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Obesity as Behavioral Risk Factors of Chronic Noncommunicable Diseases in Young Gabonese Population

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Abstract

Obesity increases of prevalence of noncommunicable diseases (NCDs) in young active populations worldwide. We sought to investigate the status of young men (n=200) and women (n=200) aged from 18 to 39 years old, living at Libreville, by examining their lifestyles and eating habits, and measuring their anthropometric parameters, including, height, weight, body mass index (BMI), percentages of total muscles, lean mass, body and visceral fats, as well as metabolic age and metabolism at rest.

We found that, only 38% of women and 30% of men displayed good eating habits. However, lifestyle was better in men (62%) vs women (23%). In addition, based on BMI values, only 18% women displayed normal body weight vs 37% overweighed and 45% obese. In men, 21% of BMIs were normals, 52% and 27% were overweight and obese, respectively. In both genders, overweight and obese subjects showed very low rate of total muscles ($p < 0.001$), but very significant higher levels of body and visceral fats ($p < 0.001$), when compare with relative subjects with normal BMI. Whereas values of biological and metabolic ages were similar in subjects with normal BMI, in overweight and obese subjects, metabolic ages were two-fold higher ($p < 0.001$) than relative biological ages. Moreover, at rest metabolisms in obese subjects was higher than those of normal and overweight individuals.

Data, though prospective, clearly suggest the presence of high NCDs behavioral risk factors in young active Gabonese populations living at Libreville. They call for emergency of preventive measures against obesity in GABON.

Keywords: BMI; Metabolic Ageing; Obesity; Behavioral Risks; Cardiovascular Diseases

Introduction

Overweight/obesity are defined by the World Health Organization (WHO) as being the abnormal or excessive accumulation of body fat that presents a risk to health. They are diagnosed by commonly using the value of the body mass index (BMI), that is calculated by dividing body weight by height squared. People with values of BMI between 25-29.9 or ≥ 30 kg/m^2 are considered as overweight or obese [1], respectively.

Despite the use of the term "Globesity" by WHO since 1997 [2] to alert countries about the globally obesity epidemic, overweight/obesity has had still exponentially growing worldwide, more affecting younger populations, even in sub-Saharan African countries, particularly in GABON, wherein nutrition transition has greatly been noticed [3-5].

Obesity during adolescence is preoccupying since its results in total adiposity and truncal subcutaneous fat accumulation that become positively and independently associated with atherosclerosis at adult ages [6,7]. This become very preoccupying since adipose tissue accumulation is translated by the increase in visceral fat content, and by intima media thickness of the carotid artery and other vessels [8]. Additionally, the deposition of adipose tissue, particularly the intra-abdominal adipose that include fat depots surrounding internal (visceral) organs, and free fatty drained by the portal vein, leading to the direct exposure of the liver to increasing amounts of free fatty acid and/or pro-inflammatory factors released from visceral adipose tissue directly into the portal vein [8]. These contribute importantly to the plausibility of the development of morbidity and mortality due to noncommunicable diseases (NCDs), including, hepatic insulin resistance, steatosis and inflammation, diabetes, as well as metabolic syndrome, dyslipidemia, hyperglycemia and hypertension [9,10], and particularly stroke, that become one of the prevalent disease in young adult people worldwide [11-13].

However, among these NCDs, arterial hypertension, type 2 diabetes mellitus, sleep apnea syndrome, coronary heart disease, cerebral vasculopathy and stroke [14,15], and increased risks of several cancer types and large decrease in life expectancy [6,16-18] seem to be the commonly encountered. This is in keeping with the fact that obesity is also related to endocrine alterations that should arising as a result of changes in the hypothalamic-pituitary hormones axes, including hypothyroidism, cushing's disease, hypogonadism and growth hormone deficiency [14].

Therefore, overall, overweight/obesity appeared as complex major public health issues nowadays [19,20] considered as a real multifactorial pathology that can be related to an altered nutritional behavior. This is the case of Gabon, a small country located in the central west of Africa, near Cameroun and Congo Rep at the north and east respectively, and Atlantic Ocean at west. Gabon has a population around 2 million, with a large majority of young people living mostly at Libreville the capital where nutrition transition harbour highest scores in the country.

Unfortunately, despite WHO alerts and devastating effects already observable with the growing of the prevalence of NCDs [21-24], particularly hypertension, diabetes and stroke in active young adult population [25,26], there is still apaucity of reliable data [1], that might allow preventive or cure approaches in GABON.

In the present study, we sought to investigate whether obesity may constitute one of the behavioral risk factor for developing NCDs in active young townsfolk Gabonese population, already very affected by these diseases.

Subjects and Methods, Subjects and Sampling

All experiments were in compliance with the Ethics Committee of Université des Sciences de la Santé de Libreville and the guidelines of Gabonese republic on Human care. All the subjects enrolled in the current study had signed a consent form for the use of their responses to questionary, and their anthropometric parameters under absolute anonimous for any publication.

The wellness center of our Laboratory was open to any individuals of Gabon society, including foreigners; all aged from 18 years old and upper. Patients have come freely and randomly to our office for their bodyweight balance sheet tchecking.

Except for pregnant women which were systematically excluded from anthropometric measurment on the OMRON medical device, all patients received exactely the same services (Consent form, Questionary evaluating of dietary habit and lifestyle, and anthropometric measurements, interpretation of data and recommandation).

Therefter all data collection, the patient dossiers were further revisited by our team to select those who met precise criterias according to the aim of our study. The first criteras of exclusion applied were the nationality, pregnancy and the age.

Indeed, all non-gabonese patients, and those aged more than 39 years old or pregnant were excluded from the study. Smokers, chronic alcoholic, unaducated (never reach the high school) and unemployed subjects as well as subjects who played competitive sport and those with a diagnosed noncommunicable diseases (NCDs), such as hypertension, diabetes, hypercholesterolemia or stroke of both genders were also excluded.

The inclusion criteria incompass, being in apparently good shape with no known or diagnosed disease, having a job with good earning (≥ 800$: month), having a minimum of a high school diploma.. The data were collected from december 2017 to February 2019.

Procedures for Dietary Habit, Lifestyle Evaluations and Anthropometric Measurements

Upon their arrivals at the wellness center of our laboratoiry, the consent form, with informations around the possibility to use data for publication were delivered and a questionnaire written in French, evaluating their dietary habit and lifestyle were provided to subjects. The questionnaire started by identification form from personal questions: name and first name, telephone number, email adress, ageing, gender (for women, indicate if pregnant or not), social statut (working or not). The school level was evaluated according the diploma that the subject stated to have had (See annex).

Questions regarding dietary habit concerned the respect of the number of three meals per day, common consistence of meals eaten, type and quantity of beverages drunk during meals or all day.

For llifestyle concerns, we have asked to subjects whether they were smokers and or alcoholic; if they sleep before or after midnight (reasons, when sleeping after midnight); if they practice physical activities or not; if they eat inside or outside the house, etc.

Thereafter, anthropometric data were measured using medical device, namely Omron Body Composition Monitor BF511 (OMRON, Paris, FRANCE), already used for similar studies in RUSSIA [27], according to the standardized procedures stipulated by the Food and Nutrition Technical Assistance (FANTA) Anthropometric Indicators Measurement Guide [28]. Subject were asked to stand on the Omron medical device, while recording parameters including, Body weight, measured to the nearest 0.1 kg, Body Mass Index (BMI), percentages of body and visceral fats, percentage of total muscles as well as percentage of lean mass, metabolism at rest and metabolic age.

The registered anthropometrics parameters were personalized since they were automatically measured by the Omron medical device, once the manually registering of the biological age and the Height of the subject; The height being indeed, measured to the nearest 0.1 cm in standing position with shoulder and the buttock touches the vertical stand using a ruban meter.

Data Compilation and Statistical Analysis

For data compilation, the preliminary collection concerned the dossiers of subjects that meet the criteria of selection. These dossiers were daily sorted by trained collectors, in order to select only dossiers of subjects aged between 18 and 39 years who sign the consent form. Therafter, another sorting was maid according to the selection criteria, giving a total of 200 Women and 200 men for the sudy.

Therefore, although the elevated nomber of patients assessed, the sample of the study (n=400 youngs people composed of 200 males and 200 females) is constituted by the number of selected dossiers that meet our criterias of selection (see inclusion and exclusion criterias described abovein the section subjects sampling).

For dietary habits, we made simple, by separating any dossier with any bad behaviour to those with good habits. For example, an individual that do not respect the number of 3 meals a day, or eating at any time, or having excessive consumption of SODA, etc… was consider with bad dietary habit.

Then, a manual counting was done to enumerate subjects with good and poor dietary habits. The same procedure was made for lifestyle evaluation. i.e. bad quality of life refered to sleeping after midnight, to sedentariness. etc.

Overall, to ascertain the quality of our data, a general control of collected dossiers was independently reviewed by collectors and our team.

Data were expressed as mean±SEM(standard error mean).

Apart from the percentages calculated by the medical device, other calculated percentages were made by superimposing the number of each category with the total number of the population studied multiplicated by one hundred. Results were analysed using GraphPad Prism 8.1.2 (332). Student's t-test was applied for unpaired samples while for multiple comparisons,a one-way analysis of variance (ANOVA), followed by Tukey post-hoc tests were performed. Only a value of $p < 0.05$ was considered significant.

Results

Mean Ageing, Mean Height, Dietary Habit and Lifestyle

There was not statistically difference between young women and men for their means ageing and height. We found means age of 31.65±0.42 vs 32.91±0.33 years old, and mean height of 1.65 ±0.11 vs 1.74 ± 0.20 m, for women and men, respectively. Both young women and men displayed bad dietary habit. only 38% of women and 30% of men harboured good dietary habits (Table 1). For the major part of the sample studied, meals were taken any time, without attention on the content, mostly outside of their house. Some of them, had only one or two meals per day. These dietary habits were corrupted by great consumption of SODA, particularly coca cola and/or alcohol.

	Means age	Means height	Bad dietary habits	Bad lifestyles	Shape Distribution		
					Normal	Overweight	Obese
Female (n=200)	31.65 ± 0.42	1.65 ± 0.11	62%	77%	18%	37%	46%
						83%	
Male (n=200)	32.91 ± 0.33	1.74 ± 0.20	70%	44%	21%	52%	27%
						79%	

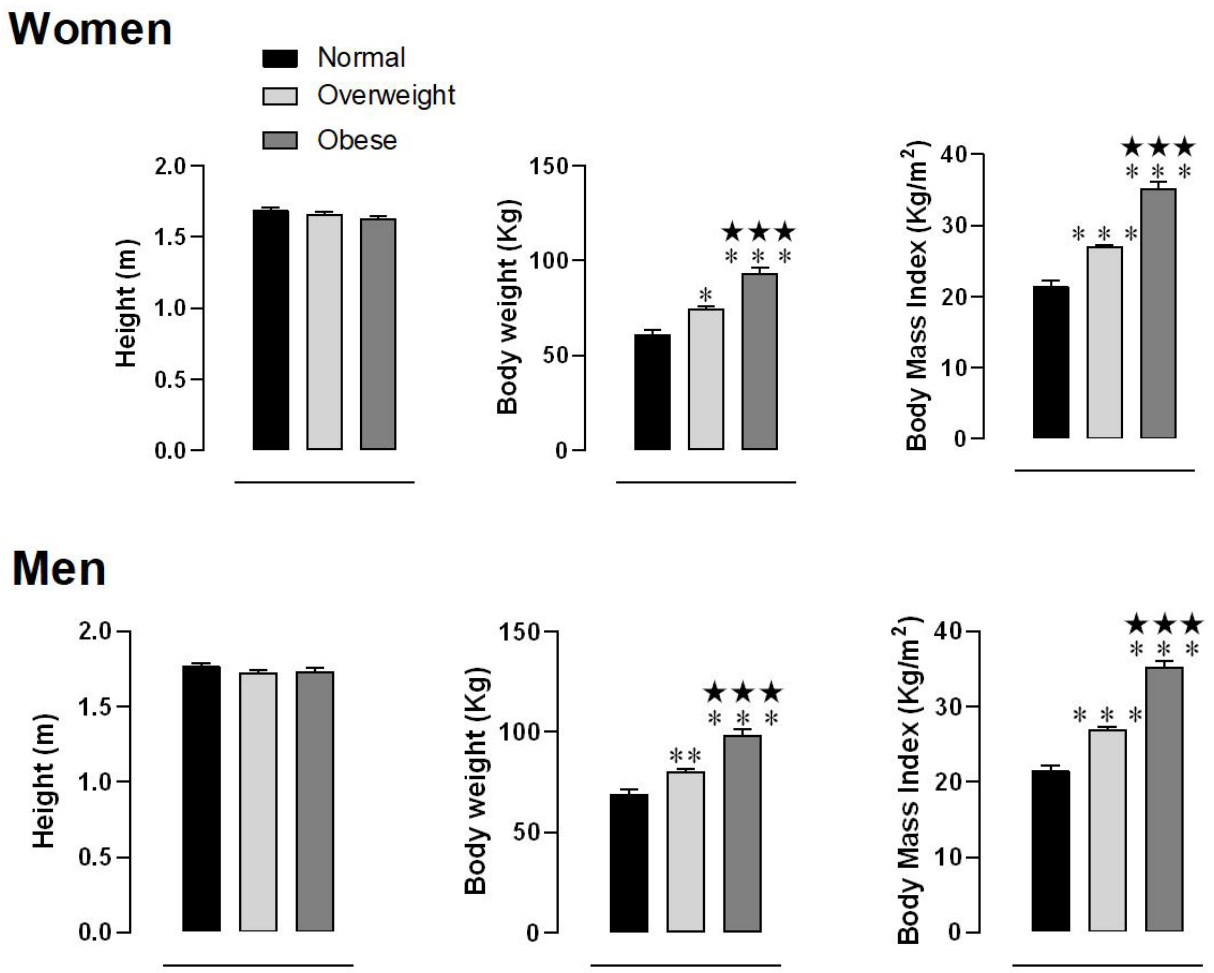
Both, women and men subjects had similar Height and age. They displayed similar eating habits whereas the better lifestyle was found in men compared to women. Since good lifestyle did not allow normalization in overweight/obese people (Women = 83%, and men =79%), we suggest that dietary habits more than lifestyle seem to have a deep impact on body weight gains in individuals. Percentages of distributions were calculated by superimposing the number of each category with the total number of the population studied multiplicated per one hundred. N= 200 (Women) and 200 (Men).

Table 1: Mean ages, means height, bad dietary habits, lifestyle and behaviour distribution of the studied population

In contrast, there was a clear difference between women and men lifestyles. Indeed, we found only 23% of women vs 66% of men with a good lifestyle (Table 1), based on thequestionnaire that also revealed that women were more sedentary than men, spending more times in front of the television, even after midnight, watching NOVELAS films. We noticed also that more men were active than women. Most of them went to gym two or five time a week, slept before midnight, except for occasionally parties with friends in the snack bars or night clubs.

Impact of the Body Weight on the Body Mass Index (BMI)

The consequences of such a lifestyle and dietary habits were perceivable at the level of body weight. Indeed, three main groups were obtained in each gender when considering the body mass index (BMI) (Figure 1). We found 18% of women and 21% of men with BMI values between 18.5 and 25 Kg/m^2 (Table 1) (Figure 1), considered as subjects with normal body weight. We also found 37% of women and 52% of men with BMI values between 25 and 30 Kg/m^2 (Table 1, Figure 1, light grey) and considered as Overweight, Finally 45% of women and 27% of men with BMI up to 30 Kg/m^2 (Table 1, Figure 1, dark grey), and considered as obese.

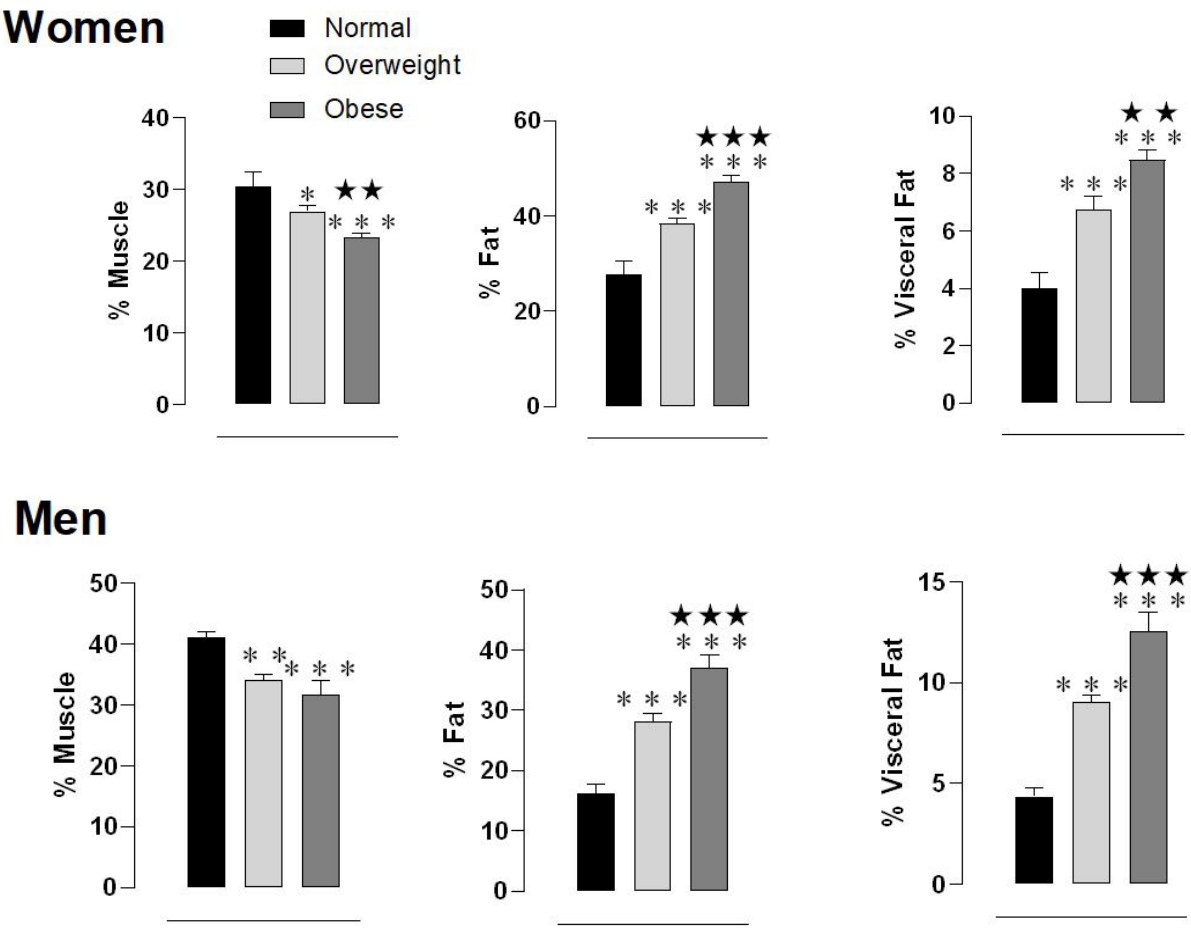


The difference noticed at the level of their body weight induced three main groups according to the resulting Bodies Mass Indexes (BMI): Subjects with BMI values between 18.5 Kg/m^2 and 30 Kg/m^2 were considered as individuals with healthy parameters (Normal), while those with BMI values between 25 Kg/m^2 and 30 Kg/m^2, or higher than 30 Kg/m^2 were considered as BMI of Overweight or Obese subjects, respectively. Percentages of these distributions were calculated by superimposing the number of each category with the total number of the population studied multiplicated per one hundred.

Comparisons to Normal subjects are indicated with **p <0.01, ***P<0.001 and to Overweight subjects with ***p < 0.001. N= 200 (Women) and 200 (Men). Analyzed by repeated-measures one-way ANOVA followed by Tukey post-hoc tests.

Figure 1: Distribution of women and men enrolled in the study

Compared with normal women and men, both overweight and obese subjects displayed very significant low level of body muscles (Figure 2, left histogram) but, a very marked increase in the levels of fats accumulated on the body (Figure 2, histogram in the center) and at the visceral level (Figure 2, right histogram). These data suggested that the excess of body weight load display significant negative impact on the amount of muscle and promoted the increase in body and visceral fats in obese and overweight subjects.

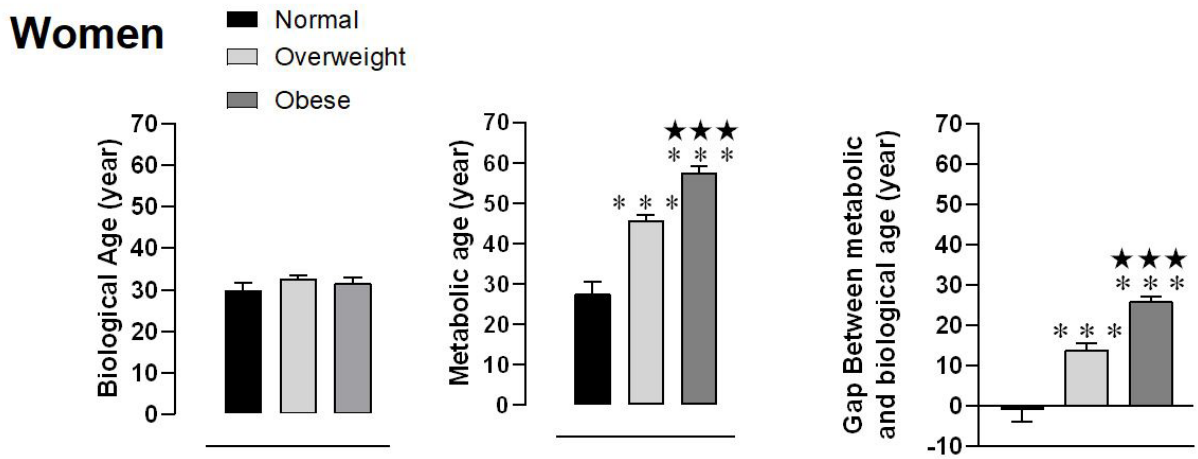


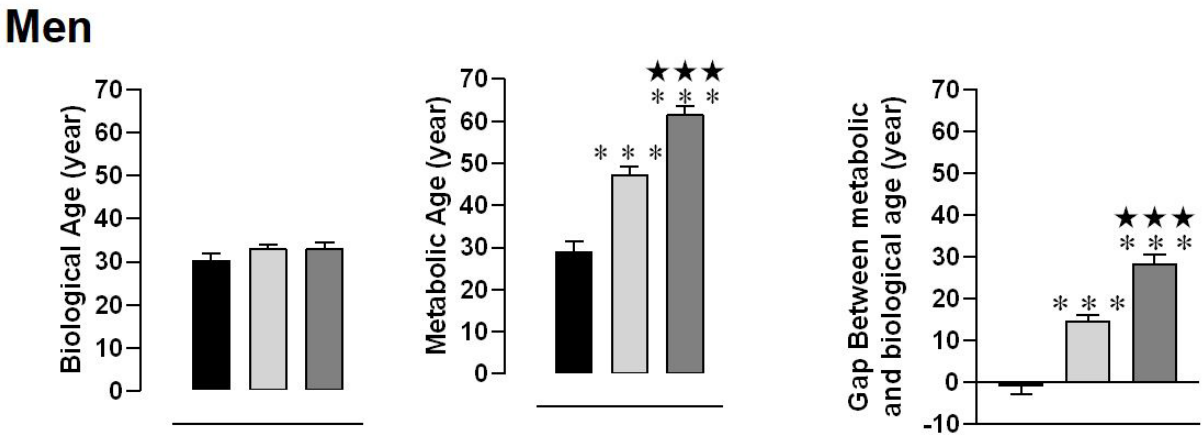
The distribution of muscle (left histogram), body fat (middle) and Visceral Fats (left histogram) in Normal, Overweight and Obese young active subjects. In both women (upper histogram) and men (down histogram), the excess of body weight load displayed significant negative impact on the amount of muscle and concomitantly very significantly promoted the amount of body and visceral fats in obese and overweight subjects. Data highlight that obesity is related to abnormally higher amount of fat and poorer quantity of body muscle. Comparisons to Normal subjects are indicated with *p < 0.05, **p < 0.01, ***P< 0.001 and to Overweight subjects with **p < 0.01, ***p < 0.001. N= 200 (Women) and 200 (Men). Analyzed by repeated-measures one-way ANOVA followed by Tukey post-hoc tests.

Figure 2: Distribution of fats and muscles in normal, overweight and obese subjects

Impact of the Body Weight on Ageing and at Rest Metabolism

Means biological age of the main groups of women (31.65 ± 0.42 years old) and men (32.91 ± 0.33 years old) was similar. This similarity was conserved even when subgroups appeared according to BMI (Figure 3, extreme right histogram).

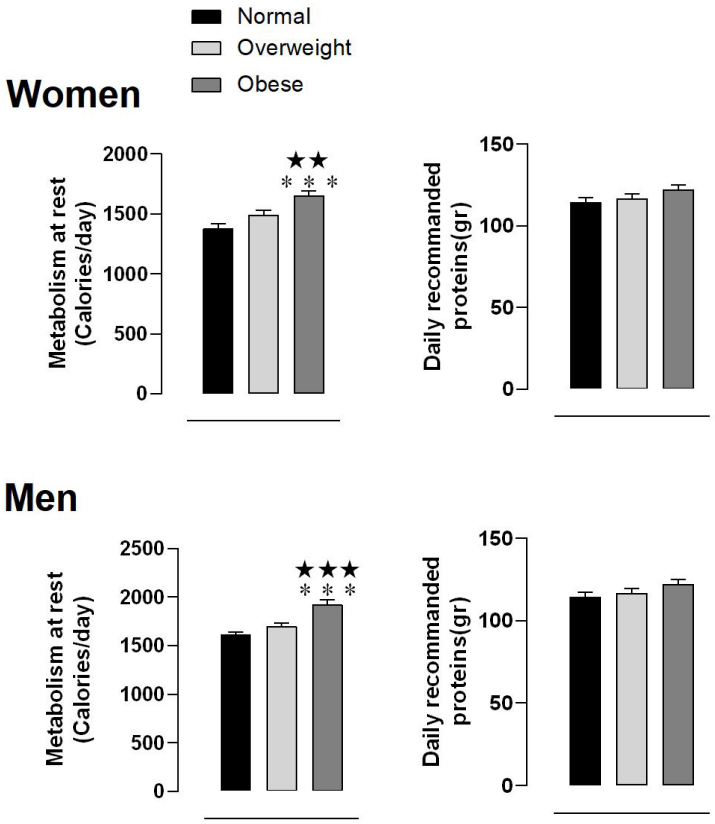




The body weight in both women and men negatively impact biological age. Indeed, whereas metabolic and biological ages remained similar in normal subjects, the metabolic age was significantly higher than biological age in Overweight an Obese subjects; suggesting that huge amounts of fat induce early aging.
Comparisons to Normal subjects are indicated with ***P < 0.001 and to Overweight subjects with **p < 0.01, ***p < 0.001.
N= 200 (Women) and 200 (Men). Analyzed by repeated-measures one-way ANOVA followed by Tukey post-hoc tests.
Figure 3: Impact of body weight on ageing

However, whereas biological and metabolic ages were similar in both women and men with normal BMI, overweight and obesesubjects displayed very higher metabolic ages ascompared to their biological age (Figure 3, central histogram). These increased were around two-fold of the biological age (Figure 3, extreme right histogram). These data suggest a drastic aging of the metabolism in overweight and obese subjects and thus translate the abnormal functioning of the organs in charge of metabolizing nutrients in these subjects. This is in keeping with the fact that obese women and men had a higher metabolism at rest than that of overweight and Normal subjects (Figure 4, left histogram).

Therefore, at rest, obese subjects need to burn more nutrients to extract necessary energies for functioning although their lean mass or daily proteins needed for the maintenance of a good health remains like those of normal and overweight subjects (Figure 4, right histogram).



Lean mass or daily proteins needed for the maintenance of a good health are similar for Normal, Overweight and Obese in both Women and men population. However, obese women and men had a higher metabolism at rest than that of Overweight and Normal subjects.
Comparisons to Normal subjects are indicated with, ***P < 0.001 and to Overweight subjects with ***p < 0.001. N= 200 (Women) and 200 (Men). Analyzed by repeated-measures one-way ANOVA followed by Tukey post-hoc tests.
Figure 4: Metabolism at rest and lean mass

Discussion

The increase of behavioral risk factors of chronic noncommunicable diseases (NCDs), and their associated risk factors are emerging rapidly in an epidemic proportion and are becoming a major public health challenge, mainly for developing countries like Gabon [3-5]. Indeed, NCDs are becoming the leading causes of mortality and morbidity worldwide [29], particularly in young population with whom, a preoccuping increase in prevalence of overweight people and obesity have been noticed.

Accordingly, we aimed at investigating whether active young Gabonese population living in Libreville, presented any behavioral risk factors for NCDs by studying teir dietary habits and lifestyle, as well as by measuring their anthropometrics parameters using medical device Omron Body Composition Monitor BF511; a device already used for similar studies elsewhere [27] and that offers the advantages to directedly measure BMI and other various parameters including, the body weight, the percentages of muscle, the percentage of body and visceral fat, the metabolic age and the metabolism at rest.

Thus, striking findings of our study were 1. The overall bad dietary habits and lifestyle leading to a generalized overweight/obesity in both young men and women; 2. The huge imbalance levels of body composition and the consequence on the body metabolisms.

The Overall Bad Dietary Habits and Lifestyle and the Generalized Overweight/Obesity in Both Genders

In keeping with worldwide trends, studies across Africa showed that the low-income of population, the nutritional transition due to societal changes and increasing urbanization are often accompanied by change of dietary habits and /or lifestyle factors and the rise in the rate of NCDs [30]. These factors may account for the dramatic dietary habits observed in our study in which, only 38% of women or 30% of men exhibited good dietary habits (Table 1).

Accordingly, subjects included in our study were young, active, educated, with relatively good incomes, and they live in a country spending more than $500 million in annual food imports, and that has been classified among the African Countries with highest nutrition transition scores [30]. There are no doupt on the effects of nutrition transition and dietary habit on data observed.

Indeed, based on our questionary, we found that most of the meals consumed by Gabonese people were the reflect of abroad kitchen, rich in carbohydrate with abuse quantities of fats of bad quality, like the ‘tchep’ from senegal. Meals eaten can mostely provent from fastfood of west such as Kentuky freid Chiken (KFC) or of Africa grilled meats full of fat, called 'coupés-coupés' or chicken wings called 'nikes', respectively, served at the curbs. These meals are made from imported frozen or over-transformed foods, whereas natural and biological foods are available in every markets, but less visited, due to some arrested ideas bringout by modernism.

Moreover, in terms of periods of meals, there were no respected of three meals and/or no precise times of eating them. Some young subjects only having one or two meals a day, albeit good incomes earned.

The typical mean day food for induals, based on our questionnarire may beremused as followed: Breakfast in pastry, or 'coupés-coupés' or 'nikes', or a simple cup of coffee or chocolate at home or nothing. Few have a real equilibrate breakfast with vegetable, protein and carbohydrate and water.

At noon, it is very difficult to be at home and have good plate, since the hours of work are continue from 7 am to 3:30 pm. Then major of them do not eat at noon while other will go in fast food or repeat the routine of breakfast. Finally, the main meal is the diner, that is preferentially consumed after 09 p.m. Some of the subjects declared going three or five time a week, with their family, to Kentucky fried chicken. Sugar sweetened beverages (SSBs) or “soft drinks” such as SODA are widely consumed in GABON where they are available at lower prices than water and sells everywhere.

However, nutritional transition and /or dietary habits may had also negatively impacted lifestyle in young women, in which, we found only 23% with satisfactory lifestyle (Table 1). Based on the questionnary, many young men declared practicing more physical activity, albeit having bad dietary habits, and even if recreational exercise is a culturally uncommon in GABON when one is not sportive. This may account for good score (62%) displayed by men regarding lifestyle evaluation. This is in keeping with the fact that women spent long times in front of the TV, or in the kitchen or beyong midnight following NOVELAS films.

Together, bad dietary habits and bad lifestyles induced a trend in increase of obesity in young women while no effect was observed on young men who harboured good lifestyle (Table 1).

However, having a good lifestyle was not enough to get back young obese men to the normal status, apart from quitting the obesity zone to the overweight zone (Table 1). These data suggested that there is no clear evidence showing that having a good lifestyle could entirely compensate for the adverse effect of bad dietary on obesity (Table 1).

Indeed, by simply consider obesity and overweight together, one can see that having a good or bad lifestyle do not impact the effects of bad dietary habits on body weight (Table 1) as good lifestyle did not allow normalization in overweight/obese people. This suggest that dietary habits more than lifestyle seem to have a deep impact on body weight gains in individuals.

In addition, probably due to a better lifestyle, young men have less obese in their ranks (Figure 1), with a well-guarded proportion of people who are overweight, unlike women who are more obese than overweight, suggesting, a gender differences pattern of behaviouralrisk factors for NCDs.

Aside from calorie excess, high glycemic load or glycemic index consumption and additional dietary factors observed in these young Gabonese may be associated with diabetes risk and may be prevalent in GABON.

The Huge Imbalance Levels of Body Composition and the Consequence on the Body Metabolisms

Though BMI does not measure body fat directly, it is moderately correlated with direct measures of body fat obtained from skinfold thickness measurements, bioelectrical impedance, underwater weighing, dual energy x-ray absorptiometry (DXA) and other methods [31-35], as well as with various adverse health outcomes consistent with these more direct measures of body fatness [36-39].

However, the debate on the measure of adipocity remain entire due to the paucity of data. Nevertheless, our data, showed that high BMI are accompanied by the reduction of muscle percentage in both women and men (Figure 2, left histograms), and increased in the percentages of body fat (Figure 2, middle histograms) and Visceral Fats (Figure 2, lefts histograms). Data confirmed that obesity is related to abnormal higher amount of fat vs poor quantity of body muscle [40].

In Malawians, a country classified in the same range than Gabon in nutrition transition [30], significant positive correlation was established between diabetes risk and increased BMI [41] that had a rate significantly higher in women relatively to men. These data suggested that higher BMI in Gabonese population have also at risk factor in developing diabtes, particularly in women, since they are less active. This is in keeping with previous studies showing the effects of moderate physical exercices on the reduction of the risk for developing insulin resistance, because exercise induce the augmentation of insulin action [42].

Althought the study shows that almost all of the young people of the study had behavioural risk factors for CNDs, its also may have a clustering of these factors significantly higher in women, since there was a higher number of obese [43]. This tendency of clustering risk factors in individuals has been observed elswhere. in the later study authors estimated hat clustering may provide opportunities to address factors with integrated approaches to prevent/delay the onset of CNDs [43]. In many African countries under nutrition transition and/or with low-middle income, like GABON, where there are relatively high levels of obesity/overweight, high consumption of energy fat/and or sugars including SODA and alcohol intakes, young people displayed classic signs of a population well established in the nutrition, related to the NCDs phase of the nutrition transition [30] with the risk to develop a high prevalence NCDs mortality more rapidly than has occurred in the West. Our data confirmed these observations and showed a gender differences and clustering pattern higher in young women than men.

Conclusion

This prospective study with absolutely no big budget suggest that in Gabon, overweight/obesity in young active population in town is preoccuping and may contribute to the high prevalence NCDs in this slice of population, as it is already seen in the hospitals with more young subjects suffering from stroke, hypertension, diabetes and etc. This trend that is probably the tendency in all the country need for a health care policy implementation, specific health promotion campaigns, and further epidemiological research may be key to attenuating an impending health crisis, seen that, the major part of young active subjects presents behavioural risk factor for the development of NCDs.

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