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Anthropometric Characteristics and Nutritional Status of Chadian Obese Children in a School Environment: Case of Moundou and Doba Cities

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Abstract:
Context: Today, excessive weight gain is considered a growing threat to developed countries, and those sending development. The problem of obesity affects all social strata of sex and age combined. This vulnerability is noted as much among the school children of the world, without however sparing those of Chad. The objective of this study was to determine the nature of the foods consumed by Chadian children suffering from obesity. Methodology: A total of 436 overweight and obese subjects recruited from 12 schools in the cities of Moundou and Doba formed the sample for this study. All children were subjected to anthropometric measurements and clinical examinations. Eating habits were measured using the 24h Recall. Results: The prevalence of overweight was 76.39%, that of obesity 23.61%. These results were obtained using the body mass index (BMI) formula. Thus, 68.11% had the abdominal perimeter <1m followed by 9.26% between 1.10m and 1.20m. There was a close relationship between BMI and the Abdominal Perimeter (p <0.0001). According to the results, (39.90%) did not practice sport; only 31.65% practiced football with a long time in front of the television. The surveys carried out made it possible to assess the frequency of meals for pupils in public and private primary schools in these two cities, consisting mainly of breakfast, lunch and dinner followed by afternoon tea and snacks. The consumption of fruits and vegetables was unfavorable. Dietary fiber was also little consumed. However, the consumption of foods such as starchy foods (32.79%), cereals (72.70%), animal proteins (54.58%), vegetable proteins (29.35%), sweet products (94.49%), dairy products (78.21%), sugary or carbonated drinks

(66.28%) were more noticeable, a significant difference (p <0.001). In conclusion: Our results indicate that the nutritional status of Chadian school children is abnormal, the food consumed is a source of overweight and obesity. It is important to change eating habits in order to fight childhood obesity in Chad.

Keywords:
Anthropometric Characteristics, Nutritional Status, School Environment, Obesity, Children, Chad

1. Introduction

Rapid changes in diets and lifestyles, caused by industrialization, economic development and market globalization, have changed people's eating habits and physical activity [1].

Throughout human history, weight gain and the accumulation of fat stores have been regarded as signs of health and prosperity [2,3]. Lifestyle habits have led people to eat in order to maintain a significant body weight [4], a guarantee of opulence and well-being.

Currently, excessive weight gain is seen as a growing threat to developed and developing countries [5]. Several studies have shown that overweight and obesity are major public health problems [6,7].

In Africa, the relationship between diet, inactivity and the onset of obesity spares no country (8). Because the problem of obesity affects all social strata of sex and age combined (9, 10).

This vulnerability is observed as much among the school children of the world, without however sparing those of Chad [11,12].

However, in Chad, in general and more particularly in the cities of Moundou and Doba, some school children show signs of obesity [13,14].

The dietary profile of obese children in the school environment is not known not only for lack of research [15,16] but also because of the difficulties of access to Chadian studies and experiences in this field [17]. Thus, the choice of these two cities located in the south of Chad marked by globalization and industrialization because of oil exploitation.

This explains the promotion of the important migratory phenomenon of populations. This migratory flow has resulted in large part in the displacement of the population from different provinces of the country and even neighboring countries, towards these currently cosmopolitan localities whose inhabitants are mostly employees.

The obesity phenomenon appears to be the price to pay for economic development that has enabled food sufficiency [18] and the reduction of the physical hardship of work, leading to over-nutrition and a sedentary lifestyle [19].

This observation leads us to assess the nutritional profile of obese Chadian children in school environment to build a database on this subject in order to provide the necessary subsequent interventions.

2. Methodologies

The weight of the students in the study was measured using a scale.

The students wore only very light clothing and were without shoes. After each measurement, the scale was calibrated with a standard weight to maintain good accuracy.

Students' height was measured using a wooden height rod placed on a flat surface.

The student was standing with his feet. The shoulders, buttocks and heels should touch the vertical measurement board, and the eyes should follow the horizontal plane of Frankfort. The size was measured to the nearest 0.1 cm [20].

In addition to measuring weight and height, the abdominal perimeter (m) was measured after the child's normal expiration using a flexible, non-elastic 2-meter tape measure.

The survey form being made up of general information on the respondent and his food consumption. The paper questionnaire made it possible to record the general information of each student surveyed.

We carried out a cross-sectional study on obese students aged 10 to 16, of two (2) sexes attending urban and peri-urban schools in the cities of Moundou and Doba between November 2018 - March 2019.

Out of 1,812 pupils surveyed, 436 were overweight and obese, regularly attending these establishments.

It was a question of obtaining a representative sample of the pupils of Middle Course second year (CM2) schooled in the private and public schools.

However, student food consumption was estimated using the "24-hour reminder" method [21].It is a retrospective interview method which consists of qualitatively and quantitatively describing all the food and drink consumed by a person within 24 hours [22].

3. Results and Discussion

The body mass index (BMI) (Table 1) between 25.0 to 29.9 is shown with 76.39%, followed by a range of 30.0 to 34.9 with 16.74%.The brackets from 35.0 to 39.9 and > 40 had 4.12% and 2.75% respectively. The difference is highly significant with a probability $p < 0.0001$.

The weight <40 is the majority with 35.8% followed by the range between 41-50 with 26.37%, then between 51-50 with 19.95%. Size <1.30 is more represented with 47.7%. The size bands between 1.31-1.40 and 1.41-1.50 respectively are dominated with 32.56% and 15.82%.

The abdominal perimeter < 1m is widely represented with 68.11%, followed by 1.11m to 1.20m with 9.26%. The age group represented between 12-14 years is the most affected by obesity with 44.26%, followed by the age between 10-12 years with 33.48%.

The difference is highly significant with a probability $p < 0.0001$.

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Table 1. *Anthropometric measurements of pupils.*

Parameters	Variables / Characteristics	Number (N = 436)	%	95% C.I	Statistical Test
Weight (kg)	**<40** **41-50** **51-60** **>60**	**156** **115** **87** **78**	**35.8** **26.37** **19.95** **17.88**	25.3-49.8 **11.1-31.8** **9.9-30.0** **9.9-30.0**	$\chi 2$ = 18.342 ddl = 64 **p<0.0001**
	Average ± Standard deviation = 66.426 ± 37.27				
Abdominal perimeter (m)	**< 1m** **1 m à 1.10 m** **1.10m à 1.20m** **> 1.20 m**	**297** **36** **84** **19**	**68.11** **8.28** **19.26** **4.35**	**45.4-86.6** **45.6-70.6** **3.5-19.0** **4.4-20.9**	$\chi 2$ = 55.741 **ddl = 64** **p<0.0001**
	Average ± Standard deviation = 52.73 ± 23.49				
BMI(Kg / m ²)	**25.0 à 29.9** **30.0 à 34.9** **35.0 à 39.9** **> 40**	**333** **73** **18** **12**	**76.39** **16.74** **4.12** **2.75**	**50.2-74.7** **16.0-38.5** **2.5-17.0** **0.4-10.7**	$\chi 2$ = 19.434 **ddl = 64** **p<0.0001**
	Average ± Standard deviation = **53.81 ± 4.66**				

The results of this Figure 1 show that 71.15% have a BMI between 25.0 to 29.9 kg / m ²corresponding to overweight, followed by 16.66% having a BMI between 30.0 and 34.9 kg / m ²corresponding to type I obesity. On the other hand, 7.71% have the BMI between 35.0 and 39.9 kg / m ²corresponding to type II obesity. Finally, those with a BMI > 40 kg / m corresponded to type III obesity with a percentage of 4.48%. The difference is highly significant with a probability p < 0.0001.

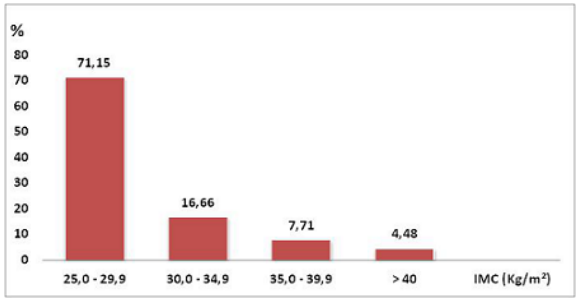

Figure 1. *Body mass index (kg / m ²) of student boys.*

The results of this Figure 2 show that girls have the dominant BMI, 65.37% between 25.0 and 29.9 kg / m ² corresponding to overweight, followed by type I obesity with 18.92% between 30, 0 to 34.9 kg / m2 then obesity type II with 9.64% between 35.0 to 39.9kg / m², finally obesity type III with 6.07% > 40 kg / m². The difference is highly significant with a probability p < 0.0001.

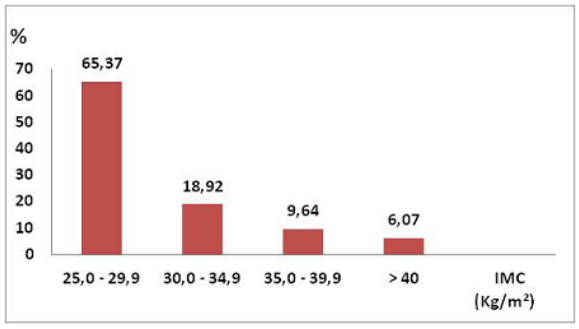

Figure 2. *Body mass index of female students.*

Table 2. *Physical activities practiced and the number of hours / day spent in front of the television.*

Parameters	Variables / Characteristics	Number (N = 436)	%	95% C.I	Statistical Test
Sports	soccer	138	31.65	22.6-46.6	$\chi2 = 26.370$ ddl = 64 p<0.0001
	basketball	13	3	0.0-11.0	
	boxing	23	5.27	2.0-9.0	
	handball	46	10.55	4.4-20.9	
	nzango	42	9.63	3.5-19.0	
	no activity	174	39.90	26.7-51.4	
Time in front of the television	< 30mn	23	5.3	0.0-11.0	$\chi2 = 42.194$ ddl = 64 p< 0.00117
	30mn to 1h	78	17.88	32.3-57.5	
	1h to 1h30mn	102	23.39	14.8-36.9	
	1h30mn to 2h	117	26.83	11.1-31.8	
	> 2h	116	26.60	11.1-21.5	
way of travel per day	walk	50	11.46	6.5-24.7	$\chi2 = 3.399$ ddl = 64 p< 0.00117
	by car	136	31.19	19.9-43.4	
	by bus	129	29.58	11.1-31.8	
	by bike	12	2.75	0.4-10.7	
	by motorbikes	109	25.02	14.8-36.9	

Regarding the practice of sport, there are 31.65% of students who play football. However, most students do not practice (39.90%). Regarding the time in front of the television, all the pupils declared watching television. There is no statistically significant difference between the number of hours per day spent watching television among overweight and obese students.

However, 26.83% of children remain in front of the television between 1:30 and 2 hours, followed by 26.60% who watch television for more than 2 hours.

Others, on the other hand, some pupils watched television between 1 hour and 1 hour 30 minutes or 23%, while 17.88% had between 30 minutes and 1 hour and only 2.30% watched less than 30 minutes on television. The results in Table 2 show that few of the students surveyed travel on foot (11.46%) of which 31.19% travel by car, similarly 29.58% travel by bus and 25% travel by motorcycle. 2.75% are cycling.The difference is significant with a probability $p < 0.0001$.

It appears from this Table 3 that breakfast is generally composed of several foods to raise the level of energy: 11% confectionery, 10.77% meat, 9.40% yogurt and respectively 8.94%, 8, 48%, 8.25%, 8.02% eggs, butter, cereals, and mayonnaise, followed by 7.33% donuts, 6.65% tubers and roots.

The consumption of pulses, fruits and vegetables is respectively lower with 5.04%, 3.66% and 4.12%.The difference is significant with a probability $p < 0.0001$.

Table 3. *The foods making up breakfast.*

Parameters	Variables / Characteristics	Number (N = 436)	%	95% C.I	Statistical Test
Composition	Confectionery	48	11.00	6.5-24.7	$\chi2=31,021$ ddl = 64 p< 0,0001
	cereals	36	8.25	3.5-19.0	
	Tubers and roots	29	6.65	2,0-9.10	
	Meats	47	10.77	4.4-20,9	
	fish	19	4.35	1.0-12.9	
	eggs	39	8.94	3.5-19.0	
	Dairy products	17	3.89	0.4-10.7	
	Legumes	22	5.04	1.0-12.9	
	Vegetables	16	3.66	0.4-10.7	
	Fruits	18	4.12	1.0-12.9	

	Donuts	32	7.33	2.5-17.0	
	Yogurt	41	9.40	3.5-19.0	
	Mayonnaise	35	8.12	2.5-17.0	
	Butter	37	8.48	2.5-17.0	

The results of this Table 4 show that lunch being the main meal of the day consists of several foods including 11.23% cereal, 9.40% yogurt, 8.71% meat, respectively 7.79%, 7 , 56%, 7.33%, 7.11%, mayonnaise, dairy products, butter, tubers and roots, and fish, followed by 6.88% eggs, 6.65% donuts.

The consumption of vegetables, fruits and legumes is respectively lower with 5.27%, 3.66% and 3.44%.The difference is highly significant with a probability $p < 0.0005$.

Table 4. *Foods making up breakfast.*

Parameters	Variables / Characteristics	Number (N = 436)	%	95% C.I	Statistical Test
Composition	Confectionery	31	7.12	6.5-24.7	χ^2=29.019 ddl = 64 p< 0,0001
	cereals	49	11.23	2.5-17.0	
	Tubers and roots	32	7.33	2.5-17.0	
	Meats	38	8.72	3.5-19	
	Fish	31	7.12	6.1-21.5	
	eggs	30	6.88	2.0-9.0	
	Dairy products	34	7.80	6.2-14.9	
	Legumes	15	3.46	0.4-10.7	
	Vegetables	23	5.27	1.0-12.9	
	Fruits	16	3.66	0.4-10.7	
	Donuts	29	6.65	1.7-15.0	
	Yogurt	41	9.40	3.5-16.8	
	Mayonnaise	34	7.80	1.7-15.0	
	Butter	33	7.56	1.7-15.0	

The analysis of results in Table 5 reveals that the dinner also consisted of several foods including 9.86% confectionery, 9.17% meat, 8.71%, 8.48, 8.25, yogurt, donuts, eggs, respectively, followed by 7.79% dairy products, 7.33% cereals, 7.11% fish, 6.65% butter.

The consumption of pulses, fruits and vegetables is respectively lower with 5.27%, 5.04% and 4.12%. The difference is significant with a probability $p < 0.0005$.

Table 5. *The foods that make up dinner.*

Parameters	Variables / Characteristics	Number (N = 436)	%	95% C.I	Statistical Test
Composition	Confectionery	43	9.86	3.5-19.0	χ^2=28.061 ddl = 64 p< 0.0005
	cereals	32	7.33	1.7-15.0	
	Tubers and roots	27	6.20	2.0-9.0	
	Meats	40	9.17	3.5-19.0	
	Fish	31	7.12	1.7-15.0	
	eggs	36	8.25	2.5-17.0	
	Dairy products	34	7.80	1.7-15.0	
	Legumes	23	5.27	1.0-1.9	
	Vegetables	18	4.12	1.0-12.9	
	Fruits	22	5.05	1.0-1.9	
	Donuts	37	8.50	3.5-19.0	
	Yogurt	38	8.72	3.5-19.0	
	Mayonnaise	26	5.96	1.0-1.9	
	Butter	29	6.65	2.0-9.0	

4. Discussion

Our study focused on 436 students including 280 girls and 156 boys, the age group chosen is between 10 and 16 years old.

The prevalence of overweight was 76.39%, for obesity was 23.61%.

These results show a progressive evolution of obesity by type: 16.74% of type I obesity with a BMI between 30.0 and 34.9 kg / m ², 4.12% of type II obesity with a BMI between 35.0 and 39.9 kg / m ², finally 2.75% of type III obesity with a BMI greater than or equal to 40 kg / m ².

In our study, the prevalence of overweight and obesity in boys are 71.15% and 28.55% respectively against 65.37% in girls. However, 56.42% live with parents, 92.21% of whom work. The socio-economic level shows its influence on the growth of the pupils, the corpulence of the boys and the adipose layer of the girls [23].

In our study, the prevalence of overweight and obesity in boys is 71.15% and 28.55% respectively, compared to 65.37% in girls.

Outside of schools, the sport most played by boys is football (31.65%) followed by handball (10.55%). In contrast, the majority of girls do not practice any sport. The results of our study show that 39.90% of the students surveyed do not practice sport.

However, sport has proven to be an effective tool in the fight against obesity. Numerous studies mention that the prevalence of overweight and obesity has risen at an alarming rate in recent decades, particularly in children and adolescents, thus becoming one of the greatest health challenges public in the 21st century [11,24].

Likewise, overweight and obese adolescents may remain obese into adulthood. They are also at risk of developing metabolic (diabetes) and cardiovascular diseases in earlier age [25]. Indeed, a negative relationship between the level of physical activity and various obesity indicators is observed in many cross-sectional studies [26,27].

Our study confirms that a sedentary lifestyle is correlated with obesity and overweight in children and that television remains the only means of distraction in most children in our country.

However, watching TV two or more hours a day doubles the risk of not participating in any physical activity [28,29].

Regarding the social situation, our study indicates that the majority of students live with parents (56.42%) and (61.35%) are in private and urban schools in Doba.

While in the city of Moundou 55.06% of students are in private schools and (559.1%) in urban schools.

Regarding energy expenditure, urban students spend their time in front of the television compared to those in peri-urban areas.

In fact, the consumption of screens among young people in urban areas is of particular concern to many researchers [30].

In this survey, sedentary activities are estimated from a questionnaire asking to specify the time spent in front of the screens.

The latest results indicate a high exposure to screens among adolescents, higher on average among boys than among girls. Our results are similar to those found by Graf & al. [30].

Indeed, watching television and using the screens is the lifestyle factor most strongly associated with obesity in children, warns this team from the Barcelona Institute for Global Health (ISGlobal) which has spent review the weight of 5 lifestyle habits in the development of overweight and childhood obesity.

The findings, presented in the journal Pediatric Obesity [31] commit, in practice, parents to monitor the incidence of advertisements for unhealthy foods, insufficient exercise and reduced time sleep related to the use of the screen.

Likewise, these pupils from wealthy parents hardly move on foot and remain in a state of inactivity. Sedentary lifestyle kills more than tobacco: children must be active and sporty [32].

On the other hand the pupils who attend the peri-urban schools, generally move on foot.

This justifies the high daily energy expenditure compared to that of private students [33].

However, physical activity is an area to encourage in order to avoid overweight and obesity [29].

With regard to the foods making up the daily meal, a systematic review of the results of 16 studies carried out on more than 59,000 European children and adolescents, examining the relationship between breakfast and weight control, showed that taking breakfast was associated with a lower body mass index (BMI) and that it lowered the risk of overweight and obesity [34].

In our study we found that the breakfast was irregular.

This irregular eating of breakfast is due to a lack of knowledge of the organization of meals in a day.Which leads to overweight.

Indeed, several studies have shown an association between lack of breakfast and the risk of obesity [35], it is possible that the usual absence of breakfast in the long term reduces the basic metabolism, because recurrent breakdown of muscle tissue: deprived of glucose, the organism in fact draws in muscle through neoglucogenesis [36,37].

On the other hand, excessive intake of carbohydrate (Confectionery, cereals, Tubers and roots) and lipid (Meat, eggs, Dairy products, Donuts, Yogurt, Mayonnaise) foods during dinner will allow the production of adipose tissue in the respondents [38,39].

In fact, the weight gain results from an accumulation of triglycerides in the adipose tissue secondary to the insufficiency of capacity to oxidize the totality of the daily lipid intake, as soon as the energy intake is greater than the expenditure and that the diet provides enough carbohydrates to oxidize [40].

This observation of the frequency of consumption of breakfast; lunch and dinner confirms that the food intake for overweight and obese children is not evenly distributed.

Furthermore, the place of consumption could be a marker of the risk of overweight, catering outside the home being associated with an increase in this risk according to studies by Koletzko and Toschke [41].

5. Conclusion

Weight growth shows a big difference between male and female, girls have more weight growth than boys; there are significant differences in weight compared to height in the 10 to 16 year age groups.

Adapting to the new food possibilities in cities concerns, on the one hand, breakfast, which consists of ready-to-eat foods contrary to habits, or breakfast, which consists of leftovers from the previous day's meal; on the other hand, the daily consumption of animal products, but in small quantities, as well as the introduction of sugary and carbonated drinks at the expense of mineral water.

This change in diet is reflected in an increase in body mass index among students, especially girls. The prevalence of overweight boys is higher than that of girls; however the prevalence of obesity in boys is lower than that of girls.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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