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RESEARCH ARTICLE

EFFECTS OF THE REGULAR SPORT PRACTICE ON BODY COMPOSITION AND THE PROFILE OF THE HEPATIC AND MUSCULAR ENZYMES IN SUB-SAHARAN AFRICAN SUBJECTS

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ABSTRACT

Introduction: The regular sport increases the hope and the quality of life, also allows the control of the weight. Questions remain on the effects of the sport on the clinico-biological parameters of the body. Our aim was to study the effect the impact of the regular sport on the body composition and the hepatic and muscular enzymatic profile by comparing foot ball players to sedentary subjects.
Methodology: It was an experimental study concerning twenty seven (27) men. They are 14 foot ball players and 13sedentary subjects, between 18 and 30 years old. They had all sudden a measure of their constitution in fat and an analysis of transaminases, ALP, GGT, Total bilirubin, Fasting blood sugar, Creatine Kinase and lipids.
Results: We had noticed that the BMI, the total fat mass as visceral fat was always higher at the sedentary subjects but the difference was not significant. The hepatic biological parameters are all higher at the foot ball players. However this differences was statistically significant only for AST (p=0,01) and ALT (p=0,04). So CK was also higer at the foot ball players. After a linear regression, we noticed that AST remains associated with ALT (p=0,005) and with CK (p=0,015).

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INTRODUCTION

The physical activity is a major factor to increase the hope and the quality of life. It is an essential determiner of the energy expenditure and is thus fundamental for the energy balance and the control of the weight (Bérubé-Parent *et al*., 2001). The physical activity is unmistakably connected to a good cardio-respiratory function and to a good metabolism (Physical Activity Guidelines Advisory Committee (PAGAC) Report 2008). At the same time, the scrawny muscle plays a role determining in the practice of the physical exercise. Besides any physical exercise requests the energy function of the muscle. Indeed the muscle is capable of assuring the transformation of the biochemical energy in external mechanical work. Then to assure this role in the steady efforts, besides its energy reserves, it needs contribution adapted in energy substrates. So these contributions in energy Substrates are filled by the organs of storage, as the adipose tissue and the liver (Guezennec, 2010). In fact, the white adipose tissue represents a considerable energy reservoir. During situation of stress as the physical exercise, the triglycerides are hydrolyzed to supply fatty acids, necessary for the power production, in particular at the level of the muscle (De Glisezinski, 2007). At the same time, liver is the most voluminous gland of the body and which performs numerous human metabolic functions (Esneault, 2009) and during the physical effort the Splanchnic debit flow of 80 %. This reduction in the blood flow splanchnique caused by the physical effort engenders a hypo-vascularization of mésentériques territories and so lead to a decrease of the hepatic Blood flow (Watelet, 2008). Such a decrease of the hepatic Blood flow would be at the origin of a hepatic cellular suffering with hépatocytolyse (Wu *et al*., 2004). However few studies were realized in but to estimate the body composition and the profile of the hepatic enzymes

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Sub- Saharan African Subjects practising regularly the physical appearances of enduring efforts and or resistant. So we led this work to estimate the impact of the regular sport on the physical composition and the hepatic and muscular enzymatic profile at African black foot ball players.

MATERIALS AND METHODS

Subjects and Protocol

This study was realized in the department of human physiology and functional explorations of the Faculty of Medicine, Pharmacy and Odontology (FMPO) of the cheikh Anta DIOP University (UCAD) from Dakar to Senegal. It has was made from March until November 2016. The protocol was create by concordance with the guideline set by the declaration of Helsinki and approved by the Ethics Committee of the FMPO / UCAD. All the recruited subjects were all informed about the interest of this work and signed an index form of informed consent. The study concerned 27 subjects between 18 and 30 years old and all male. The sportsmen were recruited in a training center of Foot Ball named Sicap Foot Ball Club of the city of Dakar.

Evaluation of the anthropometric, cardiovascular parameters and the body composition

The parameters necessary for this study were notified in a single medical examination.

For every inclusive subjects, we measured:

- Systolic Blood Pressure (SBP) and Diastolique Blood Pressure (DBP) were measured with a Spengler's sphygmomanomètre ®. The heart rate was directly measured by the sphygmomanomètre at the same time as blood pressures.

The Mean Blood Pressure (MBP) was calculated according to the formula. Ed. Arnette Blackwell (Paris) 1995: MBP = (SBP + 2 DBP) / 3.

- For the evaluation of the body composition, we used an impédancemètre of mark Omron®. It is an electronic device which allows to measure at the same time the BMI, the total fat mass, the visceral fat and the basic metabolism.

Evaluation of the biological parameters

The biological parameters were measured the same day in the laboratory of biochemistry of the FMPO / UCAD of Dakar / Senegal. The takings were made at 8 am in the morning after a fat of at least 12 hours (am). Some venous blood was taken at the level of the fold of the elbow of the not dominant arm. So on fluoride tube we measured the fasting blood sugar, on heparine tube we measured transaminases (Alanine AminoTransferase: ALT and ASpartate AminoTransférase: AST), alkaline Phosphatase (ALP), Gamma glutamyltransférase (GGT), Totale Bilirubinemia, serum albumin, lipids (Cholesterol Total, HDL-Cholesterol, LDL-Cholesterol and Triglycerides) and the renal function (creatine kinase and Urea). On Dry tube we measured Créatine PhosphoKinase (CK) and various serologies HVB, HIV1 and 2. By enzymatic method, we measured the fasting blood sugar, the transaminases, ALP, the CK, the Total Cholesterol, the HDL-Cholesterol, the LDL-Cholesterol, the Triglycerides, the Urea and the Creatininemia. By chemical method, we measured Bilirubinemia and serum albumin. At the end of the recruitment we had excluded three subjects among two witnesses and a footballer because they were chronic carriers of the AgHbs.

Statistical Analyses

Data were expressed as mean ± standard deviation, percentages and relative values. Student tests were used for the comparison of means of the quantitative variables. Pearson test for correlations and linear regressions were realized to look for relations between the various variables. Analyses were realized by means of the software EPI INFO 7 software and SPSS 16. The results of the tests are considered significant when $p<0,05$.

RESULTS

Descriptive Results

We included 27 subjects all male and between 18 and 30 years old. It was about 14 foot ball players and of 13 sedentary witnesses. The mean age was 21, 50 year-old ± 1,56 for the sportsmen and 24,00 years ± 2,00 for sedentary.

Comparative Study of the clinical constants between the foot ball players and the sedentary

Table 1. Studies of the cardiovascular constants we had noticed that the heart rate (HR) was significantly lower at the foot ball players. See board 1

Variables	Football Players (N=14)	Sedentary Subjects (N=13)	p-value
SBP (mmHg)	120,36 ± 6,92	117,69 ± 9,27	0,40
DBP (mmHg)	76,79 ± 9,73	74,23 ± 5,72	0,41
MBP (mmHg)	91,31 ± 7,68	88,71 ± 5,19	0,31
HR (bpm)	70,79 ± 9,92	79,46 ± 6,65	0,01

Comparative study of the mean of the anthropometric parameters and the parameters of the body composition

Board 2: Analyze of the body composition and the anthropometric variables

We had noticed that the total fat mass as visceral fat was always higher at the sedentary subjects but the difference was not significant.

Variables	Football Players (N=14)	Sedentary Subjects (N=13)	p-value
IMC (Kg/m²)	20,88 ± 0,14	21,15 ± 1,99	0,66
Graisse visceral fat (%)	3,07 ± 0,83	3,54 ± 1,90	0,42
Total fat mass (%)	14,64 ± 4,10	16,08 ± 4,84	0,33
basic metabolism	1594,57 ± 86,82	1600,85 ±107,23	0,87

Comparison of the mean of the hepatic and muscular enzymes

We noted that the rates of the hepatic biological parameters are all higher at the foot ball players compared with the sedentary subjects. However this differences was statistically significant only for the rate of the AST (p=0,01) and ALT (p=0,04).

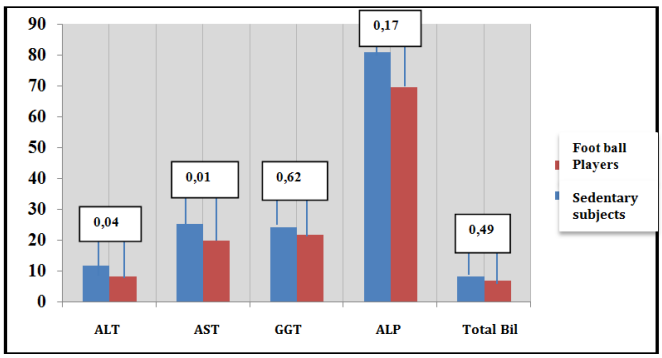

Figure 1. Comparison of the mean of the hepatic biological parameters between the foot ball players and the sedentary subjects

Comparison of the mean of the other biological parameters

The mean of the rate of the CK and the Triglycerides was significantly higher at the foot ball players (respectively p=0,02 and p=0,01). As regards the mean of the fasting blood sugar, it was significantly higher at the sedentary subjects (p=0,001). However the fasting blood sugar and the triglycerides were in the range of the normal values in both groups. On the other hand the mean rate of the CK was upper to the normal value at the foot ball players.

Variables	foot ball players (N=14)	Sedentary subjects (N=13)	p-value
Serum Albumin (g/L)	46,31 ± 3,25	45,52 ± 2,17	0,46
CK (U/L)	370,57 ± 216,89	205,15 ± 88,66	0,02
Creatininemia (mg/L)	11,06 ± 1,06	11,28 ± 1,23	0,62
Urea (g/L)	0,19 ± 0,04	0,20 ± 0,03	0,39
Total Cholesterol (g/L)	1,88 ± 0,46	1,72 ± 0,38	0,34
HDL-Cholesterol (g/L)	0,63 ± 0,15	0,53 ± 0,12	0,07
LDL-Cholestrol (g/L)	1,05 ± 0,11	1,07 ± 0,30	0,89
Triglycerides (g/L)	0,98 ± 0,52	0,57 ± 0,13	0,01
Fasting blood sugar (g/L)	0,85 ± 0,06	1,04 ± 0,16	0,001

Analize of the relations between the parameters of the physical composition transaminases and CK with the other variables studied at the foot ball players

By test of Pearson correlation, the only correlations which we noticed is:

- AST with: visceral Fat (p=0,02 and r = -0,60), ALT (p=0,027 and r=0,63), HDL (p=0,03 and r=0,56), CK (p=0,02 and r=0,59).
- fasting blood sugar with: old age (p=0,0001 and r=0,85), DBP (p=0,016 and r=0,63), MBP (p=0,02 and r=0,59), total fat mass (p=0,03 and r=0,57), Creatininemia (p=0,02 and r=0,60)

After a linear regression, we noticed that AST remains associated with ALT (p=0,005) and with CK (p=0,015). On the other hand for the fasting blood sugar, only the old age stays an influential independent factor (p=0,015).

DISCUSSION

This experimental study was led from a cohort of 27 subjects among which 14 foot ball players and 13 sedentary subjects. It shows that the mean of the BMI, the total fat mass and the visceral fat was higher at the sedentary subjects compared. However the differences were not statistically significant (respectively p=0, 66, p=0,33 p=0,42). In fact these results go to the same sense as those of Després who had already moved forward that they did not notice a significant visceral reduction of the adipose tissue during the physical activity (Després *et al*., 1991). On the other hand, Schwartz and his collaborators had found an important visceral reduction of the adipose tissue after a program of training during 6 months (Schwartz *et al*., 1991). These various reports show that the results on the impact of the physical activity on the adipose tissue are controversies. In fact it would be necessary to understand that the practice of a physical activity, which do not contain particular strategy to reduce the energy contribution by the food, do not come along generally only with a low decrease of the weight (Ballor *et al*., 1991). The rates of transaminases as well as CK were significantly higher at the foot ball players compared with the sedentary subjects. In fact the mean rate of the ALT was 11.60 ± 5.03 U/L at the foot ball players against 8.08 U/L ± 3.12 at the sedentary subjects with p=0,04. At the same time the mean rate of the AST was 25.11 U/L ± 6.21 at the foot ball players and of 19.79 U/L ± 3.62 at the sedendary subjects with p=0,01. Our results so show a high rate of the ALT and especially the AST at the foot ball players compared with the sedentary subjects. These results confirm the data of the literature because studies already showed that the physical exercise moderate and steady pulled a hepatic cytolyse with liberations of transaminases (Berthélémy, 2014) and consequently an increase of the blood rate of the hepatic enzymes (Berthélémy, 2014). Authors brought back that the increase observed in the blood of these enzymes would be an answer to the physical exercise (Yi-Shin Huang, 2016). Besides, an important increase of transaminases at the healthy sportsman was reported (Watelet and Bronowicki, 2005). The experimental models realized to the rat showed that there was an important suffering of the hepatic cells at the end of the steady efforts but without consequences on the hepatic function (Kinoshita *et al*., 2003). In fact the physiopathological mechanisms at the origin of the lyse of hépatocytes at the sportsmen are complex because entangled some in the others and bring in numerous personal parameters and / or environmental. Nevertheless, certain clearly identified factors come into play but the decrease of the Mesenteric blood flow mésentérique is considered as the determining factor of these appearances (Bronstein *et al*., 2005). As had shown it initially the works of Clausen (Clausen, 1977), the physical effort pulls an increase of the nice activity and a decrease of the parasympathetic activity. The stimulation of the receivers alpha-adrénergiques by increase of the nice activity Leads to a splanchnic vasoconstruction splanchnique vasoconstriction. There is then a redistribution of flows favoring the muscular territories in service in depend, in particular, on digestive organs. This phenomenon is more collectively known under the name of "vascular flight". So, the splanchnic blood flow debit can pass of 25 % of the cardiac output in the physiological state and in the rest in 3 % in the effort (Clausen, 1977). The intensity of the made exercise will determine the importance of the reduction of the splanchnique debit (Clausen, 1977). During a physical exercise the reduction in the splanchnic blood flow debit engenders a decrease of the hepatic debit. The decrease of the hepatic blood volume varied from 14 % to 18 % (Flamm *et al*., 1990); what made the organ the most saved on the vascular plan of the abdominal cavity. Consequently, during the sport, the liver could lose quickly until 15 % of its volume, essentially by dehydration dehydration of liver cells (Latour *et al*., 1999). The latter would be at the origin of a hepatic cells lyse with liberation of the hepatic enzymes in the blood.

At the same time, we had also found that the mean rate of the CK was significantly more important at the foot ball players. In fact there were 370,57 U/L ± 57,97 at the foot ball players against 205,15 U/L ± 24,31 to sedentary subject (p=0,02). These results show us the parallel existence of alyse of muscle cells during the sport. Several studies brought back a simultaneous increase of the CK and the transaminases especially the AST during the exercises of endurance (Wu *et al*., 2004; Smith *et al*., 2004). Because of their dominant localizations at the cardiac, renal and muscular level, ALT and especially the AST can be respectively increased until 10 % (Metivier and Gauthier, 1985) to see 300 % (Boudou *et al*., 1987) of the normal values in the consequences of a steady effort. Moreover, authors generally reported that the rise of the rate of transaminases after a physical exercise is for the greater part of muscular origin and that only a small party is of hepatic origin (Wu *et al*., 2004; Pettersson *et al*., 2007). The concomitant rise of the muscular enzymes (CK) associated on the way back with the normal of the blood rates in the days following the stop of the effort will confirm this hypothesis (Watelet and Bigard, 2005). In fact these high rates of transaminases and CK could relate to a small rhabdomyolyse led by a cellular necrosis of the scrawny muscles without clinical or renal echo. Their rate will be correlated in the intensity of the effort and in the degree of training of the subject (Watelet and Bigard, 2005). So in this study, we could say that the elevation of transaminases especially AST is at the same time of hepatic and muscular origin. Besides our results after the tests of linear regression could confirm this hypothesis by showing that only ALT and CPK is independently influential on the rate of the AST. We had not made a dosage of the haemoglobin to our subjects. However an anaemia is often reported at sportsman's training in a regular way. Various mechanisms were proposed among which one a hémolyse continuation in the destruction of red blood cells by shock plantaire repeated to the contact of the ground for the runners but also a hémolyse by reduction in the Plasma pH (Jordan *et al*., 1998). Yet we know that the concentration of the AST and in lesser measure that of the ALT is bigger in red blood cells. So a hémolyse will also have as consequence an increase plasma increase of these enzymes (Berthélémy, 2014). It is thus important to include that the intensive daily sport can pull an increase of the rate of the hepatic enzymes. Then before incriminating a hepatic étiologie, it will be necessary to look at first for a notion of regular physical activity, to eliminate also a muscular origin. We noticed that our foot ball players had in the rest a lower mean of HR compared with that of witnesses. In fact after only a few weeks of training, the contents of the heart it adrenalin and noradrénaline, which are nice substances which accelerate the HR, decrease in 30 % in the rest. The sport also increases the quantity of the acétylcholine (Strauzenberg, 1982). The resultant of these modifications entraine the decrease of the HR.

Conclusion

We allowed us to highlight an important rise of transaminases as well as CP at the follower of regular and steady sport. Then before incriminating formally a hepatic etiology in front of an infra-clinical rise of transaminases. It would be necessary to eliminate a muscular origin by a dosage of muscular enzymes as the CK. Besides at the sportsman would be needed a control after at least one-two weeks of strict rest to eliminate at first an effect of the sport on the profile of the hepatic enzymes before retaining a pathological origin.

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