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Overweight and obesity, link with sedentary indicators

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Abstract

The question of physical inactivity and sedentary behavior is a major public health issue. According to the World Health Organization (WHO), a sedentary lifestyle makes two million people dead each year in the world. There is a strong link between obesity and sedentary life, and the long-term consequences are particularly worrying for the child. The objective of this study is to estimate the prevalence of obesity and describe its association with indicators of sedentary lifestyle among high school students in central Algiers.

It is a descriptive cross-sectional study on 2355 students of both sexes. Body mass index and waist circumference information was collected by anthropometric measures, while lifestyle by a self-administered questionnaire. The results reveal: 24.5% overweight (obesity included) and 20.8% abdominal obesity more present in boys ($p < 0.01$). An association between obesity-time spent in front of the television and weight gain-sleep duration was noted. These results challenge educators to invest in school sports.

1. Introduction

The prevalence of obesity is increasing in both children and adults. The long-term consequences are particularly worrying for children.

According to World Health Organization (WHO), about 10% of children and adolescents aged 5 to 17 are affected by obesity worldwide. In addition, many international publications have found a significant association

between obesity, metabolic disorders, cardiovascular pathologies and respiratory disorders (Peppard et al., 2000).

The rapid increase in overweight and obesity in children has been accompanied by an increase in sedentary leisure time such as video games, Internet and computer games. Television is the leading cause of inactivity for most children and adolescents in developed countries, and this fact linked to the prevalence of obesity, Dietz, Gortmaker (1985); Gortmaker et al., (1996).

The question of physical inactivity and sedentary behavior is a major public health issue. According to the World Health Organization (WHO), every year in the world, the sedentary lifestyle makes two million victims. Two million deaths from cardiovascular diseases, diabetes or obesity are due to lack of physical activity. The sedentary lifestyle has become a real scourge of modern times, Hala (2008).

The way of life has changed, everything contributes to physical passivity. 60% to 85% of adults in the world do not get busy enough to stay healthy. Developed countries are far from being alone.

In Algeria, some regional surveys on the prevalence of childhood obesity (Constantine 2005, Sidi BelAbbes 2007, Sétif 2006, and Algiers 2014) have all shown the extent of this epidemic and its relationship with sedentary life, but we do not have yet national data.

Aware of the close link between obesity and sedentary lifestyle on the one hand, and particularly worrying consequences for the children that can cause long-term obesity on the other hand, we asked the following question: what are the proportions of overweight adolescents at high school and what is the relationship with the indicators of sedentarity? Our objective is therefore to estimate the prevalence of overweight and obesity and to analyze its association with sedentary indicators among high school students in central Algiers. The study is descriptive and cross-sectional on a representative sample of students from public secondary schools in Algiers.

2. Methods and Materials

2.1. Participants

The study is a descriptive cross-sectional, with a representative sample of students of both sexes between 15 and 18 years old, enrolled in the public

secondary schools of the Algiers center Academy.

This study is based on simple sampling: the draw was conducted at each level to determine classes and thus the number of students.

The number of subjects needed was estimated at 2355 students (1316 girls and 1039 boys), it was calculated by the software EPI ONFO 6 from an expected prevalence of overweight / obesity to 10%, a risk α of 5% and a precision of 2%.

2.2. Materials

Information for performing anthropometric measurements was provided to health personnel. The body mass index (weight / height²) was used to define overweight and obesity according to the International Obesity Task Force (IOTF) and waist circumference (WC) references to define abdominal obesity (android) according to the references of Taylor et al., (2000).
In addition, a self-questionnaire completed by parents focused on the lifestyle of children.

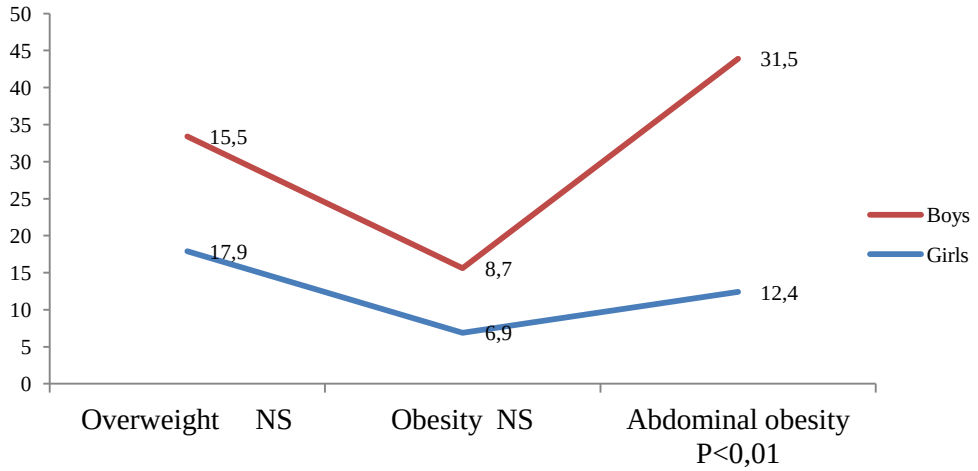
2.3. Statistical Analysis

All data collected was coded and captured on Epi-Info version 6 software (CDC, Atlanta, USA). The qualitative variables were compared using the chi-square test or possibly Fisher's test in case of reduced numbers.

Quantitative variables were compared using the t-test or possibly the Wilcoxon test in case of reduced numbers. A P value < 0.05 was considered significant.

3. Results

Figure1. Prevalence of overweight by sex

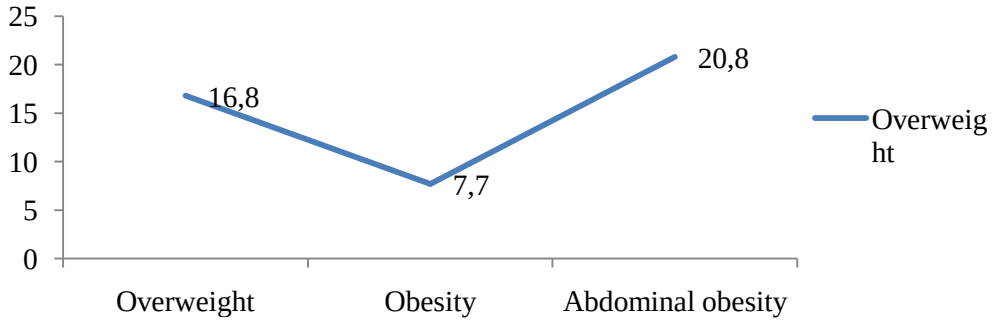


15.5% overweight (obesity not included) for boys and 17.9% for girls, with no statistically significant difference between both sexes.

The prevalence of obesity is not significantly different between sexes, 8.7% for boys and 6.9% for girls.

The distribution of abdominal obesity by sex shows a clear male predominance, 31.5% for boys against 12.4% for girls ($p < 0.01$).

Figure2. Prevalence of overweight (both sexes)



16.8% of students are overweight (obesity not included), 7.7% of students are obese and 20.8% have abdominal obesity.

Determinants of sedentarity

Table1. ***Average duration in hours per 24 hours spent in front of the television or DVD among students (during school days)***

Form of obesity	group	Mean in hours	Standard deviation in hours	P
Obese	181	2.2	1.4	0.1
Non obese	2174	2.4	1.5	
Abdominally Obese	490	2.3	1.5	0.2
Non abdodominally obese	1865	2.4	1.5	
Overweight	396	2.3	1.5	0.8
Non overweight	1959	2.5	1.5	

Students spend on average per class day (+/- standard deviation), 2.5 +/- 1.5 hours watching TV or DVDs. With a median (min-max) of 2, (0 - 12) hours. The mean is not statistically different between different forms of obesity and normo-weight.

Table2. ***Average duration in hours per 24 hours spent in front of the television or DVD among the pupils studied (Holidays and weekends)***

Form of obesity	group	Mean in hours	Standard deviation in hours	P
Obese	181	5.3	3.1	0.03
Non obese	2174	5.3	3.0	
Abdominally Obese	490	5.1	3.0	0.02
Non abdodominally obese	1865	5.3	3.0	
Overweight	396	5.3	3.03	0.8
Non overweight	1959	5.3	3.01	

Students spend on average per class day (+/- standard deviation), 5.3 +/- 3.1 hours watching television or DVDs. With a median (min-max) of 5, (0 - 12) hours. The mean is statistically different between obese and non-obese, abdominally obese and abdominally non obese.

Table3. ***Average duration in hours per 24 hours spent in front of the computer of students studied (school days)***

Form of obesity	group	Mean in hours	Standard deviation in hours	P
Obese	181	1.5	1.4	0.05
Non obese	2174	1.5	1.5	
Abdominally Obese	490	1.54	1.52	0.03
Non abdodominally obese	1865	1.47	1.49	
Overweight	396	1.3	1.4	0.004
Non overweight	1959	1.5	1.5	

Students spend an average of 1.5 hours per class day (+/- standard deviation) in front of the computer. With a median (min-max) of 1, (0 - 10) hours. The mean is statistically different between abdominally obese and abdominally non-obese, overweight and non-overweight.

Table4. ***Average duration in hours per 24 hours spent in front of the computer among students studied (holidays and weekends)***

Form of obesity	group	Mean in hours	Standard deviation in hours	P
Obese	181	5.12	3.71	0.0002
Non obese	2174	4.18	3.32	
Abdominally Obese	490	4.73	3.50	0.0004
Non abdodominally obese	1865	4.13	3.31	
Overweight	396	3.94	3.40	0.04
Non overweight	1959	4.32	3.35	

Students spend on average per class day (+/- standard deviation), 5.1 +/- 3.71 hours in front of the computer. With a median (min-max) of 5, (0 - 15) hours. The mean is statistically different between obese and non-obese, abdominally obese and abdominally non-obese, overweight and non-overweight.

Table5. ***Average duration in hours per 24 hours spent playing games among students studied (school days)***

Form of obesity	group	Mean in hours	Standard deviation in hours	P
Obese	181	0.20	0.68	0.002
Non obese	2174	0.43	0.99	
Abdominally Obese	490	0.44	1.06	0.4
Non abdodominally obese	1865	0.40	0.95	
Overweight	396	0.27	0.72	0.002
Non overweight	1959	0.44	1.01	

Students spend on average per class day (+/- standard deviation), 0.4 +/- 1 hours playing video games. With a median (min-max) of 0, (0 - 12) hours. The mean is statistically different between obese and non-obese, overweight and non-overweight.

Table6. ***Average duration in hours per 24 hours spent playing video games among students studied (holidays and weekends)***

Form of obesity	group	Mean in hours	Standard deviation in hours	P
Obese	181	1.19	2.57	0.04
Non obese	2174	1.59	2.56	
Abdominally Obese	490	1.69	2.71	0.2
Non abdodominally obese	1865	1.53	2.52	
Overweight	396	1.12	2.16	0.0001
Non overweight	1959	1.65	2.63	

Students spend on average per class day (+/- standard deviation), 1.69 +/- 2.71 hours playing video games. With a median (min-max) of 1, (0 - 15) hours. The mean is statistically different between obese and non-obese, overweight and non-overweight.

Table7. ***Average time in hours per 24 hours spent learning lessons or doing homework (without a computer) among students studied (school days)***

Form of obesity	group	Mean in hours	Standard deviation in hours	P
Obese	181	1.45	1.14	0.02
Non obese	2174	1.67	1.26	
Abdominally Obese	490	1.43	1.18	0.00001
Non abdodominally obese	1865	1.71	1.27	
Overweight	396	1.71	1.22	0.4
Non overweight	1959	1.64	1.26	

Students spend on average per class day (+/- standard deviation), 1.71 +/- 1.27 hours learning lessons or doing homework (without a computer). With a median (min-max) of 1, (0 - 8) hours. The mean is statistically different between obese and non-obese, abdominally obese and abdominally nonobese.

Table8. ***Average time in hours of sleeping per night among students studied When there is a class the next day***

Form of obesity	group	Mean in hours	Standard deviation in hours	P
Obese	181	7.59	1.09	0.0002
Non obese	2174	7.92	1.17	
Abdominally Obese	490	7.72	1.10	0.0001
Non abdodominally obese	1865	7.94	1.19	
Overweight	396	7.80	1.16	0.1
Non overweight	1959	7.91	1.17	

Students spend on average per class day (+/- standard deviation), 7.94 +/- 1.17 hours of sleep per night. With a median (min-max) of 8, (4-11) hours. The mean is statistically different between obese and non-obese, abdominally obese and abdominally non obese.

Table9. ***Average nap time in hours among students studied***

Form of obesity	group	Mean in hours	Standard deviation in hours	P
Obese	181	0.54	0.97	0.01
Non obese	2174	0.88	1.26	
Abdominally Obese	490	0.67	1.03	0.0001
Non abdodominally obese	1865	0.92	1.29	
Overweight	396	0.75	1.11	0.03
Non overweight	1959	0.89	1.27	

Students spend on average per class day (+/- standard deviation), 0.92 +/- 1.29 hours napping. With a median (min-max) of 0, (1 - 6) hours. The mean is statistically different between obese and non-obese, abdominally obese and abdominally non-obese, overweight and non-overweight.

4. Discussion

The results of our work show that high school students with a BMI and / or a significant waist circumference, (general obesity or abdominal obesity) are those who watch more television and DVDs (on average, 5.3 hours / day) or stay in front of their computer (4.3 hours / day) to work or play video games on weekends or holidays ($p < 0.05$). However, this relationship is not statistically significant for overweight children (obesity not included).
Thibault et al. (2010) stated that adolescents' sedentary behavior (22 hours or more of sedentary activity per week) was significantly associated with the risks of being overweight ($p < 0.05$) and obese ($p < 0.05$), after adjusting for other factors and the study monitored by Andersen et al. (1998), shows a positive association between time passed in front of television and obesity.
Our results may be consistent with those of this study, if we take into account only the sedentary behavior of high school students observed on weekends and holidays. But if we consider the sedentary behavior on school days (during the week), our results will be in contrast.
In contrast, the results we obtained for sedentary behavior during the study week are consistent with other studies, Vignerova et al. (2004) and

Oulamara (2005), were unable to identify the sedentary behavior of adolescents as a risk factor for overweight and obesity.

Through these results, we can say that BMI and / or high waist circumference are indices that, in any case, are indirectly related to sedentary behavior (watching television, working on a computer or doing homework at home). This behavior would significantly reduce the student's energy expenditure.

In fact, a study conducted in Sweden among healthy teenagers confirmed that the level of energy expenditure was inversely correlated with sitting time. The most sedentary subjects move three to four hours less than the more active ones per day, Frelut (2001).

Also, Robinson's (1999) study shows an average time per child of 2 to 17 years spent in front of TV or video games (4.5 hours a day), which gives us a total of 5 years of extra sleep in terms of energy expenditure, Dubot-Guais (2005, p. 148).

In addition, a Canadian survey found that sedentary people during their leisure time are more likely to be obese than those who are physically active. For example, in the 2004 Statistics Canada Survey, 27.0% of sedentary men were obese compared to 19.6% of employed men. Regarding women, rates of obesity were high not only for those who were sedentary in their free time, but also for those who were moderately active (ESCC, 2004).

Watching TV or sitting in front of the computer could not be the only reason for increasing BMI and / or waist circumference. It should be added that watching television or working with the computer encourages food intake, usually foods with high energy density and low nutritional density (sweet, salty and fatty products).

Moreover, in the United States, a study has shown that the risk of overweight related to time spent watching television increases considerably with parental obesity. It is multiplied by three when only one parent is obese and by ten when both are obese, Steffen et al. (2009).

The results for average sleep time per night during the week show that children with general obesity and abdominally obese sleep less than normal weight subjects ($p < 0.01$). Mean of (7.59 hours / night versus 7.92 hours) for the obese and (7.72 hours / night versus 7.94 hours for the abdominally obese.

As with napping, our results show that people who are overweight (overweight, general obesity, and abdominally obese) sleep on weekends and holidays less than normo-weights. Mean (0.54 hours versus 0.88) for

the obese (p = 0.01) and (0.67 hours versus 0.92) for the abdominally obese (p <0.01) and 0.75 hours versus 0.89 hours for the overweight (p <0.05).
The analysis of our results leads to the same conclusions reported in the literature, including the demonstration of a significant dose-response relationship between the duration of sleep and the risk of obesity in children. In other words, children with shorter sleep duration had a higher risk of being overweight or obese.
Many of these studies have been conducted in industrialized countries; in this case, in the United States we will quote the meta-analysis of Cappuccio et al. (2008), reported by H.A.S (2011, p. 49) who examined only from cross-sectional studies, the relationship between sleep duration and obesity at different ages and concludes that children whose duration of sleep was shorter had a higher risk of being obese.
Another meta-analysis of Chen et al. (1993), reported by H.A.S (2011, p. 49) examined only from cross-sectional studies the relationship between sleep duration and obesity in childhood. Children with shorter sleep duration had a 58% higher risk of being overweight or obese. Children with the shortest sleep duration were 92% more likely to be overweight or obese than children with the highest sleep duration. The study adds that for each additional hour of sleep, the risk of overweight or obesity decreased by 9%.
All of these studies, including ours, do not allow us to conclude in terms of causality, especially that sleep times were self-reported using questionnaires, which can lead to information biases. Moreover, these studies are of the transversal type, so they do not allow us to know if the lack of sleep was a cause or a consequence of overweight and obesity at the children.
The hypotheses evoked to explain the significant dose-response relationship between the duration of sleep and the risk of obesity are, as reported by A.N.A.E.S (2003), in the first place, a low level of physical activity leading to hyposomnia, a high number of hours spent in front of the television that prevent you from going to bed early. Secondly, the quality of sleep of obese subjects may be less because of obstructive syndrome and finally, sleep of obese children could be disrupted by variations in hormonal factors such as serotonin.

5. Conclusion

Our children are obese: 24.5% overweight (obesity included), 20.8% abdominal obesity. The Abdominal obesity is more prevalent in boys 32.5%

than in girls 12.4% (p <0.01). Children with a BMI and / or large waist circumference are those who watch more television or stay in front of their computer. Furthermore, children with shorter sleep duration had a higher risk of being overweight or obese.

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