Journal of Nutrition and Health Sciences
Volume 5 | Issue 4
ISSN: 2393-9060

Research Article Open Access

Impact of Eating Habits on Cellular Regeneration and Weight Balance in the Central African Republic

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Citation: Djorie SG, Farra A, Nyasenu YT, Wango SM, Manirakiza A, et al. (2018) Impact of Eating Habits on Cellular Regeneration and Weight Balance in the Central African Republic. J Nutr Health Sci 5(4): 404

Abstract

Food compound has an impact on cell regeneration and body mass index. Studies of observations conducted between 2015 and 2017 among men in the CAR show a similarity in eating habits and in the way of consuming food. Of 148 people from different households with different incomes observed, 79 or 53.38% were male and 69 or 46.32% were female. The median age was 28 years (18-45). In group 1 or G1, 115 (77.7%) retained the African food habit. In addition, 33 people or 22.3% adopted a western-style eating habit and have a preference for fried foods and dairy products with a high fat content (group 2 or G2). This G2 had more overweight or obesity phenomena than the G1 which presented some weight loss cases with a significant difference. The composition of the African food habit has certainly an influence on the body mass and cellular regeneration thus tissue.

Keywords: Regeneration; Overweight; Obesity; Bangui

Introduction

Renewal plays a fundamental role in cell differentiation, proliferation, and interactions between different cells. In addition, within the tissues, the regeneration of differentiated cells from their precursors is a permanent phenomenon and most of these precursors come from bone tissues, including cancellous and cartilaginous tissues, but especially from the bone marrow [1]. The notion of cellular regeneration covers several concepts. In the physiological state, each cell of our body is in perpetual renewal. The cell membranes, whether they are the plasma membrane or the intracellular membranes, are renewed, both for their lipid constituents and for the proteins that are inserted therein. These lipid or protein constituents may be of endogenous origin from certain syntheses or exogenous from the nutrients [2]. All organisms must get nutrients from their environment to live. These nutrients are the sources of substances necessary for the development and renewal of the cells that make up our body. Nutrients are essential for maintaining biological functions including metabolism, growth and tissue repair. Studies have also shown that caloric restriction (CR), which is defined as a reduced intake of nutritious calories without malnutrition, improves the maintenance of biological systems and increases lifespan and disease-related diseases age in humans [3]. The quality of the nutrients all the same the elements brought by certain nutrients are essential to the regulation of the biological functions that ensures our organism. In Africa, the notion of a food ration is no longer a problem; the problem of quality of food rations, eating habits and the way in which food is consumed is raised earlier. In Africa as in Asia, we find almost the same eating habits based in particular on the red flesh (meat of cattle, goats or hunting products), white meat (fish, chickens) but especially on vegetables, starches and vegetables

smoked flesh. Less frying so less fat. However, some differences were noted in the variability and diversity of foods [4]. In the West, there is a great diversity in the food ration. Both quality and quantity are more to show, which marks a big difference between eating habits between Europe, Africa and Asia. On the other hand, some African households have adopted western habits in their way of feeding themselves. In these households, there is a similar growth between the Africans of this group and the Westerners; all the same in the process of aging and in the occurrence of certain diseases related to food. Nutrients are the main components of the diet. Nutrients include organic chemicals, such as carbohydrates, proteins, lipids and vitamins, and inorganic substances, such as minerals and water. Each nutritional compound acts differently on cell functions, either it accelerates the aging process or it delays this process using specific signaling pathways. The staple foods in Africa are mainly composed of carbohydrates, proteins, amino acids, lipids and minerals. Studies have examined the effects of dietary nutrients, namely carbohydrates, proteins, amino acids, lipids, vitamins and minerals, on the aging process through cell renewal and thus on the shelf life a diverse group of organisms, ranging from yeast to mammals [5-7]. The importance of dietary habits on aging and age-related diseases in humans is better explained. In African-type subjects a preference for smeared flesh, plants, and the consumption of flesh with bone, during meals is often followed by the grinding of bones with swallowing of the juice contained in the crushed bone and the rejection of the bone broth. This mode of feeding will be studied and compared to the Western diet. The main objective of this study is to evaluate the impact of dietary habits on cellular regeneration (aging) and cardiovascular functions.

Materials and Method

Type, Population, Period, and Setting

This is a prospective descriptive and observational study. The study population consisted of adult subjects of both sexes aged between 18 and 45 years. The recruitment of the subjects started between January and March 2015 in the different districts and communes of Bangui and the observation from January 2015 to March 2017.

Mode and Subject Selection

The collection of the study population was carried out in the various districts and communes of Bangui according to a random mode.

Inclusion Criteria

The main criteria for inclusion were, to be an adult and aged 18 to 45, living in Bangui and its peripheries, respect for the concept of free and voluntary participation, free signature of an informed consent form by the subject. The map of Bangui, which includes all the districts of the capital and one of the two municipalities where the study was also conducted, is illustrated in (Figure 1) the red circles correspond to the sites of our study.

Criteria of Non-inclusion

The main criteria for non-inclusion were obesity, history of cardiovascular disease, hypertensive crisis and non-contact subjects.

Calculation of the Body Mass Index (BMI)

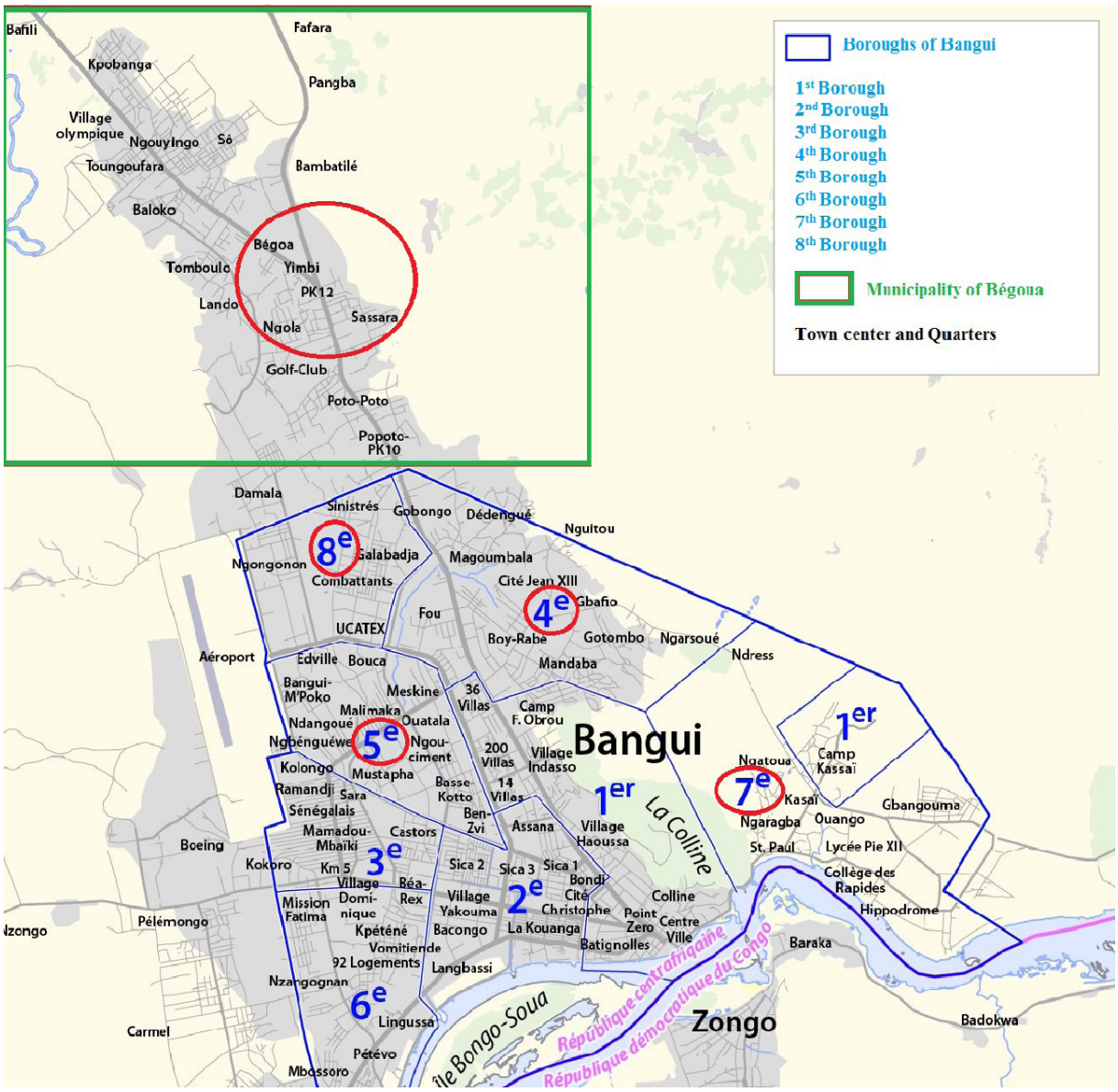
Weight and height were recorded every six months, twice a year for each individual. The measurements are carried out by the individuals themselves or in a health center closer to the place of residence and indicated on the sheet dedicated to this study and given to a member of our team. The Body Mass Index (BMI) was evaluated from the average of the individual weights over three years.

The body mass index was calculated using automatic calculation via [8]. Subjects were ranked according to the recommendations of this site based on their BMI data.

BMI <18.5 kg / m^2: underweight
18.5 <BMI <24.9: normal weight
25 <BMI <29.9: overweight
BMI> 30: Obesity.

Assessment of Body Mass and Constitution of Groups

In this study, the composition of the food ration and the way in which individuals were eaten were considered as the main parameters for grouping the population. Thus two groups were formed (G1 and G2). Weight, height and BMI were the parameters taken into account to evaluate the impact of dietary habits on body mass. Two modalities concerning the eating habit have been observed, the African food habit and the Westernized food habit. These two modalities lead us to evaluate their impact on cellular regeneration (aging) and cardiovascular functions. In group 1 or G1, the diet was much more based on plants (vegetables, cassava tuber, tarot or yam), smoked meats, fresh meat, fresh or smoked poisons. The consumption of pork or chicken was rare and



occasional. In group 2 or G2, the diet was based on bananas, apples prepared in the form of frying, dairy products, beef, poultry and pigs. Subjects were classified according to the frequency of their key foods, per month and the mean of staple foods during six months.

Statistical Analysis

The data from this study are analyzed using statistical software Stata and R by the Epidemiology and Biostatistics Department of the Pasteur Institute of Bangui. The gestures made with the subjects were the measurements of weight and blood pressure. We did not consider sex in this study. Student's test, Chi2 test and Odds Ratio (OR) calculation and 95% confidence interval (95% CI) were used to compare frequencies. The significance threshold used for statistical tests has been set at 5%.

Results

Data by Gender

A total of 148 people were observed in this study, 2 of whom had fewer data, of which 79 were males (53.38% of the study population) and 69 (46) 62% female. Out of a total of 200 people recruited in this study, 52 people were lost to follow-up or 0.26%.

Data by Age and Occupation

The average age of the study population is 30 years and the median age is 28 years (extreme), 37% of the population had a revenue-generating activity, 42% had no activity and 21% had a school activity. Of the total study population, 10% were engaged in a non-professional and maintenance-related sporting activity.

Data on Body Mass assessment and Group Formation

In group 1 or G1, 77.77% (115/148) of people were included. All the people observed in this group, ie 100% of the subjects confessed to eat by hand and to crunch the bones contained in the meats or fish cooked or braised.

In group 2 or G2, 33 subjects out of 148 or 22.3% were observed. Only one person is 3% (1/33) admits consuming smoked meat.

No mixed type of main food habit was found.

About the smoked meat or crunching bone during meal, our results are observational and were based more on body contour and body mass index. Episode of diarrhea is reported by subjects who consume smoked meat.

Body Mass Data

Table 1 illustrates the distribution of anthropometric characteristics of the population. Of the 148 people observed, the average weight was 65.86±9.75 kg with an average height of 166.01±8.58 cm. For BMI, the average was 23.87±2.96. Although average BMI shows normal body mass in both groups in general, individual group data show a large difference in body mass.

Characteristics	Size (cm)	BMI (kg / m2)	Weight (kg))
Average	65,86	166,01	23,87
Standard deviation	±9,75	±8,58	±2,96
Median	67	167	23,6

Table1: Mean, standard deviation, and median weight, height, and BMI in the general population (n=148)

Evolution and Comparison of Body Mass between the Two Groups

The BMI data provided four categories of people by weight status, underweight, normal weight, overweight and obese. In the G2, 17 people or 53.1% have a normal weight, 12 people or 37.5% are overweight and 3 people or 9.38% have been obese. No subject presented a sign of weight loss (Figure 2). In the G1, 86 people or 75.44% have a normal weight, 3 people or 2.63% presented a situation of slimming, 24 people or 21.05% are overweight and a person is 0.88% a obesity with a significant difference between the two groups (p=0.008). One subject did not have all the anthropometric data. The different statuses were classified using the calculation of the body mass index (BMI), which combines the ratio of weight (kg) and height (cm) squared. Among subjects with an African food habit, the average BMI is 23.5 versus 25.17 for those with Western dietary habits. This mean BMI in group 2 is slightly above normal with a significant difference (p=0.003) between the two groups. Comparing the subjects with each other, by age group and between the two groups, shows that between the ages of 25 and 45, subjects with an African food habit (G1) appeared younger for their age than their G2 counterpart. The type of food consumed in the G1 would have a substance that would act on the delay of cellular aging gold in this group, people consumed more plant-based nutrients, smoked meat but especially they crunched the bones and swallowed the juice contained in these bones.

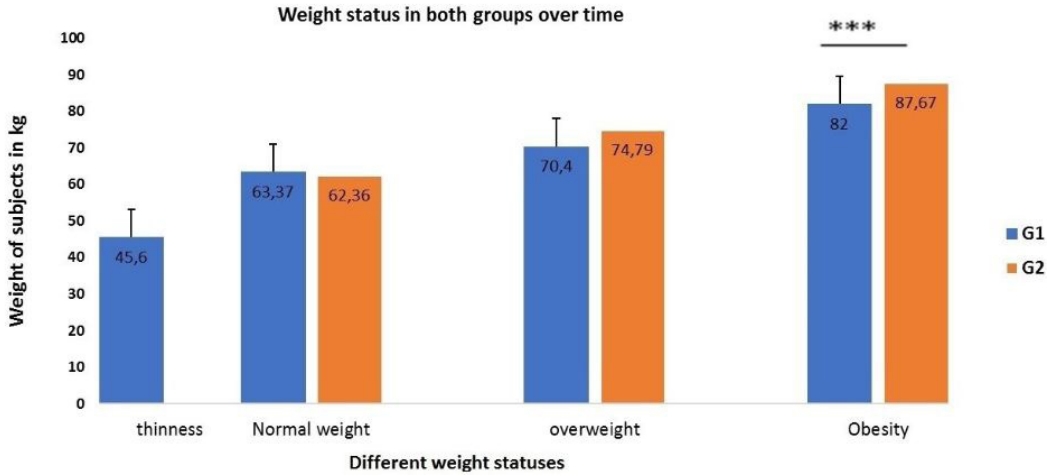


Figure2: Classification of subjects by weight and weight statut after calulation of the Body Mass Index (BMI), (n=148), (p=0.008)

Evolution of Weight Over Time

Weight tracking data over time showed that throughout the first year, G1 subjects had an average weight above that of G2 subjects even if there were no of significant difference (Figure 3). However, after a certain period of time (in the second year), those of the G2 evolved very quickly in weight to reach larger weights, unlike the subject of the G1, whose weights stabilized over time or even decreased. The weights have been raised over the years. An evolution then a stabilization were observed in the G1 unlike the G2 whose weights exponentially (n=148).

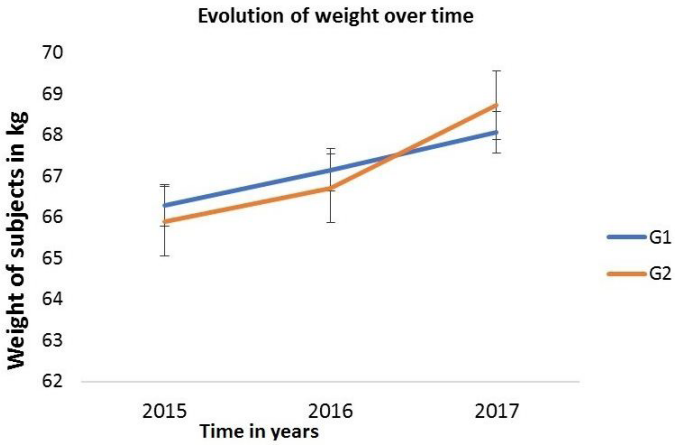


Figure3: Evolution of the weight of subjcts over the years

Data on Cardiovascular Risk Factors

The cardiovascular risk was assessed from the measurement of blood pressure, the limit of the maximum tension was set at 13 (Table 2). Beyond this value, blood pressure was considered as confirmed cases of high blood pressure therefore a risk factor cardiovascular. The blood pressure data showed that in G2, 29 people or 90.63% had a normal blood pressure, 3 people or 9.38% had cases of hypertension. However, in the G1, 111 people or 96.52% had normal blood pressure and 4 people or 3.48% showed signs of hypertension without significant difference between the two groups (p=0.16). The blood pressure results according to the severity of the arterial hypertension or not in each group (G1 or G2), are represented by (Figure 4).

Group	Total number	Status	Number/ Status	Average age (year)	Average Weight (Kg)	Average Size (cm)	Average BMI (Kg/m²)	Hypertension Case
G1	115 (77,7%)	thinness	3 (2,63%)	24,67±8,22	46,5±0,33	163,58±3,55	17,46 ±0,62	Negative
		Normal	86 (75,44%)	28,05±,78	62,59±6,11	166,43±6	22,47 ±1,40	Positive (02)
		overweight	24 (21,05 %)	28,92±10,26	70,5 ± 5,59	161,79±6,39	26,90 ±1,27	Negative
		Obesity	01 (0,88%)	45	82	154	34,6	Positive (01)
	Data less		01					
G2	33 (22,3%)	thinness	0					
		Normal	17 (53,1%)	42,71±2,04	62,36±6,02	167,06±5,36	22,21 ±1,24	Positive (01)
		overweight	12 (37,5 %)	25,67±6,56	74,79±4,28	162,75±3,96	28,23 ±0,85	Positive (03)
		Obesity	03 (9,38%)	37±6,67	87,67±9,56	169±8,67	30,57 ±0,16	Negative
	Data less		01					
Total			148 (100%)					

Table 2: Overall situation of subjects in both groups

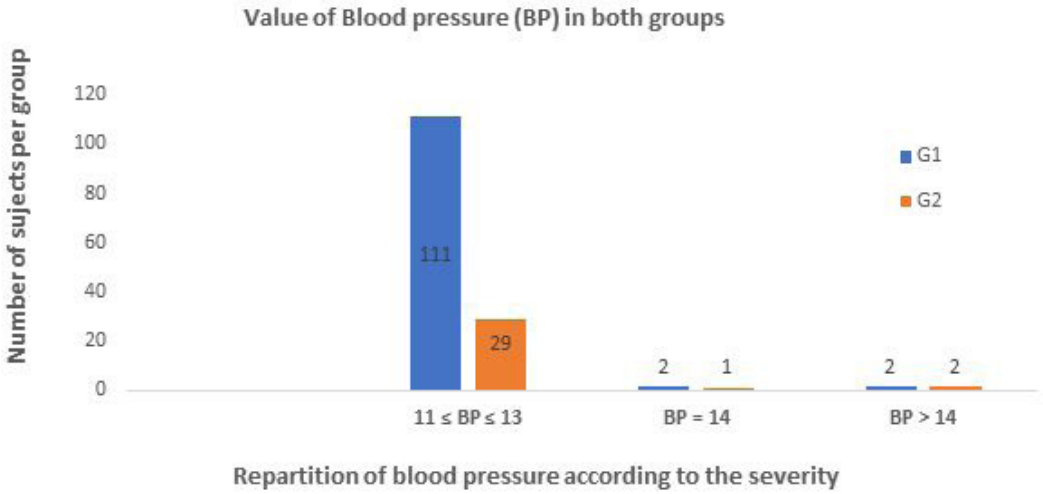


Figure 4: Classification of subject by the severity of hypertension case or not according to the value of blood pressure

Impacts of Both Types of Diet on Topics

The previous results allowed us to make a univariate regression model on the causal link between eating habits, weight gain and cellular regeneration (aging). This univariate logistic model shows us that the subjects with the western food habit were more likely to be overweight and hence to have premature aging (OR=15.17 IC (95%)=[1.48-154.7]) than subjects having kept the African food habit. The group situation was given as a global average over three years (Table 2). The sample size was 148 (G1 n=115, G2 n=33). For the cardiovascular risk factor, there is no significant difference between the two groups (p=0.16). However, the Student's test shows a significant difference (p=0.003) between the two groups for body weight.

Discussion

The concept of nutrition is very important for the development of any organism and the regulation of homeostasis. However, the quality or quantity of the nutrients we absorb on a daily basis remains. In Europe, the quality or quantity of food is more to demonstrate but what is problematic is rather the impact of nutrients in these foods on human health. The search for the factors that influence weight balance and cellular regeneration has made it possible to identify in our study the African-type food habit. Regarding the impact of these factors on cardiovascular functions, no significant difference was found between the two groups studied, however, the risk to human health cannot be excluded because in these two groups we had observed anyway cases of hypertension. In terms of weight gain over time, G1 subjects had a higher average weight than G2 over the first year. From the first quarter of the second year, G2 subjects had a higher average weight than G1 subjects. This average weight in the G2 continued to grow over time until the end of the study while that of the G1 remained stable or decreased gradually until a few cases of weight loss in the group which is not the case in the G2 where it was observed that cases of obesity with a weight average more important. Our results are consistent with the work of Paxton A et al, who described diets in African subjects prior to emigration in the United States as rich in vegetables, fruits, tuber roots (such as cassava or yam), and vegetal oils. Moderate consumption of meat, fish and remarkably low in sugar (for example, in soft drinks or desserts) and which had balanced weights before adopting the American diet. After adopting the Western-type diet, they reported a significant increase in weight after the first years of life in the United States, and all expressed concerns about weight gain [9]. This weight gain persists over time. Our results on blood pressure show that whatever the group, there are cases of hypertension without any significant difference between the two groups. In a severity approach, it was established from our data that there were more cases of hypertension with a high systolic blood pressure value in G2 than in G1 with values up to 16 for maximal blood pressure in the G2. G2. However, in G2 the food components were based much more on frying, there was also a fairly large proportion of obesity and an average age between 28 and 42 years. All of these parameters could contribute to a cardiovascular risk, which could partly explain the severity of this maximum blood pressure in G2. Our results are consistent with those of Soriguer F et al who noted a link between the occurrence of hypertension, age, obesity and frying consumption [10]. However, the work of Queenie C et al showed a predisposition to the development of high blood pressure in black subjects without a probable link with food, this hypothesis would probably explain the occurrence of hypertension in both groups [11]. In our study, the key factor studied was the composition of food rations and how to eat. Therefore, we will discuss the potential influences of these dietary components on human aging and diseases related to these components. We noted that subjects with an African-style eating habit had a plant-based food composition with high consumption of cassava, green vegetables, complex carbohydrates, and fruits, red or white flesh. They also had a preference for smoked meat but especially they absorbed the juice contained in the bones after chewing them and they rejected the bone meal. Nutrients include organic chemicals, such as carbohydrates, proteins, lipids, vitamins, and inorganic substances, such as minerals mainly calcium, magnesium, sodium or vitamin D, and water. Each nutritional compound acts differently on cell functions, either it accelerates the aging process or it delays this process using specific signaling pathways. Our study showed that staple foods in Africa in general and Central Africa in particular are mainly composed of fiber, carbohydrates, proteins, amino acids, lipids and minerals. Our results are consistent with the work of Gomez A et al., who reported that some beneficial bacteria of the genus Prevotella were very abundant in samples from BaAKA adult pygmies in the Central African Republic, whereas they were undetectable in the US . These results also showed that pygmies lived and fed mainly on the products of hunting [12]. According to the results of their work, after passing BaAka samples in gas chromatography and after eliminating the metabolites present in less than 50% of the samples, the BaAka metabolites were mainly grouped into lipids (40.8%). all metabolites), carbohydrates (19%), sterols (18.9%), phosphates (8%), acids (7.9%), amino acids and amines (3.3%), and bile acids (1.7%). Coprostan-3-ol, the major metabolite of cholesterol metabolism in the distal colon, was the most abundant metabolite (15.6%±10.6%), followed by glycerol (12.7%±11 , 74%), stearic acid (11.9%±8.7%), palmitic acid (10%±6.5%), phosphoric acid (8% ±8.5%) and lactic acid (4.5%±5%). The other metabolites accounted for less than 2% of abundance and consisted mainly of long-chain fatty acids, cholesterol, secondary bile acids (lithocholic acid, deoxycholic acid and hydrocholestane) and plant phenolic compounds (benzoic acid and benzene acid acetic, for example) [13]. Moreover, the most preferred and most consumed food in the Central African Republic are the leaves of Gnetum africanum (Koko) even among pygmies [14]. This rich fiber and tannin resource could explain the enrichment of other potentially fibrolytic taxa in the microbiome of G1 subjects [15]. Our results may be consistent with the work of Gomez A. *et al.* who showed that Prevotella, the most dominant taxon in the microbiome of the BaAka intestine, is a bacterium that strongly degrades polysaccharides. Members of the Prevotella genus may also have important β-D-xylanase and β-D-xylosidase activities, suggesting fiber degradation [16,17]. These bacteria absorb less energy which could explain weight regulation in G1 subjects.

Numerous scientific literatures speak of the effects of certain nutrient compounds on cell regeneration, either it regulates positively resulting in the control of body mass or negatively resulting in a large body mass. These effects result in early aging or the onset of chronic diseases such as diabetes or high blood pressure. Our study showed that the food intake in G1 was more plant based and consisted mainly of carbohydrates, lipids, amino acids and minerals, less glucose-based sugar However, in G2 the food intake was richer in fatty acid. Previous studies have shown that carbohydrates are organic compounds composed of carbon, hydrogen and oxygen. They act as signaling molecules, energy sources and structural components. The importance of carbohydrates for human health has been demonstrated by the association of the close link between the occurrence of chronic metabolic diseases and diets rich in carbohydrates. These diets have high glycemic indices, resulting in a rapid increase in blood glucose levels. In addition, recent studies show that several dietary carbohydrates directly affect the lifespan of various organisms through a variety of signaling pathways. In yeast, glucose decreases the lifetime through the glucose and Ras receptor that are components of a growth promoting signaling pathway. In Caenorhabditis elegans, glucose regulates downward pro-longevity proteins, such as protein kinase that is activated by AMP (AMPK), FOXO, and glyoxalase, resulting in reduced life span. However, Sirtuine 3 (SIRT3), a NAD-dependent deacetylase protein, mediates the effects of glucose on senescence in cultured mammalian cells [18]. Unlike glucose, several other monomeric carbohydrates or carbohydrate metabolites, such as trehalose, pyruvate, malate, fumarate and N-acetylglucosamine (GlcNAc), have been shown to be effective in promoting longevity in C. elegans [19-23]. In contrast to G2 subjects, our results showed that G1 subjects consumed more plant-based foods, and were less obese and appeared younger between 25 and 45 years of age. Plants have been shown to be rich in trehalose [24,25]. The trehalose contained in these nutrients produces less energy than glucose therefore decreases the risk of weight gain all the same, it could act positively on cell regeneration and therefore on cellular longevity by activating sirtuin 3, which could explain in part the youthful appearance between 25 to 45 years in the G1 and the maintenance of weight in this group. It has been shown that glucose can also accelerate aging in mammals, although direct evidence is rare. High concentrations of glucose in media accelerate the senescence of human cells in culture [26,27]. This pro-aging effect of glucose is associated with a reduction in the expression of sirtuins, in particular SIRT3 / sirtuin 3, a nicotinamide adenine dinucleotide (NAD) dependent deacetylase protein which is positively involved in various processes, in particular inflammation, energy restriction, mitochondrial biogenesis, resistance to stress and cellular senescence, endothelial function, apoptosis and circadian rhythm [28-30]. Our results also showed that lipids were the main nutrient compounds in G2 than in G1. Gold in the G2 diet was much more based on fried foods. Previous work has shown that dietary lipid components, including fatty acids, phospholipids, cholesterol and glycerides are the major structures in biological membranes. In addition, dietary lipids influence the physiology of the body, including aging. Studies have shown that a high-fat diet is generally associated with increased mortality and increased incidence of many metabolic diseases, including obesity, type II diabetes, and cardiovascular problems which would explain the high rate of overweight, obesity or hypertension in G2. However, in G1 even if we observe some cases of obesity (one case) or arterial hypertension, this does not significantly affect the risk factor related to diet as confirmed by the statistical test with the model of univariate regression on the causal link between dietary habits. Moreover, in the G1, we observed that the subjects grind the bones and ingest the juice contained in the crushed bones without swallowing the bone meal [31,32]. It has been shown that among the main constituents of bone are calcium and magnesium. Previous work has shown that cell lines cultured in a calcium-rich medium grow better. A low calcium medium causing cellular deformities with the appearance of giant or fusiform cells and Gram-negative bacteria grew better in a medium rich in calcium and magnesium, but these minerals are found in high levels in the bones [32]. The calcium or magnesium contained in the juices of the bone marrow and swallowed by the subjects could be essential energy sources for the growth of gram negative bacteria that are beneficial to humans, such as the Bacteriodes genus and cell regeneration. It has been shown that an intestinal flora rich in Bacteriodes, allowed a good weight balance in living beings which could explain the weight stabilization in G1 on the one hand and the young appearance between 25 to 45 years in this group [12]. As for smoked meat, we noticed that the consumption of this meat causes episodes of physiological diarrhea not exceeding 6 hours of time, which probably leads to a physiological balance in subjects with an African-type diet.

Limitations and Perspectives of the Study

Given the context of crisis in our country, this study was conducted only in the capital Bangui, which may not be representative of the food in the country, which remains more natural. The actual composition of the main food rations has not been analyzed to measure their real impact on growth. On the other hand, no biological samples were analyzed for scientific certification. The data of our work are observational data and based on anthropometric parameters and the correlation of our results with results of other works. Further scientific studies on the various parameters and factors studied would be essential for a better proof of concept and the development of the nutrients involved in this study.

Conclusion

African dietary habits play an important role in cell regeneration, regulation of intestinal flora, weight and cardiovascular risk factors. However, no more specific scientific study on the role of the components of these foods on human health has been made available to date. In Africa and more specifically in Central Africa, even if the quality or quantity of food does not seem to meet certain dietary or hygiene rules, African-style eating habits seem to have a positive impact on weight balance and cellular regeneration. According to the results of our study.

Acknowledgement

We particularly thank M. Pierre TCHEMAHA, for his critical reading and main contribution of the manuscript. We also thank all investigators and community relay for their main implication in this work. Not to mention all the people who gave their time for this study.

References

1. Geoffrey M (2000) The Cell: A Molecular Approach. 2nd (Edn.) Bookshelf ID: NBK9906.

2. Visioli F, Crawford MA, Cunnane S, Rise P, Galli C (2006) Lipid transport, dietary fats, and endogenous lipid synthesis: hypotheses on saturation and competition processes. Nutr Health 18: 127-32.

3. Kenyon CJ (2010) The genetics of ageing. Nature 464: 504-12.

4. Pisa PT, Pedro TM, Kahn K, Tollman SM, Pettifor JM, et al. (2015) Nutrient patterns and their association with socio-demographic, lifestyle factors and obesity risk in rural South African adolescents. Nutrients 7: 3464-82.

5. Piper MD, Mair W, Partridge L (2005) Counting the calories: the role of specific nutrients in extension of life span by food restriction. J Gerontol A Biol Sci Med Sci 60: 549-55.

6. Piper MD, Partridge L, Raubenheimer D, Simpson SJ (2011) Dietary restriction and aging: a unifying perspective. Cell Metab 14: 154-60.

7. Tatar M, Post S, Yu K (2014) Nutrient control of Drosophila longevity. Trends Endocrinol Metab 25: 509-17.

8. Doctissimo Nutrition (2016) Calculation of the Body Mass Index (BMI), France.

9. Paxton A, Pillai A, Phelan PQ, Cevette N, Bah F (2016) Dietary acculturation of recent immigrants from West Africa to New York City.

10. Soriguer F, Rojo-Martínez G, Dobarganes MC, García Almeida JM, Esteva I, et al. (2003) Hypertension is related to the degradation of dietary frying oils. Am J Clin Nutr 78: 1092-7.

11. Chan Q, Stamler J, Elliott P (2015) Dietary Factors and Higher Blood Pressure in African-Americans. Curr Hypertens Rep 17: 10.

12. Gomez A, Petrzelkova KJ, Burns MB, Yeoman CJ, Amato KR, et al. (2016) Gut Microbiome of Coexisting BaAka Pygmies and Bantu Reflects Gradients of Traditional Subsistence Patterns. Cell Rep 14: 2142-53.

13. Sekimoto H, Shimada O, Makanishi M, Nakano T, Katayama O (1983) Interrelationship between serum and fecal sterols. Jpn J Med 22:14-20.

14. Remis MJ, Jost Robinson CA. (2014) Examining short-term nutritional status among BaAka foragers in transitional economies. Am J Phys Anthropol 154: 365-75.

15. Isong E, Adewusi S, Nkanga E, Umoh E, Offiong E (1999) Nutritional and phytogeriatological studies of three varieties of Gnetum africanum ('afang'). Food Chem 64: 489-93.

16. Terrasan CRF, Guisan JM, Carmona EC (2016) Xylanase and β-xylosidase from Penicillium janczewskii: Purification, characterization and hydrolysis of substrates. Electron J Biotechnol 19: 54-62.

17. Jenkins DJ, Wolever TM, Taylor RH, Barker H, Fielden H, et al. (1981) Glycemic index of foods: a physiological basis for carbohydrate exchange. Am J Clin Nutr 34: 362-6.

18. Lee D, Hwang W, Artan M, Jeong DE, Lee SJ (2015) Effects of nutritional components on aging. Aging Cell 14: 8-16.

19. Honda Y, Tanaka M, Honda S (2010) Trehalose extends longevity in the nematode Caenorhabditis elegans. Aging Cell 9: 558-69.

20. Mouchiroud L, Molin L, Kasturi P, Triba MN, Dumas ME, et al. (2011) Pyruvate imbalance mediates metabolic reprogramming and mimics lifespan extension by dietary restriction in Caenorhabditis elegans. Aging Cell 10: 39-54.

21. Edwards CB, Copes N, Brito AG, Canfield J, Bradshaw PC (2013) Malate and fumarate extend lifespan in Caenorhabditis elegans. PLoS One 8: e58345.

22. Denzel MS, Storm NJ, Gutschmidt A, Baddi R, Hinze Y, et al. (2014) Hexosamine pathway metabolites enhance protein quality control and prolong life. Cell 156:1167-78.

23. Zentella R, Mascorro-Gallardo JO, Van Dijck P, Folch-Mallol J, Bonini B, et al. (1999) A Selaginella lepidophylla Trehalose-6-Phosphate Synthase Complements Growth and Stress-Tolerance Defects in a Yeast tps1 Mutant. Plant Physiol 119: 1473-82.

24. Reis FS, Barros L, Martins A, Ferreira IC (2012) Chemical composition and nutritional value of the most widely appreciated cultivated mushrooms an inter-species comparative study. Food Chem Toxicol 50: 191-7.

25. Mortuza R, Chen S, Feng B, Sen S, Chakrabarti S (2013) High glucose induced alteration of SIRTs in endothelial cells causes rapid aging in a p300 and FOXO regulated pathway. PLoS One 8: e54514.

26. Zhang B, Cui S, Bai X, Zhuo L, Sun X, et al. (2013) SIRT3 overexpression antagonizes high glucose accelerated cellular senescence in human diploid fibroblasts via the SIRT3-FOXO1 signaling pathway. Age 35: 2237-53.

27. Haigis MC, Guarente LP (2006) Mammalian sirtuins–emerging roles in physiology, aging, and calorie restriction. Genes Dev 20: 2913-21.

28. Maiese K, Chong ZZ, Shang YC, Wang S (2011) Translating cell survival and cell longevity into treatment strategies with SIRT1. Rom J Morphol Embryol 52: 1173-85.

29. Hwang JW, Yao H, Caito S, Sundar IK, Rahman I. (2013) Redox regulation of SIRT1 in inflammation and cellular senescence. Free Radic Biol Med 61: 95-110.

30. Schrager MA, Metter EJ, Simonsick E, Ble A, Bandinelli S, et al. (2007) Sarcopenic obesity and inflammation in the In CHIANTI study. J Appl Physiol 102: 919-25.

31. Honda H, Qureshi AR, Axelsson J, Heimburger O, Suliman ME, et al. (2007) Obese sarcopenia in patients with end-stage renal disease is associated with inflammation and increased mortality. Am J Clin Nutr 86: 633-8.

32. Owens OVH, Gey KM, Gey GO (1958) The Effect of Calcium and Magnesium on the Growth and Morphology of Mouse Lymphoblasts (MB III, de Bruyn) in Tissue Culture. Cancer Res 18: 968-73.