International Journal of Food Science and Nutrition
ISSN: 2455-4898; Impact Factor: RJIF 5.14
Received: 03-02-2019; Accepted: 06-03-2019
www.foodsciencejournal.com
Volume 4; Issue 3; May 2019; Page No. 06-12

Comparative study of the prevalence of obesity in private schools and public schools in Brazzaville

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Abstract
In Congo, the prevalence and causes of obesity are less known, l*et al*one in the school environment. The objective of this study was to highlight the excess malnutrition among children attending public and private colleges in Brazzaville, by determining the prevalence of overweight and obesity among them. We conducted a cross-sectional anthropometric survey of 825 students. The results show that the prevalence of overweight (4.6% private college versus 1.4% public college) and obesity (1.4% private colleges versus 0.2% public colleges). These prevalences are much higher in private schools than in public schools. With regard to the professional sector of heads of households, the results show that 62.3% against 60.5% have heads of families who are civil servants, 32.20% against 19.1% of pupils have heads of families. Family who operate in the private sector. Regarding eating behavior, the results show that 3.6% of private college students do not take dinner and 8.3% never take it to public college. With regard to physical activity, the results show that 70% of students in the private sector and 57.2% of the public sector do not practice any extracurricular physical activity and 59.3% for the private college and 89.4% for the private sector. The public college go to school on foot. In light of this study, we can say that there is really a problem of overweight and obesity in schools in Brazzaville.

Keywords: overweight, obesity, infant

1. Introduction
Overweight and obesity are a major public health problem worldwide because of their potential health impact and increasing frequency. The prevalence of childhood overweight and obesity has been increasing rapidly in most industrialized countries in recent years and is also expanding in countries with economies in transition (Oulamara *et al*., 2006, Taleb and Agli, 2009). Jacobi *et al*., 2010, Djadou *et al*., 2010, Bulbul and Hoque, 2014) [7, 10, 6, 5, 2]. Obesity in children is also a significant risk of persistence in adulthood. It is characterized by the accumulation of excess body fat and can be conceptualized as the physical manifestation of a chronic energy surplus (Chaput and Tremblay, 2012) [4].
Obesity is both a source of many metabolic and mechanical complications that reduce life expectancy or severely impair its quality. Added to this are the psychological repercussions and the result is a major economic and social cost taking on the dimension of a real public health problem. However, in Congo, the prevalence and causes of obesity are less known, l*et al*one in the school environment.
The objective of our work is to determine the prevalence of overweight and obesity in children attending public and private colleges in Brazzaville. Thus, this study focuses specifically on estimating the prevalence of overweight and obesity in the two school sectors; identify the socio-economic situation of the parents (head of the family); the habits and eating habits of the students; as well as the practice of physical activity among students.

2. Material and Methods
2.1 Equipment
2.1.1 Target population
The study population was chosen for students attending public and private colleges in Brazzaville for one month (January to February 2018).

2.1.2 Anthropometric material
The material consisted of: a SOEHNLE weighing scale, with a reach of 150 kg and a precision of 0.5 kg (dial 360).
a tape measure (carpenters) that allowed us to measure the size of the students. Anthropometric measurements were performed by qualified persons according to the procedures recommended by WHO. The pupils were weighed (weight in kg) and measured (size in cm to 10-1) without shoes.

2.1.3 Teaching Materials
The didactic material consists of a survey sheet that was used to collect data from students. It includes the following information: student identification, anthropometric measurements of students; information about students' social life; indication of student nutrition; practice of physical activity; moving students to school.

2.2. Methods
2.2.1 Type of study
This is a cross-sectional survey of a sample of students from private and public colleges in Brazzaville, with nutritional (qualitative and quantitative) and anthropometric (weight,

height) variables that collect data on overweight and 'obesity.

2.2.2 Sampling and survey method

For the determination of the sample, we proceeded by a random draw with regard to the schools. Four establishments were selected in the districts Bacongo and Djiri, which were chosen in a reasoned manner. The institutions studied here are private and public colleges, ranging from sixth to third grade. Our sample is 825 students in the four colleges. The choice of students in the schools was made in a comprehensive manner for each classroom.

The field work consisted of:

- Take the anthropometric measurements of the student and write them in the survey form
- Query students using a questionnaire established on a survey sheet including: the identification of the student, the type of food consumed most often, the frequency of consumption.

2.2.3 Choice of indicator

For this study, we used the WHO references to estimate the frequencies of overweight and obesity.

Table 1: WHO classification of BMI values

WHO classification	Value of BMI
Insufficient weight	<16,5
Lean	[16,5-18,4]
Normal	[18,5-24,9]
Overweight	[25-29,9]
Obese (I, II, III)	[30-34,9], [35- 39,9], [≥40]

Source: WHO, 2006

2.2.4 Inclusion criteria

The inclusion criteria for this study are:

- Agree to participate in the survey;
- Reside in the city of Brazzaville at the time of the survey;
- Attend private and public general colleges at the time of the survey;
- Accept taking anthropometric measurements.

2.2.5 Data processing

The data is processed by EPI INFO, Word and Excel software. The statistical analysis of the values obtained was performed according to the student test, and the statistical significance threshold was set at 5%.

3. Results

3.1 Breakdown of students by body mass index, sex and age

Table 2 shows the distribution of students by their body mass index, age and age.

Table 2: Distribution of students by body mass index, sex and age

Private schools				Public schools		
Parameter	**Variable**	**Effective**	**Frequency (%)**	**Effective**	**Frequency (%)**	**Significance, P**
BMI	< 18,5	175	44,6	170	39,4	*P*<0,001
	18,5-24,9	195	49,4	255	59	
	25-29,9	18	4,6	6	1,4	
	>30	05	1,4	1	0,2	
	Total	393	100	432	100	
Sex	Male	183	46,6	212	49,1	*P*<0,001
	Female	210	53,4	220	50,9	
	Total	393	100	432	100	
Average Age	15± 21 years					

These results show that 4.6% of students in the private college versus 1.4% in the public college have a BMI between 25 and 29.9 kg / m², which corresponds to the overweight and 1.4% to the private college against 0.2% at the public college have a BMI ranging from 30 to over 40 kg / m², which corresponds to obesity. The percentage of underweight is 44.6% in the private college and 39.7% in the public; 49.6% of students in private versus 59% in the public, have a normal corpulence, with p <0.001.

With regard to gender, the results show that in both school sectors, there are more female students (53.4% in the private sector and 50.9% in the public sector) than men (46.6%).% for the private college and 49.1% for the public college) whose difference is very significant, p <0.001. The average age of the pupils surveyed is 15 ± 21 years.

3.2 Sociodemographic characteristics

The socio-demographic characteristics are presented in Table 3.

Table 3: Sociodemographic characteristics

Private schools				Public schools		
Parameter	**Pariable**	**Effective**	**Frequency (%)**	**Effective**	**Frequency (%)**	**Significance(p)**
Housing Characteristics Individuals	House Endur	386	98,4	365	84,5	*P*<0,001
	Hangar	06	1,6	67	15,5	
	Total	393	100	432	100	
Place where Live Individuals	At Parents	352	89,6	360	83,3	*P*<0,001
	Moreover	41	10,4	72	16,7	
	Total	392	100	432	100	
Professional Sector the head of Family	Public (Official)	205	62,3	181	60,5	*P*<0,001
	Private	106	32,2	57	19,1	
	Workers	03	0,9	19	6,4	
	Informal	15	4,6	42	14	
	Total	392	100	432	100	

With regard to the professional sector of the head of the family, the results show that 62.3% of students in the private college versus 60.5% in the public college have head of family who are civil servants. And, 32.2% of students for the private college against 19.1% at the public college have head of family that evolve in the private sector. The children of the workers are distributed as follows: 0.9% of students in the private college and 6.4% in the public college. The percentage of pupils whose heads of households are in the informal sector is respectively 4.6% of students in the private college versus 14% in the public college (p <0.001).

Regarding the place where the individuals live, 89.6% of students for the private college against 83.3% for the public college live with their parent, and 10.4% for the private college against 16.4% for the public college live elsewhere (aunt, uncle grandparent,), with p> 0.05.

Characterization of student housing 98.5% of students in private colleges and 84.5% in public colleges live in built homes compared to 1.5% in private colleges and 15.5% in public colleges live in undeveloped homes (P > 0.05).

3.3 Distribution of meal frequency

Table 4 presents the frequency with which students eat different meals of the day.

Table 4: Distribution of meal frequency

Private schools				**Public schools**		
Parameter	**Variable**	**Effective**	**Percentage (%)**	**Effective**	**Percentage (%)**	**Significance(P)**
Breakfast	Every Day Or Ammost	330	84	380	88	*P*>0,05
	3 To 5 Times/Week	36	9,2	20	4,6	
	1 To 2 Times/Week	7	1,8	3	0,7	
	Ever	20	5,1	29	6,7	
	Total	392	100	432		
Lunch	Every Day Or Almost	333	84,7	381	88,20	*P*<0,001
	3 To 5 Times/Week	17	4,3	14	3,2	
	1 To 2 Times/Week	5	1,3	1	0,2	
	Ever	38	9,7	36	8,3	
	Total	392	100	432	100	
Dinner	Every Day Or Almost	323	82,2	367	85	*P*<0,001
	3 To 5 Times/Week	38	9,7	15	3,5	
	1 To 2 Times/Week	18	4,6	14	3,2	
	Ever	14	3,6	36	8,3	
	Total	392	100	432	100	

The results obtained in this table show that: Regarding breakfast, it appears that the majority of students is 84.0% in the private college against 88.0% at the public college breakfast every day or almost; 9.2% of students in the private college versus 4.6% in the public college take it 3 to 5 times a week. 1.8% of students in the private college against 0.7% in the public college take it 1 to 2 times a week and 5.1% of students in the private college against 6.7% in the public college never take it. Overall, the difference is very significant, p <0.001

With regard to lunch, the results show that 84.7% of students in the private college versus 88.2% in the public college eat breakfast almost every day; 4.3% of students in the private college versus 3.2% in the public college take lunch 3 to 5 times a week; 1.3% of students in private college versus 0.2% in public college have lunch 1 to 2 times a week and 9.7% of students in private college and 8.3% in public college do not take it (p> 0.05).

With regard to dining, these results show that 82.2% of students in the private college versus 85.0% in the public college take dinner almost every day; 9.7% of students in the private college versus 3.5% in the public college, take it 3-5 times a week; 4.6% of students in the private college versus 3.2% in the public college, take it one to two times a week, finally 3.6% of students in the private college against 8.3% in the public college, do not never take. Overall, the difference is not significant (p <0.001).

3.4 Place of meals for pupils

Table 5 shows the location of student meals.

Table 5: Location of meals in both school districts

Private schools				Public schools		
Parameter	**Variable**	**Effective**	**Percentage (%)**	**Effective**	**Frequency (%)**	**Significance(P)**
Breakfast	At Home	264	70,8	377	93,5	*P*<0,001
	At The Restaurant	0	0	1	0,2	
	At School	108	29,2	24	6,1	
	Aillor	0	0	1	0,2	
	Total	392	100	432	100	
Lunch	At Home	308	78,6	387	97,7	*P*<0,001
	At The Canteen	84	21,4	8	2,0	
	Other Place	0	0	1	0,3	
	Total	392	100	432		
Dinner	At Home	392	100	430	99,7	*P*<0,001
	Aillor	0	0	2	0,5	
	Total	392	100	432	100	

From this table, it appears that the majority of students at breakfast is 70.8% in the private college against 93.5% at the public college has breakfast at home; 29.2% of students for the private versus 6.0% for the public take it to school. 0% of students for the private and 0.2% for the public take it to the restaurant; and 0% of students for the private sector and 0.2% for the public take it elsewhere (with friends, etc.), with p <0.001.

Regarding the place where the lunch was consumed, the results show that 78.6% of students for the private sector, compared to 97.7% for the public, have lunch at home; 21.4% of students in private versus 2% in the public take it to the canteen (at school). And, 0% of students for the private against 1% for the public takes it elsewhere (Gargotes,) whose student test reveals a difference is very significant, p <0.001.

Regarding the place of consumption of the dinner, the results show that 100% of students for the private versus 99.7% for the public take it home, and 0% of students for the private against 0.3% for the public take it elsewhere (restaurant, other households,), p <0.001.

3.5 Types of food consumed most often by students during meals.

Table 6 presents the different foods most often consumed by students during meals.

Table 6: Types of food consumed most often by students during meals

Private schools				Public schools		
Parameter	**Variable**	**Effective**	**Frequency (%)**	**Effective**	**Frequency (%)**	**Signifiance (P)**
Breakfast	Milk+Donut With Flour	2	0,5	2	2	
	Milk+Bread Spread	213	57,1	258	64	*P*<0,001
	Milk+ Single Bread	1	0,3	1	0,2	
	Juice+ Bread	29	7,8	5	1,2	
	Other	128	34,3	137	34	
	Total	392	100	432	100	
Lunch	Bread(Single Or Spread)	1	0,2	0	0	
	Frozen(More Accompaniment)	204	52	285	72	*P*<0,001
	Fish	66	17	92	23	
	Breag+Milk	84	21,5	19	4,7	
	Other	37	09,3	2	0,5	
	Total	392	100	432	100	
Dinner	Bread(Single Or Spread)	0	0	106	24,5	
	Frozen	121	31,9	28	6,5	
	Fish	26	6,9	179	41,5	*P*<0,001
	Bread+ Milk	151	39,8	119	27,5	
	Other	81	21,4	0	0	
	Total	392	100	432	100	

The results in Table V show that 57.1% of students in the private college versus 64.0% in the public college consume at the breakfast of milk + bread spreads; 34.3% of students in the private college versus 34.0% in the public college take other things (grills,). Students who take juice + simple or spread bread (7.8% in the private college versus 1.2% in the public college); milk + flour donut (0.5% for each of the two sectors). And, those who take milk + simple bread (0.3% in private college versus 0.2% in public college) are poorly represented, with P <0.001.

It also appears that at lunch, the students consuming the frozen products are the most represented (52% for the private college versus 72.0% for the public college). Then come those who consume fish (freshwater, smoked, salted) (17% for the private versus 23% for the public); and those who take other things (porridge,), including 21.5% at the private college and 4.7% at the public college. Students who take simple or spread bread are poorly represented, (with 0.2% in the private college versus 0% for the public college).

These results also show that students at dinner, students consume bread (simple or spread), including 0% for the private college against 24.5% for the public college; those who consume frozen, 31.9% for the private college and 6.5% for the public college. 21.4% of students for the private college versus 0% for the public college, consume

other foods than those cited and 6.9% of students in the private college versus 41.5% in the public college, consume the fish (fresh water, smoked, salted, more accompaniment); and 39.8% of students for the private college and 27.5% for the public college consume bread + milk (p <0.001).

3.6 Snack Frequency, Reasons and Category of Nibbled Foods

Table 7 shows the frequency of snacking, the reasons for snacking and the category of food nibbled by students.

Table 7: Snack Frequency

Private schools				Public schools		
Parameter	**Variable**	**Effective**	**Frequency (%)**	**Effective**	**Frequency (%)**	**Significance(P)**
Snacking	Yes	263	66,1	330	76,4	*P*<0,001
	No	130	33,9	102	23,6	
	Total					
Categories Of Foods	Sweet	240	91,3	269	81,5	*P*<0,001
	Salt	23	8,7	58	17,6	
	Dairy Products	0	0	3	0,9	
	Total	392	100			
Reason Of Snacking	Hunger	137	35	147	44,5	*P*<0,001
	Usually	255	65	183	55,5	
	Total	392	100		100	

This table shows that the majority of students, 66.1% for the private college and 76.4% for the public college, nibble between meals, compared to 33.9% of the private college students and 23, 6% at the public college that does not nibble. Most students nibble routinely (65% at the private college versus 55.5% at the public college); others nibble because they are hungry (43.3% of which 35% in the private college and 44.5% in the public college), with p <0.001. Nibbled food is dominated by sweets (sweet biscuits, ice cream, etc.), ie 91.3% at the private college and 81.5% at the public college; followed by salty foods (sausages, chips, etc.), 8.7% at the private college and 17.6% at the public college). The least consumed food category is dairy products (yoghurt, cheese, etc.) with respective percentages 0% in the private college and 0.9% in the public college (p <0.001).

3.7 Practice of extracurricular physical activity and means of transportation for the school.

Table 8 presents the types of sport practiced by students and means of travel for the school.

Table 8: Out-of-school physical activity practice and means of travel for school

Private schools				Public Schools		
Parameter	**Variable**	**Effective**	**Frequency (%)**	**Effective**	**Frequency (%)**	**Signifiance (P)**
Sports Praticed	Foot-Ball	74	18,8	110	25,5	
	Basket-Ball	25	6,4	10	2,3	
	Boxing	15	3,8	38	8,8	*P*<0,001
	Hand-Ball	0	0	4	0,9	
	Nzango	4	1	23	5,3	
	No	275	70	247	57,2	
	Total					
	A Pied	233	59,3	386	89,4	
Means Of Travel	Car (Personal)	112	28,5	6	1,4	*P*<0,001
	Bus	27	6,9	39	9	
	Taxi	21	5,3	1	0,2	
	Total					

It can be seen from this table that the majority of students, 70% at the private college and 57.2% at the public college, do not practice any extracurricular physical activity; while, 18.8% of students in private college against 25.5% in public college practice football.

Students practicing boxing, 3.8% at the private college and 8.8% at the public college, basketball; 6.4% at the private college and 2.3% at the public college; the "Nzango" 1% at the private college and 5.3% at the public college. And, 0.5% of students, including 0% for the private college and 0.9% for the public college practice handball (p <0.001).

Regarding the means of transport, 59.3% of students for the private college and 89.4% for the public college go to school on foot. It follows 28.5% for the private college and 1.4% for the public college go there by car (personal); 6.9% at the private college and 9% for the public college go by bus. In the end, 5.3% at the private college and 0.2% at the public college go by taxi (p <0.001).

4. Discussion

The objective of this study is to assess the prevalence of overweight and obesity among children attending private and public colleges in Brazzaville, to compare this prevalence between the two school sectors, as well as to identify the factors influencing development of this weight gain. Comparisons between prevalence in both school sectors, overweight and obesity cases were much more apparent among students enrolled in private colleges (with prevalence of overweight of 4.6%, and obesity 1.4%), than in public colleges (with prevalence of overweight of 1.4%, and obesity of 0.2%); out of 393 students for the private college, and 432 students for the public college.

These results could be explained by the fact that most of the overweight or obese children encountered in private

colleges come from relatively well-off families where the head of household occupies a fairly important position in his sector of activity, and who for the most are officials. These results are similar to those of Chakar and Salameh (2006) who state that in Lebanon there are more overweight children in families with high socioeconomic status; among these wealthier families, children more easily adopt unhealthy eating habits (fast food, energy snacks, etc.) and reduce their consumption of traditional food. These results support Beagleole's (2004) [1] quote that "obesity in rich countries is a problem for the poor, in poor countries it is a problem for the rich".

Regarding the professional sector of the head of household, the majority is civil servant (62.3% against 60.5%), 32.2% against 19.1% are employed in the private sector, 0.9% against 6.4% are workers and 4.6% against 6.4% are informal. These values differ from those reported by Zedini *et al.*, 2016 [14], in Tunisia of which 58.9% are workers, 22.5% employees and close to our values of informal parents of private students 3, 6%. Regarding eating habits, our study shows that, overall, the majority of children usually take the main meals of the day (breakfast, lunch, dinner), or 84% against 88% of children who take breakfast, 84.7% vs. 88.20% have lunch, and 82.2% vs. 85% are having dinner. It also indicates that most children eat at home (70.8% vs. 93.5%). These results are similar, in terms of the frequency and location of meal consumption, of those obtained in Algeria by SEMEP (2011) [11], which found respectively 80% of children who usually took their main meals, 94% who took them home, as well as those reported by Zedini *et al*, 2016 [14] in Tunisia with 87.7% of children who usually took the main meals, 97.4% took them home.

Our study also shows that 5.1% vs. 6.7% of students never eat breakfast, 9.7% vs. 8.3% do not eat breakfast, and 3.6% vs. 8.3% do not eat breakfast. Do not take dinner. These results differ from those obtained by Zedini *et al* (2016) [14] in Tunisia, who found 24% of students who did not have breakfast, 2.7% who did not have lunch, and close relatives (8.3% public students) of those who did not take dinner (9.9%).

Regarding the food practices, the results obtained indicate that more than half of children (57.1% against 64%), take at breakfast milk + bread spread (butter, chocolate,) and 34.1% take other things (spaghetti, rice,);

65.1% take imported meats (chicken, chicken leg,) plus accompaniment (cassava, bread, rice and others) at lunch, and penne 21.0% take fresh fish; 42.6% take milk + bread (simple or spread) at dinner, and 29.3% imported meat (chicken, chicken leg,) plus an accompaniment (cassava, bread, rice and others). The meals taken by the students in our study are generally characterized by a fatty diet, which is a major factor in the increase in weight gain.

Our study shows that 66.1% versus 76.4% of students nibble between meals, of which 85.8% nibble sweets, 13.5% salty and 0.5% dairy products. SEMEP (2011) [11], in Algeria, found 60% of students took sweets, 78% took imported meats and 48% took fish. But the category of foods most consumed by these students, promotes a dietary imbalance, and the least consumed such as fish is essential to the nutritional balance and nutritional needs of children and adolescents (Mairie *et al.*, 2002) [12]. This poor eating behavior is among the causes of overweight observed in children and adolescents.

Also, the destructuring of the meals (breakfast jump and caloric intake evening) promotes weight gain. It is important to note that a high sugar intake is associated with less satiety, which does not favor the reduction of ingested doses (Rolland-Cachera, 2004) [13].

With regard to physical activity practice and displacement for school, these results show that most of these students (70% vs. 57.2%) overall do not engage in physical activity (outside the PSE), and 36.7% on average practice it; 59.3% against 89.4% of students go to school on foot, 17% on average (personal car and taxi) go by car and 8% go by bus. Our results are close to those indicated by the SEMEP (2011) [11], in Algeria which found 34% of children who practiced an extracurricular sport activity, 74% who went to school on foot, 18% went there by car and 8% by bus. These sedentary lifestyles or inactive behaviors promote food intake and obesity in children and adolescents (Rennie *et al.*, 2005) [9]. Regular physical activity among children and adolescents with a view to adopting lifestyle habits as early as possible that are beneficial to their health and quality of life in adulthood (OMS, 2009) [15].

5. Conclusion

The results obtained from this study allowed us, on the one hand, to gain insight into the prevalence of overweight and obesity in Congo Brazzaville, in the two environments that served as a framework for our study, particularly the private and public colleges where we have been able to detect overweight problems with some children, but are much more present in private colleges. On the other hand they allowed us to have an idea about the different factors influencing this weight gain in students from where, the professional status of the head of the family, associated with the decrease of the practice of physical activity. Brazzaville high school students are adopting a way of life that can trigger a problem of overweight in the future. In the end, overweight children should be closely monitored and any means to lose weight should be considered.

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