Afkar wa Affak, volume 8, numéro 1, année 2020 pp. 317 - 328

School stress: a risk factor for obesity

الضغط المدرسي: عامل مخاطرة للسمنة

Le stress scolaire: facteur de risque d'obésité

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Submission date: 28-10-2019 - **Acceptance date**: 01-12-2019 - **Publication date**: 28-07-2020

ملخص

إن الضغط المدرسي يشكل عنصرا معروفا بقدرته على زيادة مخاطر السلوك الصحية البدنية والنفسية عند الأطفال والمراهقين. أوضحت العديد من الدراسات الابيديميولوجية وجود علاقة الضغط المدرسي والزيادة في الوزن. إدراكا للعلاقة الوطيدة بين السمنة والضغط المدرسي من جهة، والمخلفات المقلقة والمترتبة عن السمنة على المدى الطويل من جهة أخرى فان الدراسة الحالية تهدف إلى تقييم مستوى الضغط المدرسي عند التلاميذ بصفة عامة، كما أنها تهدف إلى إيجاد علاقة بين الضغط المدرسي ومختلف أشكال السمنة الملاحظة ضمن هذا المجتمع بصفة خاصة. دراستنا عرضية و ذات طابع وصفي أقيمت على عينة ممثلة قدرت ب 2355 تلميذ. أظهرت النتائج أن ثلث العينة المدروسة يعاني من ضغط مدرسي عال، 16.8٪ من التلاميذ بوزن زائد من (السمنة غير مدرجة)، و7.7٪ في وضع السمنة المفرطة و20.8٪ يمثلون السمنة البطنية. ومن جانب آخر كشفت الدراسة عن وجود فرق ذي دلالة إحصائية بين شكلي السمنة (الشاملة والبطنية) والتلاميذ الذين يعانون من ارتفاع مستوى الضغط المدرسي، على التوالي ع <0.05 و ع < 0.01 (p<0.05 و p<0.01).

الكلمات الدالة: السمنة؛ الضغط المدرسي؛ المتمدرسين في الثانوي؛ عامل مخاطرة.

Abstract

Stress is a well-known factor that increases the risk of developing physical and mental health problems in children and adolescents. Numerous epidemiological studies have shown a link between stress and weight gain. Conscious of this close link between obesity and stress on the one hand, and particularly worrying consequences for the child that can cause long-term obesity on the other, the present study aims to evaluate the level of school stress among a population of students and establish the link with the different forms of obesity observed among this population. The study is of the descriptive and cross-sectional type, and involves a representative sample estimated at 2355 students.

The results show that one in three students suffers from high school stress, 16.8% of overweight students (obesity not included), 7.7% of obese students and 20.8% of those with abdominal obesity. In addition, the study reveals a statistically significant difference between the two forms of obesity (general and abdominal) and students with a high level of stress, respectively $p < 0.05$ and $p < 0.01$.

Keywords: obesity; stress; high school students; risk factor.

Résumé

Le stress est un facteur qui augmente le risque de développement des problèmes de santé physique et mentale chez les enfants et les adolescents. De nombreuses études épidémiologiques ont montré l'existence du lien entre le stress et la prise de poids. Partant du constat que le lien entre le stress et la prise du poids pouvant entraîner une obésité à long terme chez l'enfant, la présente étude se propose d'évaluer le niveau de stress scolaire d'une population d'élèves et à établir le lien avec les différentes formes d'obésité observées dans cette population. L'étude est de type descriptif et transversal et réalisée sur un échantillon représentatif estimé à 2355 élèves. Ces résultats montrent qu'un élève sur trois souffre de stress au lycée, 16,8% des élèves sont en surpoids (obésité non incluse), 7,7% sont des élèves obèses dont 20,8% souffrent d'obésité abdominale. L'étude révèle également une différence statistiquement significative entre les deux formes d'obésité (générale et abdominale) et les élèves ayant un niveau de stress élevé, respectivement $p < 0,05$ et $p < 0,01$.

Mots-clés: obésité; stress; lycéens; facteur de risque.

Introduction

Contrary to popular belief, children and adolescents are just as likely to experience stress as adults. They are thus exposed to the consequences of stress on their health (Dumont, 2015). Indeed, stress is a well-known factor that increases the risk of developing physical and mental health problems, especially among adolescents. This period of life is marked by many upheavals and characterized by a process of building identity. In this process, it is necessary to recognize the primary role of school and school experience. Evaluation and orientation strategies based on meritocratic ideology are today decried to the extent that they can hinder this process of personal construction and in particular the development of self-esteem, leading the adolescent to experience a loss of self-confidence or even humiliation (Moyne et al., 2017).

Many studies and medical researches show the dangers of school stress on the psychological and physical balance of the child and especially if it is combined with family, environmental, hereditary, and personal contexts that favor its presence. In our study, we investigated the relationship between school stress and weight gain, which has increased dramatically in recent decades in adolescents.

Indeed, obesity today poses a complex problem; it is the crossroads of medical, social, moral, and cultural issues (Pagnini, et al., 2009; world health organization, 2003). The increase in its prevalence is a major problem influencing public health (world health organization, 1998, 2000; 2014); therefore, it represents a growing threat to health (world health organization, 1997; 2003). Even more alarming is its increasing rate in children. It has been estimated that 70% of affected adolescents will become obese as adults (Bergouignan, 2008).

Improving diet and level of physical activity is essential to address the problem of overweight, but it is only part of the solution (Vaidya, 2006). The relationship between stress and weight gain can in many cases correspond to a symbolic stress of social stress type or mental stress of professional origin or not.

Conscious of the close link between obesity and stress on the one hand, and particularly worrying consequences for the child that can cause long-term obesity on the other hand, we believe that it is necessary to know the proportion of school-aged adolescents whose level of stress is high, in order to redefine and guide the implementation of programs and teaching methods at the different levels of education, since the school is a privileged place for the establishment of prevention and promotion of health.

Thus, the general objective of this study is, on the one hand, to assess the level of school stress among a population of students and, on the other hand, to establish the link between the different forms of obesity observed in this population, with the aim of improving the working conditions of pupils and their educational well-being.

1. Methodology

It is a cross-sectional study based on a representative sample of students of both sexes, aged between 15 and 18 years old, and enrolled in the public secondary schools of the Academy of Algiers. It used a simple sample: 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 of 10%, a risk α of 5%, and a precision of 2%.

1.1. Collected information

1.1.1. Anthropometric parameters

Anthropometric measurements were performed by health professionals. Thus, the body mass index (weight/height²) was used to define overweight and obesity according to the International Obesity Task Force (IOTF) references and waist circumference (TT) to define abdominal obesity (android) according to Taylor et al. (2000).

In addition, an anonymous self-questionnaire was completed by students in class in the presence of the teacher. The different levels of stress were established by the school stress scale developed by Lotfi Abdel Bassit Ibrahim (2009). It consists of a set of items that represent the sources of school stress in students. This scale is composed of 55 items that are divided into nine dimensions.

1.2. 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, while the quantitative variables were compared using the Student's t-test or possibly the Wilcoxon test in case of reduced numbers. The materiality threshold used was 5%.

Our study required the division of the school stress variable into three levels across the percentiles by the calibration method within the group.

The degrees obtained from the application of the school stress scale follow a natural distribution. We ranked those with degrees lower than 33% in the low school stress category, while those who exceed the 66% degrees in the high

school stress category, and finally those who are between 33% and 66% degrees of the entire sample are in the middle category.

2. Results

Table 1: Distribution of students by sex

Sex	Subjects	Percentage %
Male	1039	44.1
Female	1316	55.9
Total	2355	100

Our overall sample of 2355 urban school subjects is predominantly made up of girls (55.9%).

Table 2: Prevalence of general obesity by sex

	Male		Female		RR	P
	Subjects	%	Subjects	%		
Obese	90	8.7	91	6.9		
Non obese	949	91.3	1225	93.1	1.3	0.1
Total	1039	100	1316	100		

The prevalence of obesity is not significantly different between the two sexes, as it concerns 8.7% of boys and 6.9% of girls.

Table 3: Distribution of students according to the category of stress

Categories Of school stress	Low	Middle	High	Total
School stress	643	998	714	2355
Percentage	27.30%	42.37%	30.31%	100%

Almost a third (30.31%) of the sample says they are very stressed and just under a third (27.30%) shows a low level of stress. The rest of the population (42.37%) is classified as moderately stressed.

Table 4: Prevalence of overweight (obesity not included) by category of stress

	High level of stress		Middle level of stress		Low level of stress		P
	Subjects	%	Subjects	%	Subjects	%	
Overweight	90	14	188	18.83	118	16.53	0.7
Non overweight	553	86	810	81.17	596	83.47	
Total	643	100	998	100	714	100	

For all students involved in the study, there were no statistically significant differences in the distribution of overweight (obesity not included) by level of stress.

Tableau 5: Prevalence of general obesity by category of stress

	High level of stress		**Middle level of stress**		**Low level of stress**		P
	Subjects	**%**	**Subjects**	**%**	**Subjects**	**%**	
Obese	92	14.31	54	5.41	35	4.91	0.05
Non obese	551	85.69	944	94.59	679	95.09	
Total	643	100	998	100	714	100	

The distribution of general obesity by level of stress shows a statistically significant difference ($p<0.05$). The results obtained show a rate of 14.31% of obese among the 643 students who have shown a high level of stress and a rate of 5.41% of obese among the 998 students in the category of middle level stress. Finally, only 4.91% of students classified in the range of less stressed are obese.

Table 6: Prevalence of abdominal obesity by category of stress

	High level of stress		Middle level of stress		Low level of stress		P
	Subjects	%	Subjects	%	Subjects	%	
abdominal Obesity	365	56.76	74	7.42	51	7.14	0.01
Non abdominal obesity	278	43.24	924	92.58	663	92.86	
Total	643	100	998	100	714	100	

For all students, the distribution of abdominal obesity by level of stress shows rates of 56.76% among 643 subjects, 7.42% among 998 subjects and 7.14%

among 714 subjects, respectively belonging to categories of stress, high, medium and low. These rates show a statistically significant difference ($p = 0.01$).

3. Discussion

The effect of stress on weight is extremely variable; it can range from anorexia, for acute stress, to compulsive food intake, for chronic stress, especially in restricted subjects. Numerous cross-sectional and prospective epidemiological studies have shown a link between stress and weight gain (Lecerf, 2012).

Our study highlights high prevalence of different types of obesity among adolescents in relation to the level of stress observed. Indeed, our results show an overall overweight (obesity included) in 24.6% of high school students according to IOTF references, with a slight predominance in girls (26.1%) and 25.8% among boys. Our results show that girls are slightly more affected by overweight (obesity not included), compared to boys with respective rates of 19.2% and 17.1%, but with no statistically significant difference between both sexes. On the other hand, we note the opposite for general obesity, since it is boys who are more obese than girls with rates of 8.7% and 6.9%, respectively, but with no statistically significant difference between both sexes. This female predominance has been found in other studies (Aspray et al., 2000, Musaiger et al., 2000, Zagre et al., 2001, in Oulamara, 2005).

Also, a similar study EPSP Bouzaréah (2011), for adolescents aged between 12 and 17 years old enrolled in Bouzaréah district, shows a prevalence of overall overweight (obesity included) of 18% according to IOTF (2000) standards, with 21% for girls and 15% for boys. However, in the case of obesity, the study found no significant difference between boys and girls.

Regarding the distribution of abdominal obesity by sex, our study shows a clear male predominance of the population at 31.5% for boys against 12.5% for girls. The difference between both sexes is significant with $p < 0.01$ and a relative risk of 2.5 times higher in boys. Through these results, we confirm that obesity reaches alarming proportions among Algerian adolescents. This increase in the prevalence of obesity presupposes an abnormal regulation of the energy balance and/or that of macronutrients. Indeed, many studies confirm significant correlations between sedentarity and the risk of overweight; nutritional factors

remain important elements of energy homeostasis whose failure leads to obesity (Andersen, 1998). However, obesity is primarily the result of a failure of regulatory mechanisms and is therefore not reduced to excessive consumption of nutrients. Gene-environment interactions play a crucial role here (Maffeis, 1999 and W.H.O, 1998).

Health professionals know that the causes of obesity and the mechanisms causing complications are complex and multifactorial (Bergouignan, 2008). Stress is one of those factors that would play a significant role. In fact, according to a recent English study by University College London, people with stress over a long period of time seem more likely to suffer from obesity (Gruffat, 2017).

In our work, the results concerning the level of stress in high school students go in the same direction as what the literature says (Christine et al., 2014; Glaser, 2015; Pressler et al., 2015). We found that one-third of the study population suffers from high levels of stress (30.31%). Our results are broadly in line with the study by Esparbès-Pistre et al. (2015), conducted on a population of 1130 pupils (704 girls and 426 boys), from the sixth (10 to 11 years old) to the final year (18 to 20 years old). One out of three students was very stressed in middle school or high school; the same study finds that girls were more stressed by the school situation than boys.

This high level of school stress can be explained first and foremost by the ever-increasing and constantly changing school curricula, the increasing difficulty of exams, the anguish of the teachers, the lack of leisure activities, etc. It can also be explained by the institutional, social, family and socioeconomic injunctions, by the pubertal growth and all the physical and psychological changes having an important impact on the regulation of the emotions (Braconnier, 1996).

When we compared these stressed students with their weight profile, we noted that for overweight children (obesity not included), there was no statistically significant difference between the degree of stress and the overweight of students ($p = 0.7$). However, when we compared the level of stress with obese students, there was a statistically significant difference ($p = 0.05$), that among the 181 students selected as obese, 92 had high stress and 35 had low stress, respectively 50.83% and 19.33%. In addition, regarding abdominal obesity, the link appears

even stronger with the level of stress recorded. Our results show a statistically significant difference (p = 0.01). Thus, of the 643 high-stress students, 56% are abdominally obese, and from 714 low-stress students, only 7.14% are abdominally obese. Bjorntrop, Rosmond and Jeanrenaud were the first to suggest a link between stress and abdominal obesity in particular, as well as the role played by cortisol (Lecer, 2012). Indeed, the physiological explanation for this weight gain that occurs only during periods of prolonged stress is that the body is facing an 'aggression' and reacts with a secretion of cortisol (also called stress hormone), when the level of cortisol is chronically high, it can promote weight gain by storing fats more easily. In addition, American and Australian researchers have discovered that with equal food intake, a stressed subject gained more weight. The Y2 peptide produced by the hypothalamus under stress would act on the fat mass by proliferating adipose tissue cells and endothelial cells of the wall vessels. This work confirms then the role of stress on weight gain.

On the other hand, a period of stress often results in poor food choices. Indeed, a Belgian study published in European Journal of Nutrition, establishes a link between the stress related to the passage of an examination and the occurrence of cravings pushing the student to more fast food and a lower consumption of fruits and vegetables (Riou-Milliot, 2019). Chronic stress can also lead to poor sleep habits, fatigue and resistance to regular physical activity at school and at home. Insufficient sleep is a known risk factor of obesity (Ievers-Landis et al., 2008). Stress can also have a detrimental effect on the immune system by increasing the risk of viral infections of the upper respiratory tract (Walsh et al., 2011) and further accentuate the sedentary lifestyle. In addition, an American study shows the combined effect of stress and fat that slow down the body's metabolism, to the point of causing a weight gain of 5 kilos per year (Ostermann, 2017).

Another American study that looked at 4762 adolescents, established a link between long-term family stress and being overweight. Though the impact is different depending on sex, the study confirms that being exposed to stressful situations during childhood leads to overweight or obesity during adolescence (Pressler et al., 2015). However, results from an English study have shown that high levels of cortisol for several months seemed to increase the risk of being overweight or obese, even though scientists admit not knowing whether it is a

cause or a consequence (Jackson et al., 2017). Stress can no longer be trivialized. It is pathogenic when it is negative, which is the case of social stress. Numerous cross-sectional and prospective epidemiological studies have demonstrated a link between stress and weight gain, especially at the abdominal region, and the occurrence of a metabolic syndrome and an increase in coronary risk (Lecer, 2012).

Conclusion

Our study shows that while some of the adolescents seem to be in school without too much stress, there are relatively many who say they are very stressed, with a weight profile that could become the precursor to many diseases after adolescence. Our results show that one in three students suffers from high school stress. In addition, the study reveals a statistically significant difference between the two forms of obesity (general and abdominal) and students with high levels of stress, $p < 0.05$ and $p < 0.01$, respectively. Regarding the weight profile, we note that 16.8% are overweight students (obesity not included), 7.7% are obese students and 20.8% have abdominal obesity.

Therefore, all stakeholders in the educational community (teachers, administration, school doctors and parents) are called to work together to find concrete solutions to advocate strategies to reduce stress and improve the well-being of adolescents. Detection and early management of chronic psychological and physical symptoms are essential to reduce their impact on daily life and prevent their persistence during and beyond adolescence.

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