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Original Research

Predictors of Academic Performance in High School Students: The Longitudinal ASAP Study

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ABSTRACT

International Journal of Exercise Science 15(4): 616-631, 2022. Academic performance is influenced by multitude factors. However, little is known about their relative importance and how they evolve over time. The purpose of the present study was to determine the relative importance of cognitive control, physical, psychological and sociological factors as well as lifestyle habits in predicting academic performance in high school students using cross sectional and longitudinal approaches. One hundred and eighty-five grade seventh to ninth students (mean age: 13.1 ± 1.0 years old) from a single high school completed a 3-year prospective study. Academic performance, cognitive control, physical, psychological and sociological factors as well as lifestyle habits were assessed every year during the 3-year study. Results showed that different combinations of factors were found to predict academic performance measures in both male and female students at baseline and after a 3-year period. For example, in female students, screen time and VO_2 max were found to be important predictors of academic performance, whereas working memory was the only recurring factor in predicting academic performance in male students. Moreover, our models were able to explain between 6.1 to 52.2% of the variation in the change of the different measures of academic performance. Results of the present study show that academic performance may be predicted by a wide range of multiple factors in high school students. Indeed, the factors that predicted academic performance varied between school subjects, sex and study design, highlighting the complexity of predicting academic performance in high school students.

KEY WORDS: Academic achievement, adolescents, secondary school, longitudinal design, maximal oxygen uptake, screen time

INTRODUCTION

It is well-established that education has positive impacts on various spheres of society and on people's standard of living (28). In recent decades, many policies have been implemented in order to promote access to postsecondary studies and, in turn, increase the level of education as well as the standard of living of the population (10, 28). Indeed, acceptance into postsecondary programs is usually based exclusively on academic performance of applicants, and limited enrolment programs require excellent grades in high school. Adolescence is therefore a crucial period in terms of academic performance because of the direct impact it can have on the probability of being accepted into the chosen postsecondary program. In addition, it seems that high school students have become very competitive regarding the excellence of their academic results (8). Accordingly, every element that could positively influence academic performance during high school may be helpful. Thus, having a better understanding of the various factors related to academic performance could have important implications for policymakers and stakeholders as well as for the students and their parents.

In the current literature, a multitude of student-related factors influencing their academic performance have been identified (5-7, 11, 15, 18, 19, 25, 31, 33, 37, 42, 43, 45, 47, 48, 52). Cognitive control seems to be an important factor (6, 7), with interference control and working memory appearing to be strongly related to academic performance (46, 49). In addition, physical factors such as fitness and body composition have been reported to be associated with academic performance (5, 31). Within these physical factors, cardiorespiratory fitness (VO_2 max) seems to be the most important element with regards to academic performance (9, 22). Lifestyle habits which include physical activity and screen time as well as sleeping and eating habits also appear to influence academic performance (11, 19, 25, 45, 47). Finally, psychological factors such as self-esteem, academic motivation and anxiety as well as sociological factors including socioeconomic status, ethnicity, mother tongue and religiosity were found to be associated with academic performance (15, 18, 33, 37, 42, 43, 48).

Collectively, it is obvious that the academic performance of students is influenced by multitude factors. However, little is known about their relative importance and how they evolve over time. To our knowledge, no study has examined the relationship between cognitive control, physical, psychological and sociological factors as well as lifestyle habits with academic performance in the same study in order to determine which factor may best predict academic performance. This multivariate approach may give us a better insight into a large variety of important factors involved in academic performance. Therefore, the purpose of the present study was to determine the relative importance of cognitive control, physical, psychological and sociological factors as well as lifestyle habits in predicting academic performance in high school students using a cross sectional and longitudinal approach.

METHODS

The results of this study are based on data collected within the Adolescent Student Academic Performance longitudinal project (ASAP), a 3-year prospective study conducted at a single high school in Montreal, Canada. It should be noted that this high school follows a specific educational program called the International Baccalaureate, which corresponds to an elite program in the province of Quebec. Thus, all students enrolled into this high school had excellent grades in elementary school and had to achieve an entrance exam prior to their admission. All participants and their parents or guardians were fully informed about the nature, goals and protocols of the study and gave their informed consent in writing. Inclusion criteria were: 1) to be enrolled in grade 7, 8 or 9 at the beginning in the selected school, 2) to have a normal or corrected-to-normal vision, 3) to be free of attentional disorders or neurological diseases (confounders), 4) no health conditions or physical incapacities and 5) to be able to complete standard academic performance testing (our primary outcome). In order to confirm certain inclusion criteria, participants and their parents or legal guardians completed screening questionnaires on the health condition of the adolescent. The Child Behavior Check List (1) was also used to screen for any attentional disorders. The research was carried out fully in accordance to the ethical standards of the International Journal of Exercise Science (38) and all procedures were approved by the school's administration, by its Governing board, by the school board and by the Ethics Committee of the Faculty of Science at the Université du Québec à Montréal (approval number: 2013-0100A). It should be noted that the ASAP study methods have been previously published in detail elsewhere (14, 16, 17). However, a brief description of all measures is provided below.

Participants

At the beginning of the study, 205 students were enrolled in the project, which represents 34.8% of eligible students. At the end, a total of 185 grade seventh to ninth students (mean age: 13.1 ± 1.0 years old) from the selected high school completed the 3-year follow-up (see Figure 1).

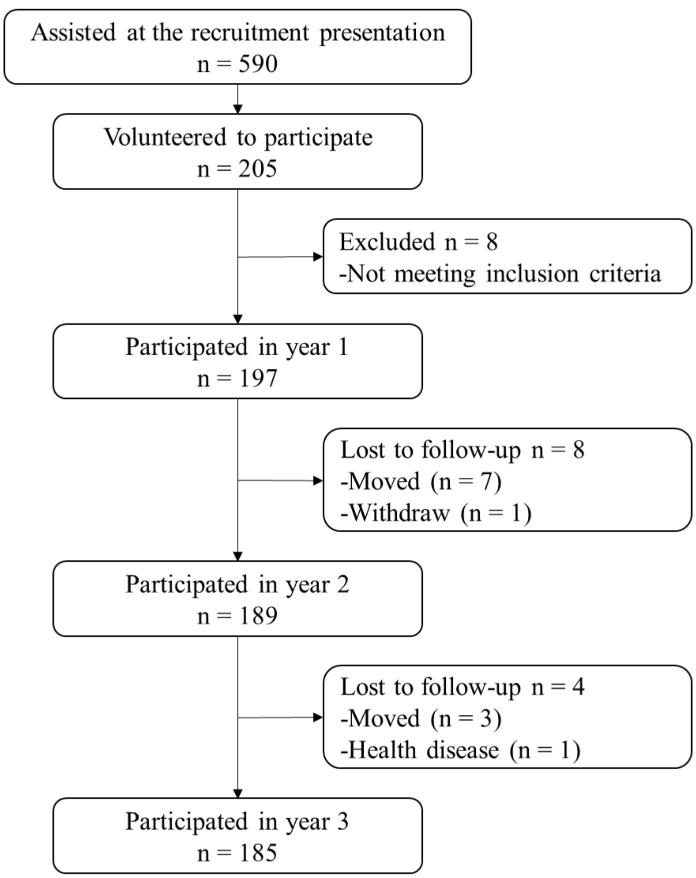

Figure 1. Participants flowchart.

Protocol
In order to control our analysis for potential cofounding factors, important information on our participants was collected. First, the age and the sex of our participants were obtained using school records and their ethnicity was self-reported using a questionnaire. Also, the pubertal status was obtained once a year using the Petersen puberty scale (40). Finally, the socioeconomic status was estimated every year using the Hollingshead four factor index of social status (29).
Academic performance was assessed every year using the school's final report card. In the present study, grades in science, mathematics, language (French) as well as the overall average of each student, in percentage, were reported. The overall average is an overall weighted average calculated by the school using the final grades, in percentage, of all courses taken by a student during the school year.

Inhibitory control was assessed every year using the Flanker task (20), as previously described (17). This cognitive task was performed using a computer and the Inquisit 4.0.9 software (Millisecond Software, WA, USA). Total congruent and incongruent accuracy, in percentage, as well as the mean reaction time (MRT) for congruent and incongruent correct answers were collected. In addition, accuracy interference was calculated by subtracting incongruent accuracy from congruent accuracy, and MRT interference was calculated by subtracting congruent MRT from incongruent MRT. Thus, greater interference scores indicate poorer performance. It should be noted that participants performed one block of 10 practice trials prior to the Flanker task.

Working memory was assessed once per year using the N-back task (32, 36), as previously described (17). This cognitive task was performed using the Inquisit 4.0.9 software (Millisecond Software, WA, USA). Accuracy, in percentage, and the MRT for correct answers in both conditions were collected. It should be noted that participants performed two blocks of 10 practice trials (one block for the 1-back condition and one block for the 2-back condition) prior to the N-back task.

Waist circumference was measured every year to the nearest 0.5 cm using a nonelastic plastic tape at the midpoint between the costal margin and the iliac crest with the participant standing upright. Skeletal muscle mass, body fat percentage and body mass index (BMI) were measured using the validated Inbody 230 multifrequency analyzer (Biospace, CA, USA) (30).

Cardiorespiratory fitness was assessed every year using the validated multistage 20-meter shuttle run test, which estimates VO_2 max. Participants ran back and forth on a 20-meter course and had to touch the 20-meter line before a sound signal was emitted from a pre-recorded tape. The estimated VO_2 max was calculated using the following validated prediction equation: VO_2 max (ml/kg/min) = 31.025 + 3.238 x S - 3.248 x A + 0.1536 x A x S, where S = speed (km/h) and A = Age (years) (34). Test-retest reliability coefficient of the multistage 20 meter shuttle run test was 0.89 for children aged between 6 and16 years old (34).

Muscle endurance was assessed every year using push-up and curl-up tests (3). The push-up test and the 60-second curl-up test have been shown to be highly reliable (r = 0.95 and r = 0.98, respectively) (4, 13).
Muscle strength and power were assessed every year using two different methods: the handgrip strength (muscle strength) and the standing broad jump test (muscle power). Maximum voluntary handgrip strength (in kg) was measured with a hand dynamometer with adjustable grip (Lafayette Instrument, IN, USA). Three attempts on each hand were performed in a setting with 1 minute of rest between each attempt. The maximum score, regardless of the hand used, was recorded. For the standing broad jump test, participants completed one practice trial followed by two trials and the longest distance (in cm) achieved from the starting line to the heel of the closest foot was recorded. Both tests have been found to be reliable in adolescents (21, 39).
Academic motivation was evaluated every year using the validated 28-item Academic Motivation Scale (50). It assesses three subscales of intrinsic motivation (toward knowledge: 4 items; toward accomplishment: 4 items; and toward stimulation: 4 items), three subscales of extrinsic motivation (identified regulation: 4 items; introjected regulation: 4 items; and external regulation: 4 items), and amotivation (4 items). Higher scores in each subscale represent higher levels of motivation except for amotivation.

Self-esteem was assessed every year using the validated 10-item Rosenberg Self-Esteem Scale (41). Higher scores represent a greater self-esteem.

The anxiety level of participants was evaluated every year with the 9-item DSM-Oriented Scales of the Youth Self-Report Child Behavior Check List (1). Higher scores represent higher levels of anxiety.

Education level, profession and employment status (unemployed, part-time or full-time job) of both parents as well as nationality, mother tongue and religious beliefs (i.e. follows a religion or is an atheist) were self-reported by the participants using a questionnaire.

Participants self-reported every year the following lifestyle habits using a questionnaire: Employment status (working or not), studying time, screen time (television, computer and video games, other computer usage and cellphone), time spent on social medias, physical activity habits (moderate to vigorous physical activity practice, the type of sports and the participation in an after-school program), eating habits (daily number of meals, daily serving of fruits and vegetables and breakfast consumption) and sleeping habits (sleeping schedule, sleep duration and sleep onset latency). Participants had to report all these habits during both the weekdays (WD) and the weekend (WE), except for employment status, studying time, moderate to vigorous physical activity practice, daily number of meals and of serving of fruits and vegetables.

Statistical analysis
It should be noted that a sex interaction was detected in our cohort using a moderated linear regression analysis. Therefore, participants were divided into two groups based on their sex

(Female: n = 115; Male: n = 70) prior to analysis. An independent t-test was used for the comparison of academic performance measures between female and male students at baseline. Cohen's d test was performed to calculate the effect sizes. Pearson's partial correlations were performed at baseline between cognitive control, physical, psychological and sociological factors as well as lifestyle habits with academic performance in both groups to identify which variables would be included in our regression models. Correlations were controlled for age, pubertal status, socioeconomic status and ethnicity. Separate hierarchical linear regression analyzes were used to identify predictors of academic performance measures in both groups at baseline. Step 1 analysis included demographic variables that were significantly correlated with measures of academic performance. Then, all other variables that were significantly correlated with academic performance measures were included in step 2.

The Δ in all variables between year 1 and year 3, in percentage, were calculated using the following formula: (Year 3 value – Year 1 value) / Year 1 value x 100, except for a few lifestyle habit variables. Instead, the Δ between year 1 and year 3 for these variables was calculated by subtracting year 1 value to year 3 value. Then, Pearson's partial correlations were performed between the Δs in cognitive control, physical, psychological and sociological factors as well as in lifestyle habits with the Δs in academic performance in both groups to identify which variables would be included in our regression models. Correlations were controlled for age, pubertal status, socioeconomic status and ethnicity. Separate hierarchical linear regression analyzes were used to identify predictors of the Δ in academic performance measures in both groups. Step 1 analysis included demographic variables that were significantly correlated with measures of academic performance. Then, all other variables that were significantly correlated with academic performance measures, at baseline and for the Δs, were included in step 2.

Statistical analysis was performed using SPSS 26 for Windows (IBM Corp., NY, USA). Significance was defined at $p < 0.05$.

Table 1. Participants baseline characteristics.

Variables	Female students n = 115	Male students n = 70
Age (years)	13.1 ± 1.0	13.3 ± 1.0
Ethnicity (nb (%))		
Caucasians	70 (60.9)	43 (61.4)
Asians	25 (21.7)	9 (12.9)
Arabs	8 (7.0)	4 (5.7)
Hispanics	6 (5.2)	2 (2.9)
African-Americans	1 (0.9)	5 (7.1)
Mixed	5 (4.3)	7 (10.0)
Pubertal status (nb (%))		
Early pubertal	0 (0.0)	5 (7.1)
Midpubertal	23 (20.0)	11 (15.7)
Late pubertal	1 (0.9)	23 (32.9)
Post-pubertal	91 (79.1)	31 (44.3)
SES (nb (%))		
Low income	0 (0.0)	0 (0.0)
Low-middle income	6 (5.5)	2 (3.0)
Middle income	6 (5.5)	4 (6.2)
Middle-high income	29 (26.6)	23 (35.4)
High income	68 (62.4)	36 (55.4)

Values are mean ± standard deviation (SD). SES: Socioeconomic status.

RESULTS

Participants baseline characteristics are shown in Table 1. The academic performance measures for both groups are presented in Table 2. Results show that female students had higher grades in science and language as well as higher overall average than male students (p values < 0.03; d's range: 5.3 to 7.8). Linear regression analysis showed that, in female students, the main predictors of the different academic performance measures at baseline were screen time, VO_2 max, sleep duration, age and cellphone use on weekends (see Table 3). These predictive factors could explain between 24.3 to 37.7% (all p values < 0.001) of the variations in academic performance depending on the school subject.

Table 2. Differences in academic performance measures between female and male high school students.

Academic performance (%)	**Female students** (n=115)	**Male students** (n=70)	***p* values**	***d***
Overall average, *year 1*	86.7 ± 4.8	83.7 ± 6.0	0.001	5.26
Overall average, *year 3*	84.2 ± 5.0	81.1 ± 7.1	0.002	5.85
Science, *year 1*	84.8 ± 7.4	82.1 ± 8.5	0.023	7.81
Science, *year 3*	80.3 ± 7.1	80.5 ± 9.0	0.900	7.86
Mathematics, *year 1*	83.7 ± 7.7	83.1 ± 8.2	0.603	7.88
Mathematics, *year 3*	78.6 ± 10.5	77.2 ± 10.4	0.365	10.47
Language, *year 1*	86.2 ± 6.2	83.3 ± 6.7	0.003	6.42
Language, *year 3*	82.7 ± 5.9	78.5 ± 8.6	< 0.001	7.04

Values are mean ± standard deviation (SD).

In male students, results indicate that a combination of factors such as being on a school team, age and playing video games on the weekend were able to explain between 21.6 to 39.7% of the variance in the different academic performance measures (see Table 3). Furthermore, from all the variables that were measured, the accuracy in the 2-back test was the only one to significantly predict two different measures of academic performance. It should also be noted that none of the variables assessed in the present study were able to predict language in our final model.

Results of the linear regression analysis in regard to the changes in academic performance in female high school students are shown in Table 4. They indicate that the factors used to explain variations in academic performance differ according to school subject. Our model was able to explain between 9.0 to 38.9% of the variation in the Δ of the different measures of academic performance. Age and Δs in a inhibitory control measure, namely incongruent accuracy, were the only variables to significantly predict two different measures of academic performance. It should be noted that only age, a demographic factor, was able to explain part of the variation in the Δ in mathematics. Finally, independent predictors of changes in academic performance in male high school students are presented in Table 4. The factors explaining the variations in academic performance vary according to school subject and could explain between 6.1 to 52.2% of the variance in the Δ in academic performance.

Table 3. Independent predictors of academic performance at baseline in high school students

Dependent variables	Independent variables	*β*	Total R^2	*P* value
Female students				
Overall average	Cellphone on WE	-0.61	0.377	< 0.001
	Television on WE	-0.55		
	Sleep duration on WE	0.54		
	VO_2 max	0.36		
Sciences	Age	-3.38	(0.258*)	(< 0.001§)
	Total screen on WD	-0.43	0.353	< 0.001
	VO_2 max	0.34		
Mathematics	Television on WD	-1.37	0.243	< 0.001
	Cellphone on WE	-0.80		
	Curl-ups	0.17		
Language	Cellphone on WE	-1.00	0.299	< 0.001
	VO_2 max	0.48		
Male students				
Overall average	Being on a school team	4.71	0.397	< 0.001
	Identified motivation	0.64		
	VO_2 max	0.40		
	2-back accuracy	0.21		
Sciences	Age	-3.05	(0.150*)	(0.001§)
	Motivation towards knowledge	0.52	0.216	0.021
Mathematics	Videogames on WE	-0.96	0.237	0.001
	2-back accuracy	0.19		
	Push-ups	0.14		

*Represents the partial R^2 of the step 1 variable. §Represents the *p* value for the step 1 analysis only. VO_2 max: cardiorespiratory fitness, WD: Weekdays, WE: Weekend. Independent predictors included in the model varied between dependant variables based on significant correlations. None of the demographics variables (age, pubertal status and socioeconomic status) included in step 1 analysis remained in the final model for overall average, mathematics and language in female students and for overall average and mathematics in male students. None of the variables included in the model remained in the final model for language in male students.

DISCUSSION

The purpose of the present study was to determine the relative importance of a variety of factors that could predict academic performance in high school students. That is, we attempted to develop a model that includes multiple cognitive control, physical, psychological, sociological and lifestyle habits measurements that may help us better understand predictors of several academic performance measures in female and male high school students.

Results from the hierarchical linear regression analysis showed that different combinations of factors predict academic performance according to school subjects. Specifically, in female students, our results indicate that VO_2 max and screen time were the two main factors associated with academic performance. That is, different screen time measures, in particular cellphone use on the weekend, were negatively associated for each of the three school subjects as well as for the overall average, whereas VO_2 max was able to predict three out of four academic performance measures. These results are consistent with the literature, which suggests that VO_2 max is the physical characteristic that most influences academic performance in female students (9, 22). In addition, the literature indicates that the time spent in front of screens could be negatively associated with academic performance in high school students, which is in line with the results of our study (25, 44, 54). Furthermore, age was the most important predictor of academic performance in our sample of female students (β of -3.38 for sciences). This finding is in line with previous research, which suggested that academic performance from grades 7 to 9 significantly decrease (53).

In male students, our results indicate that working memory was the only recurring factor in predicting the different school subjects, which is in line with previous research that showed a positive association between working memory and academic performance (46). In addition, in our sample of male students, being a member of a school sports team was by far the most important predictor for academic performance, with a β of 4.71 for overall average. Previous studies have also reported a positive association between the participation in school-organized sports and academic performance (24, 51).

Table 4. Independent predictors of change in academic performance in high school students.

Dependent variables	Independent variables	*β*	Total R^2	*P* value
Female students				
Δ Overall average	Δ Incongruent accuracy	-0.23	0.090	0.013
	Δ 2-back MRT	-0.04		
Δ Sciences	Age	4.43	(0.335*)	(< 0.001§)
	Δ Incongruent accuracy	-0.32	0.389	0.009
	Δ MRT interference	0.05		
Δ Mathematics	Age	-6.32	(0.298*)	(< 0.001§)
Δ Language	Maternal tongue	-2.73	0.117	0.001
	Push-ups	-0.13		
Male students				
Δ Overall average	Father education	2.45	0.261	< 0.001
	Δ Daily F/V	0.02		
Δ Sciences	Age	5.37	(0.390*)	(< 0.001§)
	Father education	5.35	0.522	0.001
	Δ Studying time	0.01		
Δ Mathematics	Age	-2.62	(0.069*)	(0.028§)
	Δ Bedtime on WD	-4.75	0.273	< 0.001
Δ Language	Δ Push-ups	0.03	0.061	0.041

*Represents the partial R^2 of the step 1 variable. §Represents the *p* value for the step 1 analysis only. Daily F/V: Daily servings of fruits and vegetables, MRT: Mean reaction time, WD: Weekdays. Independent predictors included in the model varied between dependant variables based on significant correlations. None of the demographics variables (age, pubertal status and socioeconomic status) included in step 1 analysis remained in the final model for overall average and language in both female and male students.

Another aim of the present study was to explore if changes during a 3-year period in cognitive control, physical, psychological and sociological factors or lifestyle habits could predict Δs in academic performance in high school students. Results showed that different combinations of factors were found to predict between 6.1 to 52.2% of the variation in the Δs in academic performance in both male and female high school students. In female students, we observed that Δs in language were explained by the mother's first language and by muscle endurance (push-ups) (cumulative $R^2 = 0.117$), while the Δs in science and for overall average seem weakly explained by cognitive control (partial R^2 varying between 0.054 to 0.090). These results are consistent with previous longitudinal studies in reporting an association between physical fitness, which included muscle endurance, with academic performance (35) and between cognitive control with academic performance (2). Evidence has also shown that students whose mother tongue was different from the language of instruction had poorer academic performance than other students, which is in line with our results (26, 42). On the other hand, the most important independent factor that was able to explain, at least in part, the Δs in science ($R^2 = 0.335$) and mathematics ($R^2 = 0.298$) in female students was age.

In male students, 26.1% of the variation observed for the Δs in overall average was explained by eating habits and the father's level of education. The father's level of education also appears to be one of the main factors that could explain the variations in the Δs in science. In terms of Δs in mathematics, our final model explained 27.3% of its variation with age (partial $R^2 = 0.069$) and Δs in bedtime on weekdays. These results support previous findings indicating that a higher level of education from the parents (23) and a healthier diet were associated with better academic performance (11, 27).

Collectively, results of the present study suggest that the predictors of academic performance differ between sex groups. Thus, our results indicate that it may be important to analyze male and female students separately when studying academic performance in order to detect potential disparities that could exist between female and male students. In addition, results also indicate that the factors explaining academic performance at baseline are different from those explaining it after a 3-year period, suggesting that predictors of academic performance evolve over time. Therefore, researchers/educators studying predictors of academic performance need to be aware of this phenomenon, which adds a level of complexity in this field of study.

Results obtained within this 3-year prospective study may have important implications in the curriculum of high schools for educators, policymakers and stakeholders as well as for the students and their parents. For example, in order to improve the general health of students as well as their academic performance, interventions aimed at reducing screen time (e.g., by limiting their use at home and at school during non class time) as well as increasing the fitness levels (VO_2 max) of students and muscle endurance by performing moderate to vigorous physical activities and push-ups should be implemented. Moreover, measures to increase the number and the variety of school activities, including sports teams, could be implemented to promote motivation and investment towards school. Cognitive interventions aimed at improving inhibitory control and working memory may also be considered as an additional option for students. Awareness campaigns reminding the daily physical activity recommendations (i.e. minimum or maximum amount of PA, inactivity and screen time allow per age) could also be implemented. Free workshops offered at noon, after school or in the evening to educate students and their parents about adopting a healthy and active lifestyle could take place in various high schools. In addition, educators could consider inviting a great variety of free guest speakers such as academic motivational speakers, psychologists, kinesiologists and nutritionists that have an expertise to promote the importance of improving lifestyle habits to students in the classrooms.

In the province of Quebec, the knowledge and skills surrounding the adoption of a healthy and active lifestyle are taught within physical education and health classes by qualified teachers. However, the time allocated for this class is usually around 75 minutes per week in high school, which does not allow enough time to teach important health concepts properly and develop students' skills toward their own adoption of a healthy and active lifestyle while engaging in the teaching of sports. In fact, worldwide school systems aiming to improve the academic performance of their students could consider the implementation of health courses within their curriculum. Ultimately, a better academic performance for high school students has the potential of increasing the probability of being accepted in a university program, obtain a bursary or an award as well as develop a greater self-satisfaction.

There were some limitations to the present study. First, our findings are limited to a population of students from a single French-Canadian public high school in Montreal, Canada. Also, our results are limited to the biological sex of the student and not their gender. Nonetheless, our results are strengthened by studying a homogenous population in a relatively large sample size. Furthermore, our cross-sectional and longitudinal approach does not allow us to conclude to any causal associations between cognitive control, physical, psychological and sociological factors as well as lifestyle habits with academic performance in our cohort. Second, due to the differences in academic curriculums and assessments in high schools all around the world, it is difficult to establish comparisons in academic performance with other investigations. However, we used grades in percentage to facilitate comparisons and to allow conversions to letter grade systems. Due to a limited amount of time, another limitation was the number of cognitive control evaluations. However, it should be noted that inhibitory control and working memory are two of the most common cognitive control measures in school-based studies (12), allowing comparisons with other results. Due to a logistic reality, another limitation was the use of self-reported measures of lifestyle habits, which did not include the frequency and duration of the physical activities.

Results of the present study show that academic performance may be predicted by a wide range of multiple factors in high school students. Indeed, this study also highlights the complexity of predicting academic performance in high school students. That is, the factors that predicted academic performance varied between school subjects (mathematics, science, language (French) or overall average), sex (male vs. female) and study design (cross sectional vs. longitudinal). Further studies on academic performance should be aware of these differences. Finally, a better understanding of the interrelationship between academic performance with cognitive control, physical, psychological, sociological and lifestyle factors could help guide educators and policymakers in the development of effective intervention programs, which in turn, may lead to better grades.

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