ORIGINAL ARTICLE

ENERGY EXPENDITURE IN DAILY PHYSICAL ACTIVITIES IN CONGOLESE MIDDLE SCHOOL CHILDREN

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| Received 27 July 2018 | | Accepted 11 August 2018 | | Published 21 August 2018 | | ID Article | Massamba-ManuscriptRef.5-ajira010818 |

ABSTRACT

Context: No studies in sub-Saharan Black Africa notably in Congo have studied the energy expenditure associated with the physical activity in school adolescent. **Aim**: This study aimed to evaluate the daily energy expenditure associated with the physical activities of the adolescent schooled in Brazzaville-Congo. **Method:** the cross-sectional survey included 5520 middle school students, aged 12 to 16 years old. Any healthy, non-smoker and non-alcoholic pupil, free of metabolic symptoms and pathologies, of heart disease, which has participated in the physical education course and has lived in Brazzaville for at least one year, was eligible and included in the study according to age. Daily energy expenditure (in kJ / kg / day) was calculated from three different ways: scolar time, scolar leaves weather, leisure time, from the QAPACE questionnaire. **Results:** in the 190 days of schooling, ie 1330 hours (7 hours / week), an average of 1027 hours (77.2%) during the school year and 12.7 hours (76.2%) during the holiday period corresponded to fixed activities and only 22.8% and 23.8% of the variability in physical activity during the periods considered. During the school year, mean value of daily energy expenditure was 156.45 ± 32.74 kJ / kg / day for boys versus 142.14 ± 13.1kJ / kg / day for girls. During school holidays, it was around 187.59 ± 11.31 kJ / kg / day for boys 170.32 ± 9.24 kJ / kg / day for girls. In all cases, the differences observed between boys and girls were all significant, regardless of school periods ($p = 0.031$), school holidays ($p = 0.027$) and leisure time ($p = 0.023$). **Conclusion:** We conclude that the average Daily Energy Expenditure (DEE) is significantly higher during the period of school holidays than during the school period. In addition, we observe that the average DEE begins to gradually drop from 14 years.

Keywords: *Daily energy expenditure, Physical activities, School holidays, Leisure, Middle school*

1. INTRODUCTION

Physical activity, in the broad sense, includes all movements in daily life and is not limited to sport. The practice of regular and sustained physical activity is well known as an effective means of preventing and controlling a number of chronic diseases (eg, overweight / obesity, metabolic syndrome, type 2 diabetes, depression) [1,2]. Strongly, the generalization of sedentary habits and the decline in physical activity stretch to become the prerogative of school-aged children, not only in post-industrial societies but also in emerging countries and even developing countries. The United States Department of Health thus discusses physical inactivity as one of the major public health challenges of the 21st century and addresses the struggle against physical inactivity and the promotion of physical activity one of its priorities [3]. This public health objective is currently being promoted in several countries, particularly with regard to children, with the aim of forging active behaviors likely to persist into adulthood [4,5]. In France, the fight against physical inactivity and physical inactivity is now one of the 100 health objectives defined by the Public Health Act of August 2004 (Law No. 2004-806, 2004). In addition, an ambitious and unprecedented program in the European Union (EU) - the National Program for Health Nutrition (PNNS) launched in 2001 for the period 2001-2005 and then renewed for the period 2006-2010 - has made room for the promotion of physical activity among the nine objectives it pursues [6].

In Congo-Brazzaville, a country in Central Africa straddling Ecuador, the traditional approach to health care (which focused on medical care) over the past decades has been modified in a new conceptual framework: maintaining healthy individuals and their communities through healthy lifestyles. Moreover, according to the U.S. Department of Health [4], the fundamental pillars of good health are physical exercise, balanced nutrition and healthy lifestyles. It is currently well argued that well-conducted physical and sports activities are excellent preventive tools against the

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development of coronary heart disease [5], depressions [4], and delayed mortality [7]. Conversely, habitual persistence such as smoking, alcoholism and physical inactivity in adults is a risk factor in the development of certain degenerative diseases. Concerning Congolese children, studies by Mabiala Babela et al in Brazzaville report a high prevalence of alcohol consumption among adolescents [8], and on the other hand that of smoking [9]. Moreover, energy intakes in food consumption are insufficient within households [10].

Similarly, the prevalence of obesity continues to increase from 1.9% in 1963 to 8.1% in 2003 [11]. This increase appears to be related to the poor lifestyle and the increasing poverty of Congolese social groups, with Congo in 2011 ranked 136th in the world in human development with a human development index equal to 1.116 [12].

Children who are physically active stretch to have lower blood pressure levels and a more balanced blood lipid profile than inactive children [13]. Physical activity allows sedentary and obese children to reduce their fat mass [14,15]. In addition, the literature reports that the decrease in risk factors during childhood, through physical activity (PA) in many chronic non-communicable diseases, may persist in adult life [4]. Physical activity and fitness are therefore important to health. For example, the current physical activity guidelines for schoolchildren aged 5-16 years are to encourage 60 minutes per day to several hours of physical activity or structured activity [16].

To our knowledge, there are currently no studies in sub-Saharan Black Africa, notably in Congo, on the energy expenditure associated with the physical activity of the adolescent in school. In view of this observation, we have proposed to carry out this research with the aim of resolving these preventive health problems. The aim is to quantify the daily energy expenditure (DEE) of the Congolese middle schoolchildren aged 12 to 16 years old, through the many physical activities practiced at school, at home, in the neighborhood and on the school-to-school route.

2. MATERIALS AND METHODS

2.1 Workgroup

This epidemiological, cross-sectional, descriptive and analytical study consisted on a survey carried out on a sample of the population of adolescents in school in the city of Brazzaville. The study was conducted from 15 November 2016 to 15 June 2017. The study was carried out in different communes and districts, chosen in advance taking into account their geographical situation (peripheral zone, entirely urban area) and density of their population. Five out of the nine (9) municipalities in the agglomeration of Brazzaville were selected.

2.2 Sampling

Sampling was calculated on the basis of a population limited to 56 middle school (private and public) in these municipalities of Brazzaville. The population represented 616,477 pupils from the socio-economic strata of these municipalities that make up the city and data statistics of the various sectorial inspections of secondary education. Figure 1 summarizes the process of selecting schools in accordance with recognized recommendations for conducting epidemiological studies.

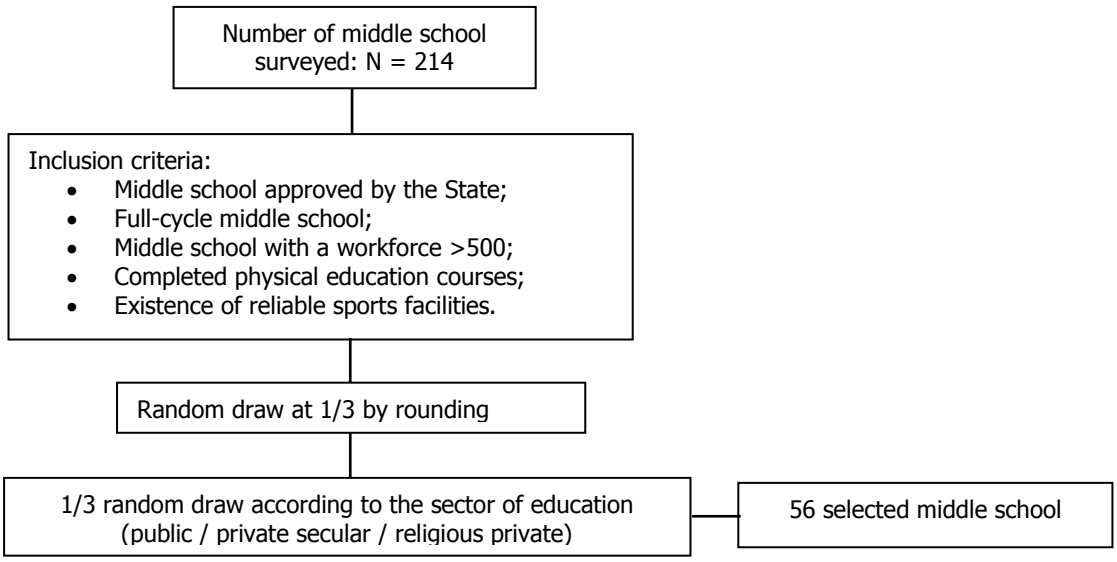

Figure 1: The figure presents the middle school selection chart.

Any healthy, non-smoker and non-alcoholic pupil, free of metabolic symptoms and pathologies, of heart disease, which has participated in the physical education course and has lived in Brazzaville for at least one year, was eligible and included in the study according to age (12 to 16 years). The oral consent of the children and written parents, the written agreements of the chief inspectors of the school district and the Ethics Committee of the Medical Society of

Congo, compliance with the recommendations of Helsinki II constituted a prerequisite. In total, the selected population of pupils aged 12-16 years was 9307. However, the presentation of a hematological pathology during the investigation and a pregnancy state of the girls constituted a criterion of exclusion.

In each middle school, a 1: 3 draw was made at the grade level to retain the grades per grade (6th, 5th, 4th, and 3rd). At the end of this process, the population was reduced to 6135 pupils. The sample size was calculated from the formula [17]:

$$n = \frac{Nb^2\sigma^2}{(N-1)\,e^2+b^2\sigma^2} \qquad (1)$$

Where,
N: is the total population of students between 12 and 16 years of age,
E: is the estimation error,
b: is the 95% probability threshold value,
σ : is the standard deviation.

In our case, we have: N = 6135; e = 2.43; b = 196; σ = 91.97.

Replacing these values in the previous equation gives the following sample size: n = 5520. The distribution of subjects of both sexes according to age is reported in Table 1. This study, which received the approval of the Ethics Committee of the General Delegation of Scientific and Technical Research, Medical Committee, met the criteria of Helsinki II.

Table 1: The table presents the number and percentage of subjects by age.

Age (years)	Total sample studied	Boys sub-sample sample (n=%)	Girls sub-sample n=(%)
12	1002 (18.2)	510 (50.9)	492 (49.1)
13	1290 (23.4)	672 (52.1)	618(47.9)
14	1056 (19.1)	510 (48.3)	517 (51.7)
15	1104 (20.0)	576 (52.2)	528 (4.8)
16	1068 19.3)	486 (49.9)	582 (50.1)
Total	5520 (100)	2754 (49.9)	2766 (50.1)

Their anthropometric characteristics are shown in Table 2.

Table 2: the table presents the anthropometric characteristics of subjects.

Variables	Boys (n=2754)	Girls (n=2766)	P
Age (years)	14.1±1.3	13.8±1.1	0.082
Weight (kg)	50.3±6.5	48.1±5.3	0.074
Height (cm)	157.5±3.8	155.0±4.5	0.079
BMI (kg/m^2)	20.4±0.4	20.0±0.3	0.101
PBM (%)	16.2±3.7	20.5±4.1	0.038
LBM (kg)	42.2±3.1	38.2±1.7	0.032

BMI: body mass index; **TPMG**: Tolal % of mass grass; **LBM**: Lean body mass.

2.3 Variables studied

They were summarized:

1- To the dependent variable: the average Daily Energy Expenditure (DEE) in kJ / kg / day over the study period.
2- To the independent variables: 1) the chronological age of the pupil between 12 and 16 years of age; 2) the student's gender: male or female; (3) the socio-economic level of the parents or guardians.

The classification of socio-economic level (SEL) was based on the 6 strata officially determined by the National Center for Statistics and Economic Studies of Congo (2016) [18]. By combining them, three levels have been created:

3- SEL 1: strata 1 and 2
4- SEL 2: strata 3 and 4
5- SEL 3: strata 5 and 6

The anthropometric variables were body weight (P) in kg, height (T) in cm, body mass index in kg / m^2 (BMI = P / T^2), and the lean mass (Mm, in kg). The body weight (or body mass) of students was determined, subjects wearing light clothing, on a calibrated scale (Seca Digital Floor Scale-Model 7700, precision: 100g by default). The size was measured using a measuring rod with an accuracy of 0.1 cm, with the head in the Frankfürt position and the soil taken to the vertex. To calculate lean mass, the Tolal % of mass grass (TPMG) was first calculated from the Slaughter

and al., (1988) [19], adapted to children. For these purposes, the mean of two measurements of tricipital skinfolds (TRI) and subscapular (SS) skinfolds was performed using a Harpenden type adipometer. Thus, the PCTG was evaluated by the formula:

$$TPMG\ (\%) = 1.33\ (TRI + SS) - 0.013\ (TRI + SS)^2 - 2.5 \quad (2)$$

Where,

TPMG: Tolal % of mass grass;
TRI: Tricipital Skinfolds,
SS: Subscapular Skinfolds,

If the sum of the two skinfolds is greater than 35 mm, the following equations have been applied:

For boys: $TPMG\ (in\ \%) = 0.783\ (TRI + SS) + 1.6$ (3)

For girls: $TPMG\ (in\ \%) = 0.546\ (TRI + SS) + 9.7.$ (4)

The lean body mass (Mm) was then estimated from the relationship:

$$Mm\ (kg) = P - [(P \times TPMG)] / 100 \quad (5)$$

Where,
P: weight,

The quantification of physical activity in children was first recorded in the day using the QAPACE (Questionnaire de l'Activité Physique chez les Enfants Colombiens) questionnaire by Barbosa and al., (2007) [20]. This questionnaire consists of 18 questions divided into 13 categories of daily physical activity, covering the study period (Table 3).
The mean DEE was then calculated from the student's physical activity (PA) collection by type of activity, duration (hours), frequency (number of times / week), and reported energy equations such as 'they appear in the compendium of Ainswork and al., (2000) [21] and according to the formula [21]:

$$TDEE = \left\{ \left[\frac{f_{ps}(i) \times d_{ps}(i) \times 280 + f_{Pc}(i) \times d_{pc}}{180} \right] \right\} \quad (5)$$

Where,

TDEE: total daily energy expenditure,
$\mathbf{f_{ps}}$: frequency of physical activity during school time,
$\mathbf{d_{ps}(i)}$: average duration of physical activity during the school year,

The sum covers all possible activities i (i varying from 1 to 13). For each activity i (i = 1 to 13), f (i) corresponds to its daily frequency, d (i) to its average duration and m (i) to its intensity as a function of the compendium, pc at the time of the holiday (or vacation).

Table 3: the table presents the categories of physical activity with their corresponding elements in the QAPACE.

Category	Questions	Description
1	1	Sleep
2	2, 3	Washing, dressing and undressing
3	4, 5, 6	Meal
4	7, 8	Transportation (on foot, by car, motorcycle, bicycle, school transport)
5	9, 10	Class (sitting in class, class work at home, etc.)
6	11	Physical Education
7	12	Other activities at school: artistic, agropastoral and sports
8	13	Excluding school activities: diverse sports and leisure activities (agropastoral and office work, watching television, video games, listening to music, reading, leisure sports activities, etc.)
9	14	Religious activities
10	15	As item 8, but during school holidays
11	16	Artistic or agropastoral activities not associated with the school
12	17	Sports competition and training
13	18	Activities at home: sweeping, wiping, cleaning, washing, laundry, ironing, cooking, babysitting, etc.

Concerning data processing and analysis, the central trend indices of the descriptive statistics were calculated. The parameters of interest concerned were the total daily energy expenditure (expressed in kJ / kg / day) for school and holiday periods respectively, then overall and anthropometric data (chronological age, weight, height). Quantitative values are presented as an arithmetic mean ± standard deviation. To facilitate calculations and conversion of the physical activities identified by the quantified energy expenditure questionnaire from the compendium, Visual Fox Pro 6.0 software was required, in which the QAPACE database was integrated.

Energy expenditure was calculated from three different ways: scolar time (180 days according to the official docket of ministry of the education), scolar leaves weather (Christmas and Passover, it is 25 days), leisure time.

A subject of which daily energy expenditure (expressed in kJ / kg / day) was located to over 50th percentile is defined as physically active according to study of Barboza and al. In same, the inactive children were divided to higher inactive (energy expenditure lower than percentile 25) and moderate inactive (with energy expenditure comprise between percentile 25 and percentile 50).

Student's t-test allowed us to compare two arithmetic means of independent samples. According to more than 2 means, an analysis of variance (ANOVA) with one way and several factors was used through the F test. When significance was obtained for ANOVA, the most significant level was determined from the Dunn-Bonferroni post-hoc test.

The dependent variables (to be explained) studied were: height, weight, leisure time expressed in hours per day, DEE (kJ / kg / day) [during the school period (DEE-SP) (DEE-LT) and school holiday periods (DEE-HP), as well as the average energy expenditure over the period studied (DEE-PS). Independent (explanatory) variables were: gender (boy vs. girl), age and socio-economic status SEL.

2.4 Statistical Analysis

Statistical analyzes were carried out with the SPSS^{TM} software, version 23.0 (IBM), in the Laboratory of Numerical Analysis and Applied Computer Science (LANIA) of the Faculty of Sciences and Technology, Marien NGOUABI University. Statistical significance of all tests was accepted as $p<0.05$.

3. RESULTS

3.1 Physical activity inventories and variability of daily energy expenditure

The average durations of the main physical activities identified are shown in table 4 in which categories 1-3, 9, 11-13 correspond to fairly stable activities throughout the study period, whereas categories 4-7 and 8 correspond to stable activities only during the school period. In the 190 days of schooling, ie 1330 hours (7 hours / week), an average of 1027 hours (77.2%) during the school year and 12.7 hours (76.2%) during the holiday period corresponded to fixed activities and only 22.8% and 23.8% of the variability in physical activity during the periods considered. The time spent in front of television varied between 3 hours and 4 hours during the school days, and bordered 5 hours in period of school holidays.

Table 4: the table presents different categories of physical activity for one week depending on the period.

Category	Questions	Description	School period (hours / week)	Period of school holidays (hours / week)
1	1	Sleep	7.4	6.8
2	2, 3	Toilet, clothing and undress	1.8	2.1
3	4, 5, 6	Meal	2.6	3.0
4	7, 8	Transport (on foot, by car, moped)	4.2	6.3
5	9, 10	Class (sitting in class, class work at home, etc.)	42.7	Unspecified
6	11	Physical education	2.0	Unspecified
7	12	Other activities at school (running, traditional games for girls, mini football)	1.5	Unspecified
8	13	Watching television, video games, listening to music, reading, recreational sports activities, etc.	24.3	47.1
9	14	Religious activities	1.5	1.5
10	15	As item 8, but during holidays	32.4	35.7
11	16	Agropastoral and socio-economic activities not associated with school	6.3	16.3
12	17	Sports competition	Unspecified	10.4
13	18	Activities at home: sweeping, wiping, cleaning, washing, laundry,	1.7	3.9

ironing, cooking, babysitting, etc.

3.2 Global data

During the school year, mean TDEE was 156.45 ± 32.74 kJ / kg / day for boys versus 142.14 ± 13.1kJ / kg / day for girls. During school holidays, it was around 187.59 ± 11.31 kJ / kg / day for boys 170.32 ± 9.24 kJ / kg / day for girls. On the other hand, the total energy expenditure related to leisure reached 60.12 ± 15.22 kJ / kg / day for boys against 48.04 ± 08.16 kJ / kg / day, for a leisure time of 7.17 ± 15.22 kJ / kg / day respectively. h / day for boys and 4.98 h / day for girls. In all cases, the differences observed between boys and girls were all significant, regardless of school periods (p = 0.031), school holidays (p = 0.027) and leisure time (p = 0.023) (table 5).

Table 5: the table presents the average daily energy expenditure (in kJ / kg / day) of subjects by gender.

Variables	Boys (n=2754)	Girls (n=2766)	P
DEE-SP	156.45±32.74	142.14±13,20	0.031
DEE-SH	187.50±11.31	170.32±9.24	0.027
DEE-LP	60.12±15.22	48.04±8.16	0.023
TDEE mean	134.69±19.76	120.43±10.20	0.028

DEE-SP: daily energy expenditure during the school period; **DEE-SH**: daily energy expenditure during school holidays; **DEE:-LP**: daily energy expenditure during leisure periods.

The weighted values of DEE for school and cumulated leave periods were 161.98 ± 16.25 kJ / kg / day for boys versus 142.16 ± 10.13 kJ / kg / day for girls. On the other hand, the calculation of the DEE, both in absolute and relative values, revealed significant differences in favor of boys, after adjusting for total weight and lean mass.
Compared to the "age" effect (Figure 1), the DEE in kJ / kg / day during the school years did not differ significantly in favor of boys until the age of 14, particularly at 16 years old (p<0,001).

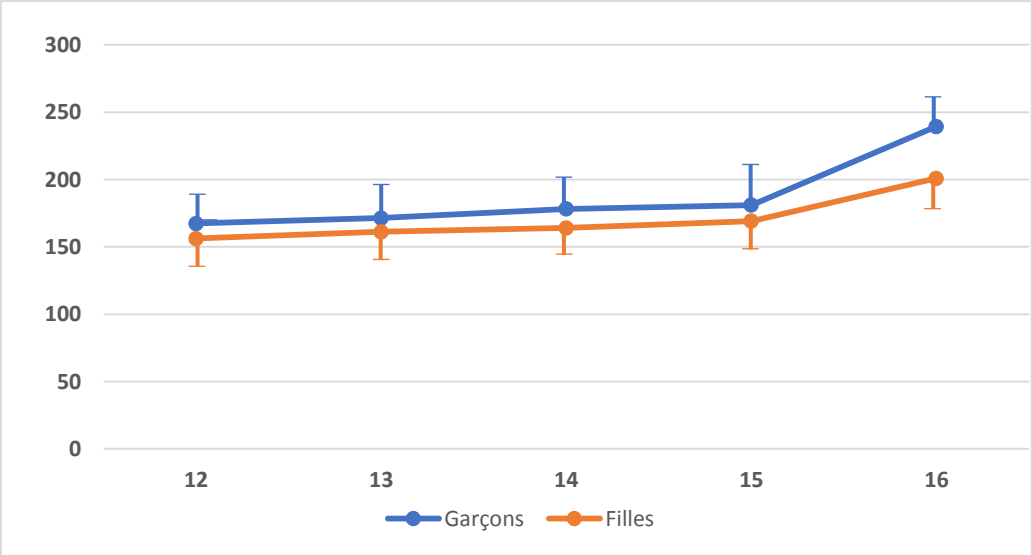

Figure 1: The figure presents the evolution of total daily energy expenditure (in kJ / kg / day) by age.

In addition, the values of the DEE in kJ / kg / day, reported at the socioeconomic level and at the gender level (Figure 2), were significantly higher among the boys in the first group (SEL 5-6: highest level), and second group (SEL 3-4) [respectively: p=0.036 and p=0.043] compared to girls in the same group.

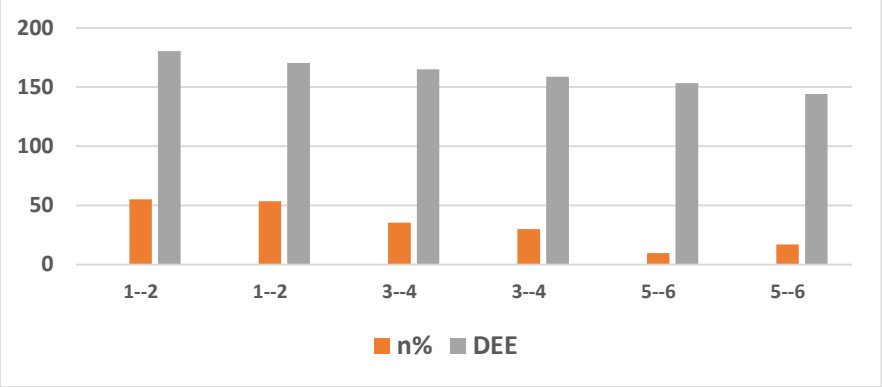

Figure 2: The figure presents the evolution of the daily energy expenditure by socio-economic level.

Finally, the daily energy expenditure (DEE) study in relation to lean mass and age reveals that there was a higher energy expenditure (75th percentile, 90th percentile, 97th percentile) in boys over 14 years of age compared to girls, especially at 16 years old. These boys who lived in the outlying districts of Brazzaville, practiced during the leisure time the agropastoral work (market gardening in particular). In addition, from disadvantaged social strata they carried out small trades such as rock stones in the quarries located along the Congo River, the filling of sand transport trucks. Moreover, they constituted mainly the group of physically very active students.

4. DISCUSSION

The aim of this study was to identify the daily physical activities carried out by schoolchildren in Brazzaville (Congo) and to evaluate the total energy expenditure during school periods, school holidays and during leisure time during the period study. The main results obtained show that mean DEE was 156.45 ± 32.74 kJ / kg / day for boys versus 142.14 ± 13.1kJ / kg / day for girls. During school holidays, it was around 187.59 ± 11.31 kJ / kg / day for boys 170.32 ± 9.24 kJ / kg / day for girls. On the other hand, the total energy expenditure related to leisure reached 60.12 ± 15.22 kJ / kg / day for boys against 48.04 ± 08.16 kJ / kg / day, for a leisure time of 7.17 h / day for boys and 4.98 h / day for girls. Physically active children were found in middle school located in outlying neighborhoods. Their energy expenditure was higher, between the 75th percentile and the 97th percentile. This observation parallels that of Verschuul and Kemper (1985), conducted on 12.5 to 17.5 year olds in which DEE in boys since 12 - 13 years is 9.1 MM / day to reach 12.2 MJ / day at 17.5 years, knowing that 4.184 kJ/hour = 1kcal/kg/hour [22]. Moreover, according to the approach of the state of activity and sedentarity by Harrel et al., (2005), a young person considers himself "active" when in his free time he devotes to rigorous physical activity 3 hours or more per week [23]. Similarly, the Canadian Fitness and Lifestyle Institute (CBCRI) classify a subject as vigorously "active" when he or she spends at least 8 kcal/kg/hour (33.5 kJ/hour) [24].

The low energy expenditure of the subjects studied is mainly found in children whose parents have a monthly income classifying them in high socio-economic levels (SEL 5-6). In fact, the daily consumption of food among the latter is characterized by poor eating habits resulting in overconsumption of dairy products and red meat. In the latter case, Bauchart et al., (2010) in a study investigating the effects on meat lipids and fatty acids of extruded linseed (high in n-3 polyunsaturated fatty acids) alone or with extruded rapeseed (high in n-6 and n-3 and 18: 1n-9 polyunsaturated fatty acids) in association or not with antioxidants in dairy cows, report that increased uptake of polyunsaturated fatty acids-3 by cattle with flax diet would stimulate lipoperoxidation in his entire body, altering the health of meats for the consumer [25]. In view of the absence of a food quality control agency in our country and of meat processing industries, it is reasonable to assume that there are certain risks of lipoperoxidation of imported meat consumed by the consumer Congolese people.

Added to this is a high consumption of lipids (source of saturated fatty acids). However, excessive consumption of lipids, especially saturated fatty acids, has a negative impact on the health of the growing child, particularly by promoting the development of obesity. This fact was noted by Mabiala et al., (2004) in a previous study, authors who noted in four decades an increase of over 6, 2% in the prevalence of obesity in schools in Brazzaville [11]. Moreover, Massiera et al., (2003) advocate limiting daily consumption of lipids (visible and hidden fats) to 30-35% of total energy intake, reducing the intake of saturated fatty acids and rebalancing fatty acid intake to polyunsaturated n-6 and n-3 [26].

These caloric contributions, associated with a high prevalence of sitting activities (watching television, high attendance of cybercafés, weakness of sports practice, transport by vehicle, etc.), contributes to exceed contributions for children in this age range (3500 kcal / day). Moreover, these children attend in most cases private schools whose monthly school fees exceed 50$ US. But current data show an ever-increasing poverty of households, characterized

by more than 5 months of unpaid wages in most state and parastatal structures. Already in 2006, Mbemba et al., (2006) found in the Congolese schoolboy low daily energy intake, value 1948.9 ± 448kcal [27]. These absolute intakes, all ages, were distributed as follows: 15.4% for breakfast; 26.6% for lunch; 42.5% for dinner; 15.5% for nibbling. Students from disadvantaged backgrounds (SEL between 1 and 3) are characterized by the lack of taste, the lack of breakfast in 13.1% of children and lunch in 10.7% of them.
In the QAPACE study, mean DEE (all ages) was 170.41 ± 39.92 kJ / kg / day for boys in Chile and 165.64 ± 34.26kJ / kg / day for girls. These values are lower than ours: 134.69 ± 19.76 kJ / kg / day for Congolese boys versus 120.43 ± 10.20 kJ / kg / day for our daughters. These differences are attributable to the quality of food and socio-economic development.

Statistically, energy expenditure among our daughters showed significant differences except for the under-14 age group where boys had a significantly higher average energy expenditure ($p = 0.027$) than girls. Graphically, there were significant differences from those of boys. These results coincide with those of Verschur (1985) in which the change in the average energy expenditure of girls and boys aged 14 to 17 follows approximately the same pattern as that observed in our study, with the difference to that in our population the expenditure of energy exceeds that of girls from the age of 14 [22].

As for the DEE, compared to the lean mass of the subjects, it expresses significant differences ($p < 0.05$) only for the ages of 15 and 16, and those in favor of the boys. These findings are consistent with the Amsterdam Growth Study in adolescents from Van Mechelmen et al., in 1995 who report that after the age of [11], energy expenditure begins to decline [28]. These results are indicative of the gradual abandonment of physical activity by girls. It is known that 25% of girls between the ages of 14 and 19 will be active in adulthood compared to only 2% of inactive subjects during youth [24]. Consequently, among the girls studied, the level of physical activity would undoubtedly be likely to favor the development of chronic pathologies in adulthood. Indeed, the relationship between the amount of physical activity (the "dose") and its consequences on health is a major aspect of the discussion of the effects of physical activity on health.

Other studies [29] evaluating DEE physical activity by age from childhood to adolescence to analyze differences between children and adolescents have shown that post-puberty (14-16) induces biological changes while respecting sexual development as described by Tanner (1962) [30]. In short, the benefits of physical activity under health are well argued, especially in situations as diverse as heart disease and mental health.

Nevertheless, limitations can be observed in our study at the physical activity level of children. Indeed, it would be relevant to use other measuring tools of the DEE such as indirect calorimetry, the use of pedometers or accelerometers. However, the expensive cost of these devices and their implementation have helped to limit the reliable and adequate approach of the adopted method.

5. CONCLUSION

Our study, which corresponds to an analytical epidemiological survey, from the QAPACE questionnaire, shows the DEE is significantly higher during the period of school holidays than during the school period. In addition, we observe that the average daily energy expenditure begins to gradually drop from 14 years. However, in relation to lean mass, the DEE (kJ / kg lean / day) continues to increase in boys up to the age of 16 unlike girls. Despite the limitations observed, the data obtained is a source that can be used and available for a powerful multifactorial statistical treatment that optimally analyzes the influence of the factors that may influence the daily energy expenditure of our school subjects.

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Abbreviations liste:

QAPACE: Questionnaire de l'Activité Physique chez les Enfants Colombiens,
DEE: Daily Energy Expenditure,
EU: European Union,
PA: Physical activity,
BMI: Body Mass Index,
LBM: Lean Body Mass,
SEL: Socio-Economic Level,
P: Body Weight,
T: Height,
TRI: Tricipital Skinfolds,
SS: Subscapular Skinfolds,
TPMG: Tolal % of Mass Grass,
Mm: Lean Body Mass,
TDEE: Total Daily Energy Expenditure,
$\mathbf{f_{ps}}$: Frequency of Physical Activity During School Time,
$\mathbf{d_{ps}}$(i): Average Duration of Physical Activity During The School Year,
ANOVA: Analysis of Variance,
DEE-SP: Daily Energy Expenditure during the school period,
DEE-HP: Daily Energy Expenditure School Holiday Periods,
DEE-PS: Daily Energy Expenditure over the period studied,
LANIA: Laboratory of Numerical Analysis and Applied Computer Science,
DEE-LP: Daily Energy Expenditure During Leisure Periods,
CBCRI: Canadian Fitness And Lifestyle Institute.

Annex:

Questionnaire used to assess physical activity in children and adolescents (QAPACE):

	School period	Period of holidays	Leisure time
1. How many hours do you sleep each day? - Less than 6 hours - 6-7 hours - 8 hours and more	○ ○ ○	○ ○ ○	○ ○ ○
2. How long do you have to wash or wash (morning, evening)? - 10 minutes - 30 minutes - 45 minutes - 1 hour - 2 hours	○ ○ ○ ○ ○	○ ○ ○ ○ ○	○ ○ ○ ○ ○
3. How long do you put to undress? - 5 minutes - 10 minutes How long do you have to get dressed? - 5 minutes - 10 minutes	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○
4. How long do you eat at breakfast? - Less than 15 minutes - 15 to 30 minutes - More than 30 minutes	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○
5. How long do you have lunch? - Less than 15 minutes - 15-30 minutes - More than 30 minutes	○ ○ ○	○ ○ ○	○ ○ ○
6. How long do you put in the evening meal? - Less than 15 minutes - 15-30 minutes - More than 30 minutes	○ ○ ○	○ ○ ○	○ ○ ○
7. During school time, I'm traveling - walk - by car - by bike - on a motorcycle	○ ○ ○ ○		
8. During leisure, I make my travels - walk - by car - by bike - on a motorcycle		○ ○ ○ ○	○ ○ ○ ○
9. In class, I sit - Very often Yes ○ No ○ - Mandatory Yes ○ No ○			
10. In class I am standing - On the board Yes ○ No ○ - At break Yes ○ No ○			
11. In high school, I participate in EPS Yes ○ No ○ I practice physical activity with an intensity: - Light weight ○ - Moderate ○ - Average ○ - Intense ○			
12. In secondary school, the other activities practiced are: - Artistic ○ - Agro-pastoral ○ - Sports ○ Their duration is: - 30 minutes ○ - 45 minutes ○			

And the frequency of: - once a week ○ - 2 times / week ○			
13. I practice recreational activities outside of school? Yes ○ No ○ Which ones? The weekly frequency of these activities is - once a week ○ - 2 times / week ○ - 3 times / week ○ - ≥ 4 times / week ○ The duration of the activity is: - 30 minutes ○ - 1 hour ○ - 2 hours ○ During my free time, I watch television: - often ○ - Very often ○ I play video games: - often ○ - Very often ○ I am listening to music: - often ○ - Very often ○			
14. Outside of school I participate in religious activities: Yes ○ No ○ The duration of these activities is: - 1 hour ○ - 2 hours ○ The frequency is: - once a week ○ - 2 times / week ○ - 3 times / week ○ - More than 3 times / week ○			
15. During school time I travel - Walk ○ - By car ○ - By bike ○ - A motorcycle ○			
16. Outside of the middle school, do I practice non-school-related personal arts activities? Yes ○ No ○ The weekly frequency is: - once a week ○ - 2 times / week ○ - 3 weeks / week ○ - More than 3 times / week ○ Outside the middle school, I practice agropastoral activities, Yes ○ No ○ which ones? The weekly frequency is: - once a week ○ - 2 times / week ○ - 3 weeks / week ○ - More than 3 times / week ○			
17. During leisure, I practice competitive sport. Yes ○ No ○ Which? The weekly frequency is: - once a week ○ - 2 times / week ○ - 3 times / week ○ - More than 3 times / week ○ The duration of a session is: - 1 hour ○ - 2 hours ○			

18. At home, I work on: - Sweeping the house and / or the court ○ - Wiping ○ - Cleaning ○ - Washing ○ - Cleaning ○ - Ironing ○ - Cooking ○ - Babysitting ○ If there are others, which ones?			

Cite this article: Mabassa David Sylvain, Massamba Elvina Lys Surêche , Itoua Okemba Jean, Moulongo Jean Georges André, Makosso-Vheiye Georges, Massamba Cola Steven Ismael, Mabiala Babela Jean Robert, and Massamba Alphonse. ENERGY EXPENDITURE IN DAILY PHYSICAL ACTIVITIES IN CONGOLESE COLLEGIANS. *Am. J. Innov. Res. Appl. Sci.* 2018; 7(2): 97-108.