinary sodium tended to be higher with longer stay in Italy, but did not reach statistical significance.

DISCUSSION

Our results show that cardiovascular risk of sub-Saharan Africans who migrate to Italy are significantly related to the length of time of their permanence. This is likely linked to changes in dietary habits and lifestyle, reinforcing the role of environmental factors ("Westernization") on cardiovascular risk.¹ Nonetheless, excess weight and decreased physical work may be perceived as positive among African immigrants, which may make delivering prevention messages difficult.

African descendents who live in Western countries have a high prevalence of hypertension,^{2,3,14,15} which is proposed to be mediated by the interaction of environmental factors with a susceptible physiology determined in

| Characteristic | All (N=83) | Women (<i>n</i> =23) | Men (<i>n</i> =60) |
|-----------------------------|-----------------|-----------------------|---------------------|
| Age (years) | 28.1±6.3 | 29.9±8.3 | 27.3±5.2 |
| Sex (%) | | 27.7 | 72.3 |
| Weight (kg) | 69.0±10.9 | 70.7±13.0 | 68.3±10.0 |
| BMI (kg/m ²) | 23.6±3.4 | 25.7±4.9 | 22.8±2.2** |
| Waist (cm) | 78.3±8.2 | 80.9±12.1 | 77.4±6.1 |
| Waist-to-hip ratio | $.85 \pm .08$ | .83±.1 | .86±.1 |
| SBP (mm Hg) | 118.8±12.9 | 120.2±15.1 | 118.3±12.1 |
| DBP (mm Hg) | 78.7±9.4 | 79.0±9.2 | 78.5±9.6 |
| Mean blood pressure (mm Hg) | 92.0±10.0 | 92.8±10.4 | 91.8±10.0 |
| Plasma glucose (mg/dL) | 90.9±9.1 | 86.3±6.2 | 92.7±9.4* |
| Total cholesterol (mg/dL) | 149.3±38.3 | 163.6 ± 45.4 | 144.1±34.4* |
| HDL cholesterol (mg/dL) | 51.1±14.7 | 50.4 ± 18.5 | 51.3±13.3 |
| Triglycerides (mg/dL) | 63.5 ± 26.0 | 63.8 ± 25.0 | 63.4±26.6 |
| LDL cholesterol (mg/dL) | 85.5±33.1 | 100.4±39.6 | 80.2±29.0* |
| Uric acid (mg/dL) | 4.4±1.2 | 4.2±1.2 | 4.5±1.2 |

| Table 1. | Clinical characteristics | 6 of 83 | sub-Saharan | African | immigrants | to Italy |
|----------|--------------------------|---------|-------------|---------|------------|----------|
| | | | | | | |

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL, high-density lipoprotein; LDL, low-density lipoprotein.

* P<.05 vs women; **P<.0001 vs women.

part by genetic factors,³ but many unsolved questions remain. Rare genetic disorders may affect blood pressure (eg, mineralocorticoid-remediable aldosteronism, 11- β -hydroxylase deficiencies, Liddle syndrome), but their contribution to hypertension in the general population is very small.^{3,4} Polymorphisms in several candidate genes have been tested for linkage and association with hypertension, but no one has been shown, either alone or in combination, to be responsible for hypertension in the general population, and most seem to be cases of a complex polygenic disorder.^{3–5}

Salt sensitivity, which is often seen in Africans,¹⁵ has been proposed as a

contributor to the high incidence of hypertension. We found a large variability and nonsignificant tendency to increased urinary sodium in relation to the length of stay of Africans in Italy. The large genetic heterogeneity of salt sensitivity in Africans⁴ has made more likely the influence of environmental factors, but there is still great controversy. Even if experimental studies demonstrated that increasing amounts of dietary sodium resulted in marked rises in blood pressure,16 epidemiologic evidence is weak.¹⁷ Furthermore, populations without age-related hypertension, despite substantial salt intake, have been reported.¹⁸ Black populations

from Nigeria, Jamaica, and the United States showed a steep gradient in hypertension prevalence (15%, 26%, and 33%, respectively),3 and BMI and salt intake accounted for 70% of the variability. Conversely, the HERITAGE Study showed a higher hereditability of hypertension in African Americans than in Caucasians.¹⁹ In 8 White and 3 Black populations in different countries,¹⁴ wide variations were seen in hypertension prevalence; rates among Blacks were not unusually high, and the world's highest hypertension prevalence was seen in German men (60%). Hence, genetic predisposition appears to be only permissive, requiring environ-

| Table 2. | Cardiovascular | risk factors | in 83 | sub-Saharan | African | immigrants | to It | aly |
|----------|----------------|--------------|-------|-------------|---------|------------|-------|-----|
|----------|----------------|--------------|-------|-------------|---------|------------|-------|-----|

| Risk Factor | All (N=83), n (%) | Women (<i>n</i> =23), <i>n</i> (%) | Men (<i>n</i> =60), <i>n</i> (%) |
|---------------------------------------|-------------------|-------------------------------------|-----------------------------------|
| Hypertension | 7 (8.4) | 3 (13.0) | 4 (6.7) |
| Family history of CVD | 4 (4.8) | 2 (8.7) | 2 (3.3) |
| Smoking | 9 (10.8) | 0 | 9 (15.0) |
| Physical activity | | | |
| Once a week | 5 (6.0) | 0 | 5 (8.3) |
| Twice a week | 3 (3.6) | 3 (13.0) | 0* |
| Three times a week | 75 (90.4) | 20 (87.0) | 55 (91.7) |
| Obese (BMI $>$ 30 kg/m ²) | 5 (6.0) | 5 (2.2) | 0 |
| Overweight (BMI >25 but ≤30) | 13 (15.7) | 4 (17.4) | 9 (15.0) |
| Total cholesterol >200 mg/dL | 9 (10.8) | 4 (17.4) | 5 (8.3) |
| Total cholesterol >250 mg/dL | 0 | 0 | 0 |
| Metabolic syndrome | 4 (4.8) | 2 (8.7) | 2 (3.3) |

* P<.05 vs women.



Fig 1. Scatterplots describing the relationship between the time (months) of residence in Italy and body weight, waist circumference, body mass index, systolic and diastolic blood pressure, total and low-density lipoprotein cholesterol, and urinary potassium in 83 sub-Saharan Africans who immigrated to Italy

mental factors (ie, Westernized diet, weight gain-induced insulin resistance, mental stress) for the condition to result.

Sodium metabolism is connected to other ionic modifications that help

regulate vascular smooth muscle tone.²⁰ After two months of a high-salt diet, intracellular calcium and sodium are elevated and intracellular magnesium is suppressed, and this effect is more prominent in salt-sensitive subjects.²¹ We observed a close negative relationship between time in Italy and urinary potassium, which correlates positively with blood pressure. Potas-



Fig 2. Scatterplots describing the relationship between systolic and diastolic blood pressure with body weight, waist circumference, body mass index, and urinary potassium among 83 sub-Saharan Africans who immigrated to Italy

sium-deficient diets provoke renal sodium retention, which leads to increased blood pressure and salt sensitivity. Africans seem particularly susceptible to the adverse effects of a low-potassium diet and require higher intake to mitigate potassium deficiency-induced salt sensitivity.²² Western diets are frequently poor in potassium, calcium, and magnesium and rich in sodium (potassium/sodium molar ratio <.4), in contrast to diets in rural Africa (potassium/sodium ratio >3).³ The favorable effects of a diet rich in

potassium, calcium, and magnesium and low in sodium may reflect the influence of ionic events at the cellular level.²⁰ Fasting intracellular potassium levels are significantly lower in untreated hypertensive subjects; this effect is inversely correlated with blood presMIGRATION AND CARDIOVASCULAR RISK - Dominguez et al

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sure and closely linked to other intracellular ions levels.²⁰

Several studies have identified isolated "primitive" communities where hypertension is rare and blood pressure does not increase with age.^{17,23,24} In these populations in Africa^{23,24} and outside Africa,¹⁷ not only low blood pressure but also low cholesterol,²⁵ plasma glucose,²⁶ and BMI²⁵ have been reported. Again, the debate on whether the differences in cardiovascular risk are mainly genetic or environmental has not been completely resolved. However, the observation that groups of different genetic origin (eg, nomadic hunters,²³ Italian nuns²⁷) do not experience the age-related blood pressure increase that is seen in most people in Western societies² suggests that socioeconomic independence from Western civilization is a protective factor.⁵

International migration to industrialized countries doubled from 1975 to 2003 and is projected to remain high.²⁸ The African population is steadily growing in Italy, as in most Western countries,⁹ and the potential increase in CVD in this population warrants preventive measurements, similar to those recommended in Africa.⁵ Reliable epidemiologic observation and recommendation of nonpharmacologic intervention for highrisk individuals should be considered.

Limitations of the present study include the lack of followup of the participants over time to document the occurrence or worsening of cardiovascular risk and the lack of controls. Another limitation is the fact that most of the participants had been in Italy less than 50 months, but this short time illustrates that changes in cardiovascular risk may occur after a relatively short residence in Italy. One strength of the study is that the change in urinary potassium over time confirms the fact that African diets with a potassium/sodium ratio >3 may be protective and the change to diets with a ratio <.4 may be a risk factor.³

Conclusions

Our results suggest that the length of time of residence in Italy significantly increases cardiovascular risk in sub-Saharan African immigrants. A rapid switch to a Western lifestyle may help to explain these findings. Studying cardiovascular risk in this population provides the opportunity to investigate the nutrition transition and dramatically illustrates the need for public health measures to prevent future trends of obesity and sedentary lifestyle and their consequences.

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