



# Overweight and Abdominal Obesity among School Children in Porto-Novo/Benin

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### Abstract

**Introduction:** An increasingly higher prevalence of overweight and abdominal obesity among children is noted in developing countries, with all its serious consequences.

**Objective:** Determine the prevalence and factors associated with overweight and abdominal obesity among primary school students aged 5 to 12 years in the city of Porto-Novo.

**Methods:** This research work was a cross-sectional and analytical study carried out from December 2016 to May 2017. It focused on 651 primary school students randomly selected in schools of Porto-Novo; we calculated their BMI and measured their umbilical cord circumference. Data were entered, analyzed and processed using the softwares EPI-DATA3.1 and EPI-INFO 7; p value is significant when it is <0.05.

**Findings:** Prevalence of overweight was 8.6% (56/651) including 6.5% (42/651) for excess weight and 2.1% (14/651) for obesity. The one of abdominal obesity was 8% (52/651). The factors associated with excess weight and obesity were parents' high socioeconomic status, absence of exclusive breastfeeding during the first six months of life, daily snacking of sweet cakes, use of motor vehicles to go to school, high number of hours spent watching television or video games. As regards abdominal obesity, in addition to factors mentioned above, associated factors were lack of regular sports activity and exercises and prematurity. Prevalence of abdominal obesity was more significantly higher in primary school students with overweight and obesity than in those with normal weight ( $p=0.000$ ).

**Conclusion:** There are overweight, obesity and abdominal obesity in the schools of Porto-Novo and risk factors were identified. It is advisable to extend the study to a larger population of children and raise awareness among the community about those scourges.

### Keywords

Prevalence of overweight; Obesity and abdominal obesity; Risk factors for obesity and abdominal obesity

## Introduction

According to the WHO estimates, more than 75% of overweight children live in developing countries. In Africa, their number has doubled over the past 20 years. In the absence of any action or

response, those children with obesity are likely to remain in that condition till their adolescence and adult age [1,2]. School-aged children are also affected as demonstrated by two African studies which reported significant prevalences of obesity and overweight [3,4]. Obesity exposes children to several diseases e.g. cardiovascular, metabolic, orthopedic and even cutaneous diseases [5]. A better assessment and measurement of cardio-metabolic risk is possible through abdominal obesity. In this context, a study carried out in 2010 in Bogalusa in the United States of America among children aged 4 to 18 years had disclosed that 9.2% of children with normal weight had abdominal obesity versus 80.2% for children with overweight (excess weight and obesity) [6]. The data available on prevalence and risk factors for excess weight, obesity and abdominal obesity are limited in Sub-Saharan Africa and more particularly in Benin. That is the reason why the purpose of this study is to determine the prevalence and risk factors associated with overweight and abdominal obesity among 5-12 year students enrolled in primary schools of the city of Porto Novo. This research work is conducted with a view to contribute to the management of both scourges.

## Methods

This medical research work was a cross-sectional, descriptive and analytical study focused on students aged 5 to 12 years attending government and private primary schools in Porto-Novo. It was carried out from December 2016 to May 2017. We investigated overweight (excess weight and obesity) and abdominal obesity in those children. The study included primary school students in the above-mentioned age group whose parents and education authorities had given their consent and permission. It did not include physically disabled school students whose disability is related to locomotion.

We calculated sample size according to Schwartz formula and used 10.7% prevalence of obesity among high school students found in 2013 in Cotonou according to an unpublished study. The samples were generated using a three-stage random sampling. Overall, 651 primary school students were included in the study. We conducted a structured individual interview with each child respondent in cooperation with his/her teachers and parents. Then, we made the physical measurements of each child and his parents. Weight was taken by means of an electronic scale of "OMRON" brand. Student or his parent was undressed but kept at least lightweight underwear; then he/she climbed barefoot on the bathroom scales placed on a flat and stable surface. His/her weight corresponded to the figure displayed. Size was measured with a standing stadiometer. The participant stood firm, with arms swinging up his body, the feet together and firmly on the ground, the knees stretched out, and the heels in contact with the stadiometer while looking straight ahead. Then, the sliding horizontal rod was put down the head by compressing hair to get a firm and closer contact. Size was directly read on the stadiometer in centimeters. Abdominal circumference (waist circumference) was measured using a tape measure on a child standing, breathing out (end of normal breathing out), midway between the last rib and the iliac crest. To assess students' weight status, we used BMI charts in z-score from 5 to 19 years published by the WHO in 2007 and reinterpreted in 2013 [7,8]. According to those charts, normal weight is defined by a BMI between -2 and +1, overweight by a BMI higher

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than 1 zs and obesity by a BMI above 2 zs, taking into account age and sex. We assessed cardiovascular risk associated with abdominal adiposity by calculating waist to height ratio (WHR) which, if higher than 0.5, indicates an excess of abdominal fat that suggests risk for cardiovascular disease [9]. The variables collected were sociodemographic, related to personal physiological and pathological history of the child, family health history, behavioral habits (dietary patterns, practice of physical activity and sedentary lifestyle) and physical examination data (weight, size and waist circumference). Data were collected using a questionnaire. The software EPI-DATA 3.1 served for their entry and software EPI-INFO 7 was used for data analysis and processing by systematically excluding inaccurate and non-response data. The qualitative variables were described using percentages and their confidence interval. As regards quantitative variables, they were described using averages and standard deviations. Frequencies were compared by means of Chi-square test and averages were compared using Student's test. P-value less than or equal to 0.05 was considered as statistically significant.

## Results

### Characteristics of the respondents

**Sociodemographic features:** Primary school students in 5-7 year age group (40.9%; 266/651) were predominant followed by those in 8-10 year age group (31.6%; 206/651) and eventually those aged more than 10 years (27.5%; 179/651). Respondents' mean age was 8.1 years  $\pm$  1.9 years and sex ratio was equal to 0.8. More than six out of ten children (65.6%; 427/651) came from a family with average socioeconomic status. That socioeconomic status was low in the parents of 188 students (28.9%) and high in 36 parents of student (5.5%; 36/651). In more than half of cases (56% ; 358/651), family size was >6 persons, followed by size oscillating between 4 and 6 persons (40.7%; 265/651) and size <4 persons in 28 cases (4.3%). Concerning educational background or status, 194 mothers (29.8%) did not attend school, 227 had primary school level (34.9%), 88 had secondary school first cycle level (13.5%), 93 had secondary school 2nd cycle level (14.3%) and 49 had higher education level (7.5%). Among the fathers interviewed, 81 were not educated (12.5%), 203 had primary school level (31.2%), 115 had secondary school 1st cycle level (17.7%), 129 with secondary school 2nd cycle level (19.8%) and 122 had higher education level (18.8%).

**Health history:** As far as personal and family health history is concerned, population size varied according to the health history investigated, for we did not have the opportunity of getting information on all the 651 primary school students. More than eight out of ten children (87.7%; 143/163) were born full term, nine children were born before term (5.6%) and 11 were born from post-term births (6.8%). Birth weight was <2500 g in 25 students (14.2%), between 2500 g and 3500 g in 143 students (74.4%) and >to 3500 g in 20 students (11.4%). More than seven out of ten (74.5%; 484/650) were exclusively breastfed during the first six months of life, 16 children were fed with formula milk (2.5%) and 95 students benefitted from mixed feeding (14.6%). Among the 194 mothers who were present, approximately three out of ten (29.4%; 57/194) were with excess weight and two out of ten (23.2%; 45/194) were obese. Three mothers were very thin (1.5%) and weight was normal in 89 cases (45.9%). Among the 61 fathers present, nearly three out of ten (29.5%; 18/61) had excess weight and one out of ten (9.8%; 6/61) was obese. Three fathers were very thin (4.9%) and 34 of them had a normal weight (55.7%).

**Dietary patterns:** More than eight out of ten children (87.4%; 569/651) used to take three to four meals per day. Roughly three out of four children (71.1%; 463/651) snacked sweet cakes everyday. More than nine out of ten children (97.1%; 632/651) had an insufficient intake of fruits and vegetables. Those findings are indicated in Table 1.

**Physical activity and sedentary lifestyle:** Six out of ten children (64.2%; 418/651) went to school on foot or by bicycle and three out ten (31.6%; 206/651) went with motor vehicles. Among the 454 primary school students walking or using bicycle as means of displacement or transport, about seven out of ten (67.2%; 305/454) took at least 15 minutes to cover the distance. Three out ten children (32.1%; 209/651) spent more than four hours watching television or playing games with a tendency to sedentary position on rest days. The findings mentioned above are summarized in Table 2.

### Prevalence and factors associated with overweight

Overall prevalence of overweight was estimated at 8.6% (56/651) including 6.5% (42/651) of excess weight and 2.1% (14/651) of obesity. Table 3 outlines the factors associated with excess weight and obesity.

Table 1: Distribution of primary school students according to dietary patterns, Porto-Novo, 2017.

Variables	Population size	Percentage (%)
<b>Number of meal per day</b>		
3 to 4 meals	569	87.4
Less than 3 meals or more than 4 meals	82	12.6
<b>Sweetened drinks</b>		
Yes	111	17.1
No	540	82.9
<b>Candy/chocolates</b>		
Yes	250	38.4
No	401	61.6
<b>Sweet cakes</b>		
Yes	463	71.1
No	188	28.9
<b>Fruits/Vegetables</b>		
<5 portions	632	97.1
$\geq$ 5 portions	19	2.9
Total	651	100

**Table 2:** Distribution of primary school students according to physical activity and sedentary lifestyle, Porto-Novo, 2017.

Variables	Population size	Percentage (%)
<b>Displacement to get to school (N=651)</b>		
Walking	418	64.2
Bicycle	5	0.8
Motorbike/car	206	31.6
Varied	22	3.4
<b>Trip length on foot or with bicycle (N=454)</b>		
<15 mn	305	67.2
15-30 mn	135	29.7
≥ 30 mn	14	3.1
<b>Regular physical activity (N=651)</b>		
Yes	236	36.2
No	415	63.8
<b>Television, video games and smart-phone on working days (N=651)</b>		
Nil	338	51.9
<1 h	154	23.7
1 – 2 h	110	16.9
>2 h	49	7.5
<b>Television, video games and smart-phone on working days (N=651)</b>		
Nil	179	27.5
<2 h	120	18.4
2 – 4 h	143	22.0
>4 h	209	32.1
<b>TV set in the child room (N=651)</b>		
Yes	43	6.6
No	608	93.4

**Table 3:** Factors associated with excess weight and obesity

Variables	Excess weight n %	Obesity n %	Total	p	
<b>Mother's educational status</b>				<b>0.026</b>	
Uneducated	9	4.6	1	0.5	194
Primary school	17	7.5	3	1.3	227
Secondary school 1st cycle	4	4.5	1	1.1	88
Secondary school 2nd cycle	9	9.7	5	5.4	93
Higher education	3	6.1	4	8.2	49
<b>Socioeconomic status</b>				<b>0.0029</b>	
Low	7	3.7	2	1.1	188
Average	32	7.5	8	1.9	427
High	3	8.3	4	11.1	36
<b>Nutrition during the first 6 Months of life</b>				<b>0.0001</b>	
Exclusive breastfeeding	18	3.7	6	1.2	484
Mixed nutrition	15	15.8	5	5.3	95
AF*	2	12.5	1	6.2	16
Others	7	12.7	2	3.6	55
<b>Number of meals per day</b>				<b>0.0442</b>	
3 - 4 meals	31	5.4	13	2.3	569
< 3 ou > 4 meals	11	13.4	3	3.6	82
<b>Snacking of sweet cakes ≥ Once a day</b>				<b>0.0085</b>	
Yes	36	7.8	14	3.0	463
No	6	3.2	0	0.0	188
<b>Displacement to get to school</b>				<b>0.0056</b>	
Walking	23	5.5	2	0.5	418
Bicycle	0	0.0	0	0.0	5
Motorbike or car	18	8.7	11	5.3	206
Varied	1	4.5	1	4.5	22

Television/video games and smart- phone on working days						0,0069
Nil	11	3.2	8	2.4	338	
< one hour	10	6.5	2	1.3	154	
1 - 2 hours	13	11.8	2	1.8	110	
> 2 hours	8	16.3	2	4.1	49	

note : AF : artificial feeding

Table 4: Factors associated with abdominal obesity.

Variables	Abdominal obesity			
	Total (N)	Yes (n)	Percentage (%)	P
<b>Age (Years)</b>				<b>0.0115</b>
5-7 years	266	33	12.4	
8-10 years	206	12	5.8	
> 10 years	179	7	3.9	
<b>Term of pregnancy</b>				<b>0.0357</b>
<37 Weeks of Amenorrhrea (WA)	9	3	33.3	
37-40 WA	143	11	7.7	
> 40 WA	11	1	9.1	
<b>Nutrition during the first 6 months of life</b>				<b>0.001</b>
Exclusive breastfeeding	484	30	6.2	
Mixed food	95	8	8.4	
AF	16	4	25.0	
Others	55	10	18.2	
<b>Snacking of sweet cakes ≥ Once per day</b>				<b>0.0251</b>
Yes	463	43	9.3	
No	188	9	4.8	
<b>Trip length</b>				
< 15 mn	305	30	9.8	
15-30 mn	135	4	3.0	
≥ 30 mn	14	0	0,0	
<b>Regular sport activity</b>				<b>0.0031</b>
Yes	236	10	4.2	
No	415	42	10.1	
<b>Television /video games and smart-phone on working days</b>				<b>0.0004</b>
Nil	338	15	4.4	
< one hour	154	15	9.7	
1 - 2 hours	110	12	10.9	
> 2 hours	49	10	20.4	

### Prevalence and factors associated with abdominal obesity

Prevalence of abdominal obesity was equal to 8% (52/651). Factors associated with abdominal obesity are shown in Table 4.

### Relationship between abdominal obesity and students' weight

Occurrence of abdominal obesity was noted in 57.1% of subjects with obesity, in 50% of primary school students with excess weight and in 4.3% of children who had normal weight, with significant difference (p=0.0000).

### Discussion

There is overweight in all countries around the world and at all ages. It is estimated at 8.6% in this study. Other two studies carried out in Benin and in a country of the West African region, among the general population or in school settings on children of the same age group, have found out similar values [10,11]. High prevalences were noted in other African countries: 14.7% in Ethiopia in 2017

amongst adolescents with mean age estimated at  $13.1 \pm 1.4$  and 18.6% in Algeria among primary school students aged 6 to 12 years [12,13]. Developing countries are thus exposed to the phenomenon of double burden of malnutrition (DBM) characterized by increasingly higher prevalences of overweight associated with changes in lifestyle. If prevalence of overweight is increasingly becoming a problem, obesity which is its most hazardous component is a matter of serious concern. Prevalence of obesity was estimated at 2.1% in this research work. Three African authors have reported higher prevalences in their studies. This gap would be due to the standards used by those authors (IOTF standards or the American standards); it may also be due to respondents' age. Many of them had reached the age of puberty which, according to literature data, implies a more or less significant increase in body fat mass [12-14]. Although they are lower, all those prevalences gradually tend to the ones of two developed countries: from 2% to 5% of children and adolescents in Switzerland in 2008 [15], 10% to 12% of French citizens aged 5-12 years [16]. The association of high socioeconomic status (p=0.0029) with prevalence of excess weight and obesity in developing countries has

been reported by many African researchers [10,17,18]. In contrast, in developed countries, low socioeconomic status is an enabler of occurrence of overweight [15,19]. In both situations, the relationship between overweight and socioeconomic status would be explained by an increased availability of foods high in fat and sugar; it may also be due to lack of access to choices of healthy foods as illustrated by these words: (we eat whatever is available).

As described in literature [20], the beneficial and protective effect of breastfeeding in the first six months of life has been confirmed by this study ( $p=0.0001$ ). Concerning the dietary patterns assessed in the study, excess weight and obesity were significantly associated ( $p=0.0442$ ) with meal skipping and the fact of taking more than four meals a day, frequent snacking of sweet cakes ( $p=0.0085$ ). As a matter of fact, skipping of meals encourages snacking and, in addition, subjects tend to make up for lost meals by increasing energy inputs [21]. Besides, the frequent intake of sweetened foods and/or snacking of food pave the way for occurrence of overweight [10,22]. We have identified a significant association between prevalence of overweight and physical inactivity as well as sedentary lifestyle. For instance, this study has highlighted that the students walking or using bicycle as a means of transport were less obese ( $p=0.0056$ ). It has also pointed out that prevalence of excess weight and obesity among primary school students declined according to trip length i.e. time taken to cover the distance between their residence and school. Those results are compatible with the ones published in literature [23,24]. Moreover, in this research work, the number of hours spent watching television on working days is a factor statistically associated ( $p=0.0069$ ) with excess weight and obesity. These findings confirm those reported in another study [25]. The fact of reducing the length of time spent watching television would enable the child to move more, eat better (less snacking) and experience less influences from advertising concerning foods high in fat and sugar.

Abdominal obesity research is a critical issue. Indeed, obesity is certainly a risk factor for cardiovascular risk but that risk is more common if there is concentration of fats in the abdomen. Waist-to height ratio helps determine cardiovascular risk not only in subjects with overweight but also in those with normal weight [26]. Among the 651 subjects included in this study, 52 had abdominal obesity i.e. a prevalence of 8%. This prevalence declined significantly with age ( $p=0.0115$ ). Exclusive breastfeeding and physical activity seemed to be protective factors. In contrast, this prevalence of abdominal obesity was higher according to snacking of sweet cakes and number of hours spent watching television and playing video games. Two other authors have emphasized the role of insufficiency or absence of physical activity in the occurrence of abdominal obesity [22,26]. Besides, in this study, among the 56 primary school students with overweight (excess weight and obesity), 29 had abdominal obesity i.e. a prevalence of 51.8% versus 4.3% of the 530 subjects with normal weight. This suggests that one can have a normal weight i.e. in adequacy with size and age and also present with high/significant risk for cardiovascular disease. In addition, overweight represents an additional risk for cardiovascular disease [6]. Therefore, we should have a keen interest in fighting that scourge.

## Conclusion

Overweight prevalence was estimated at 8.6% including 6.5% for excess weight and 2.1% for obesity. Abdominal obesity prevalence was equal to 8%. All those prevalences increased significantly depending on socioeconomic status, everyday snacking of sweet

cakes and number of hours spent watching television on a working day. They were also higher in primary school students who moved to their educational center with motor vehicles. Exclusive breastfeeding appears to be a protective factor as well as walking and bicycle riding. Furthermore, 4.3% of the students who had a normal weight presented with cardiovascular risk versus 50% and 57.1% respectively for students with excess weight and obesity. Therefore, to reduce the prevalence and incidence of overweight and abdominal obesity, awareness among parents and children on good dietary patterns and regular practice of sports is required. Moreover, monitoring of child weight gain and height growth is also necessary.

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