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RESEARCH ARTICLE

Evaluation of vascular function in depigmented black women: Comparative study

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ABSTRACT

Background: Prolonged application of skin depigmenting substances could expose human organism to serious general complications such as hypertension or diabetes. Artificial depigmentation (AD) is a widespread practice within Sub-Saharan Africa subjects. AD is based on the use of dermocorticoides which could lead to vascular complications. **Aims and Objectives:** Our aim was to evaluate the vascular function in depigmented Senegalese women. **Materials and Methods**: Thirty six depigmented (depigmented group) and 36 undepigmented black women (control group) participated in the study. They were aged 33.10 ± 7 years and 30.22 ± 6 years, respectively. Brachial artery flow-mediated dilation (FMD) was measured in two groups. Biochemical and cardiovascular profiles of our study population were evaluated. The duration of depigmenting products exposure was evaluated in depigmented subjects. **Results**: Our study showed an abnormal kinetic of FMD in depigmented group compared to control group. Mean arterial pressure was 95.9 ± 8.8 mmHg in depigmented subjects and 89.6 ± 6.2 mmHg for control subjects and a significant difference was observed ($P = 0.002$) while triglycerides was significantly different ($P = 0.01$) between the two groups (0.8 ± 0.3 and 0.6 ± 0.2 g/L, respectively). FMD was significantly and positively correlated with exposure time ($r = 0.25$; $P = 0.029$). **Conclusion**: Prolonged percutaneous application of depigmentation products could alter metabolic and vascular functions, and consequently install cardiovascular risks. Thus, we recommended ways to prevent of AD in the African population.

KEY WORDS: Artificial Depigmentation; Black Population; Vascular Function

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INTRODUCTION

Artificial depigmentation (AD) or cosmetic depigmentation involves applying natural chemicals to the natural skin. It is a widespread practice among black women, mostly from Sub-Saharan Africa.[1,2] For example, in Senegal, 67% of adult black women practice AD.[3] The most widely used products

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are based on dermocorticoids, mercurial compounds, and hydroquinone.[4] AD is performed mostly by the combined dermal application of corticosteroids and hydroquinones. Duration of the depigmentation practice is variable up to 35 years according to the studies.[4] The daily amount of depigmenting agents applied to the skin of black women is often not estimated, but it seems that it could be the cause of the metabolic and/or vascular complications. Indeed, the AD may be complicated by systemic conditions considered as cardiovascular risk factors such as diabetes and high blood pressure.[5] Studies[6] conducted in humans have shown that these vasculo-metabolic risk factors related to AD are often associated with alterations of vascular function. Moreover, it appears that the prolonged use of dermocorticoids could cause an oxidative stress state and thereby perturbs nitric oxide (NO) availability in the vascular endothelium, leading to vascular complications in patients with depigmentation.[6] Although dermatologic[7] and systemic[8-10] complications of AD are described the pathophysiological processes of vascular damage by depigmenting products are not yet well studied. The aim of our study was to assess vascular function in Senegalese black women practicing AD.

MATERIALS AND METHODS

Subjects and Protocol

The present study was conducted at the regional hospital of Thies, Senegal and took place during the period from 01 November 2015 to 30 March 2016. The protocol was designed in accordance with the guidelines set by the declaration of Helsinki and approved by the Ethics Committee of the faculty of health Sciences of Thies. Our subjects were recruited from the population of the city Thies. Participants were informed of the procedures and purposes of the study and gave written informed consent to participate.

Seventy-two Senegalese women recruited from the general population of the Thies city participated in this study. Thirty six subjects regularly use cosmetics depigmentation (depigmented group), and thirty-six were non-pigmented black skin (control group). Baseline characteristics of our study population were 18-40 years of age and 150-185 cm for height. They had not chronic diseases such as systemic diseases or tuberculosis and were not smoking.

Biochemical and Cardiovascular Parameters

All the subjects were summoned in the morning at 8 am to the regional hospital of Thies. Blood samples were withdrawn from antecubital vein after an overnight fasting for at least 8 h. Blood was drawn into fluoride tubes (5 mL) for glucose measurement, heparin tubes (5 mL) for lipid measurement, citrate tube (5 mL) for plasma fibrinogen determination. Biochemical parameters such as plasma lipids (total cholesterol, triglycerides, low-density lipoprotein cholesterol, and high-density-lipoprotein-cholesterol) and glycemia of our subjects were evaluated by the standard enzymatic method on fresh blood samples.

Systolic and diastolic arterial pressures (SAP and DAP respectively) were measured manually using a sphygmomanometer (Omron M3, Intellisense, Japan) with a cuff adapted to our subjects. Blood pressure measurements were performed as recommended by the American Heart Association.[11] Arterial pressures were taken in a sitting position after a 15 min rest. SAP and DAP were used to calculate mean arterial pressure (MAP) as:

$$MAP=(SBP+2*DBP)/3$$

Evaluation of Vascular Function

Vascular function was studied by flow-mediated dilation (FMD) of the brachial artery measured with ultrasound according to guidelines.[12] Brachial artery ultrasonography was performed by the same experienced cardiologist after resting in supine position for 15 min and fasting state. All participants refrained from drinking beverages containing caffeine or alcohol for 12 h before the examination and were also advised not to take antihypertensive or vasodilator drugs the day of examination. Subjects were examined in a quiet and temperature-controlled room (25°C). The right arm was extended and immobilized with an angle of 60° from the trunk of the body. A 10-MHz linear transducer connected to an ultrasound device (DC-6 Mindray) was placed in the brachial artery at 1-2 cm proximal to the elbow joint. After scanning the baseline artery diameter, the cuff was rapidly inflated to 50 mmHg above systolic blood pressure and kept for 5 min. By rapid deflation of the cuff, reactive hyperemia was induced, and scanning was performed at 5, 30, 60, 90, and 120 s and 10 min after cuff deflation to obtain the FMD, expressed in percentage of the baseline diameter (% FMD). Because of limited technical (software) resources, we were not able to capture the diameter continuously. FMD was measured in duplicate for each patient with at least 1 h in resting condition between the two measurements, and the mean of the two FMD values was calculated. A difference of 10% between the two measurements was considered as acceptable. The cardiologist who performed FMD experiments was blinded to the diagnosis of the patient.

Statistical Analysis

Means and standard deviations were calculated for each parameter. Anthropometric, biochemical and hemodynamic data were compared between the two groups using a non-parametric Mann–Whitney U test. Bi-varied analyses (Spearman test) allowed us to look for a correlation between the FMD and the other variables. Chi-square or Fischer exact test was used to compare the depigmentation duration, depigmenting agents used and dermatological complications

data expressed as a percentage. The significance level was $P < 0.05$ and analyses were conducted using SPSS software (version 20; IBM SPSS Statistics, Chicago, IL).

RESULTS

Anthropometric Characteristics of the Study Population

The average age of depigmented subjects was 33.10 ± 7 years for and 30.22 ± 6 years for control subjects. The BMI was not significantly different between the two groups. Products used by the depigmented subjects were corticosteroids in 52%, hydroquinone in 13% and a mixture of both in 31%. Among depigmented population 55% presented stretch marks and 25% for exogenous ochronosis (Table 1).

Hemodynamic, Cardiovascular, and Biochemical Parameters

Comparison of FMD kinetics in the two groups showed no difference until 90 s post-occlusion. However, at 120 s FMD was significantly (P = 0.012) decreased in depigmented subjects compared to controls (Figure 1). Positive correlation between FMD at 102 seconds and duration of exposure (r = 0.25 and P = 0.029) was observed.

Arterial pressures (SAP, DAP, and MAP) were significantly higher in depigmented subjects compared to control subjects. Significant increase in fasting blood glucose (0.93 ± 0.15 ≠ 0.89 ± 0.24 g/L; P = 0.050) and triglycerides (0.810 ± 0.33 g/L ≠ 0.627 ± 0.23 g/L; P = 0.017) was observed in depigmented subjects (Table 2).

DISCUSSION

Our results showed overall that depigmented black women had abnormal FMD kinetics compared to controls. The alterations in vascular function observed in this population were contemporaneous with (1) an increase in arterial pressure, (2) a profile lipid imbalance in favor of an increase in triglycerides and, (3) a tendency to hyperglycemia. The deleterious effects of the chronic use of glucocorticoids on the cardiovascular system have been widely suspected in the literature. Indeed, studies indicated that chronic glucorticoids excess is associated with a cluster of cardiovascular risk factors, including hypertension, chronic hyperglycemia, and dyslipidemia,[13] thereby leading to the development of arteriosclerosis and increased the prevalence of cardiovascular morbimortality.[14-16] In fact, several experimental studies have also shown that glucocorticoids excess could cause cardiovascular effects, such as increased renin-angiotensin system as well as decreased NO synthesis and Kallikrein/Kinin system.[17] In this study, 52% of depigmented women have used glucocorticoids for depigmentation. In accordance of several clinical studies, FMD has been reported to predict

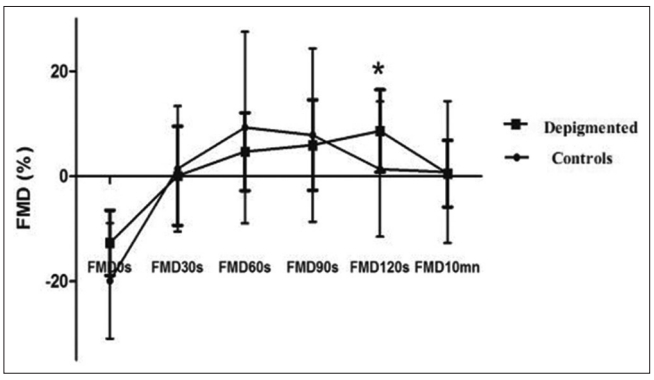

Figure 1: Kinetic of flow-mediated dilation in the two groups

Table 1: Characteristics of the population

Parameters	Depigmented women (n=36)	Control women (n=36)	P-value
Age	33.10±7	30.22±6	0.9
BMI (kg/m^2)	24.22±5.13	23.05±4.08	0.08
Dépigmentation duration (years)	10.37±7.93	NA	P<0.05
Depigmenting agents used			
Corticostéroïds (%)	52	NA	P<0.05
Hydroquinone (%)	13	NA	P<0.05
Corticostéroïds+ hydroquinone (%)	31	NA	P<0.05
Dermatological complications			
Stretch marks (%)	55	NA	P<0.05
Exogenous ochronosis (%)	25	NA	P<0.05
No complications (%)	20	NA	P<0.05

BMI: Body mass index, NA: Not applicable

Table 2: Cardiovascular and biochemical parameters of depigmented and control women

Parameters	Depigmented women	Control women	P-value
DBP (mm Hg)	80.9±6.8	75.6±6.1	0.001
SBP (mm Hg)	126±14.4	118±8.8	0.011
MAP (mm Hg)	95.9±8.8	89.6±6.2	0.002
Glucose (g/l)	0.9±0.1	0.8±0.2	0.05
LDL-c (g/l)	1.2±0.3	1.2±0.3	0.76
HDL-c (g/l)	0.6±0.1	0.7±0.5	0.25
Triglyceride (g/l)	0.8±0.3	0.6±0.2	0.01
TC (g/l)	2.0±0.4	2.0±0.3	0.86
Fibrinogen (g/l)	4.5±1.3	4.3±1.2	0.7

DBP: Diastolic blood pressure, SBP: Systolic blood pressure, MAP: Mean arterial pressure, LDL-c: Low density lipoprotein cholesterol, HDL-c: High density lipoprotein cholesterol, TC: Total cholesterol

cardiovascular events.[18,19] Thus, the impaired FMD observed in our depigmented subjects could indicate a cardiovascular risk factors profile, such as arterial hypertension,[20,21] diabetes,[22] and/or dyslipidemia.[23] This hypothesizes could be reinforced by some arguments observed in our study. Depigmented women had high arterial pressures (systolic, diastolic or mean), and elevated values of glycemia and/or triglycerides compared to control women. Second, correlations between FMD data and other parameters such as duration of glucocorticoids application were observed in our studied population. However, the pathophysiological mechanisms by which glucocorticoids excess could induce endothelial/vascular dysfunction are not well known. Nevertheless, it has been shown that glucocorticoids decrease endothelial NO synthase (NOS) activity,[24] inhibit trans-membrane transport of its substrate, arginine,[25] and decrease its cofactor, tetrahydrobiopterin.[26] Intriguingly, glucocorticoids have been shown to increase oxidative stress characterized by an overproduction of reactive oxygened species (ROS) which could reduce NO bioavailability and consequently alter vascular function. Indeed ROS induced by oxidative stress may impair endothelial NOS activity.[27] Although glucocorticoids have been described as being responsible for alterations in vascular function by acting directly on the NO metabolism, metabolic disorders such as hyperglycemia and hypertriglyceridemia may also be the cause of vascular dysfunction. In fact, many authors demonstrated that chronic hyperglycemia and hyperlipidemia could cause endothelial and vascular dysfunction in large arteries and microcirculation.[27] Whatever, the pathophysiological mechanism of impaired vascular function related to glucocorticoids, our study is the first to describe peripheral vascular dysfunction in depigmented patients using a noninvasive method (FMD). Although advanced age may be a factor of impairment for vascular/endothelial functions,[12] in our study, we did not find any significant difference between the mean ages of the two groups (33.10 ± 7 years and 30.22 ± 6 years for depigmented and control women, respectively). Our finding supports the existence of an underlying generalized vascular/endothelial dysfunction in black depigmented women. However, our study has several limitations. Indeed decreased FMD observed in depigmented subjects at 120 seconds may occur before at this time point measurement; hence, the interest of a continuous recording for diameters of the brachial artery in post-occlusion period.

CONCLUSION

Our study shows that prolonged percutaneous application of depigmentation products containing corticosteroids could induce alterations in vascular/endothelial function, and therefore could lead to the occurrence of cardiovascular risks. Future researches with a continuous recording of diameters should be necessary to confirm eventually the vascular alterations and to focus on the effects of particular treatment.

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