

Effects of health behaviors, social cognitions, demographics and parenting styles on academic achievement of Lebanese youth

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Effects of health behaviors, social cognitions, demographics and parenting styles on academic achievement of Lebanese youth

DISSERTATION

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on the authority of the Rector Magnificus, Prof. dr. Pamela Habibović
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Table of contents

CHAPTER 1	General introduction	7
CHAPTER 2	Is Academic Achievement Related to Mediterranean Diet, Substance Use and Social-Cognitive Factors: Findings from Lebanese Adolescents	31
CHAPTER 3	Parenting style as longitudinal predictor of adolescents' health behaviors in Lebanon	59
CHAPTER 4	Authoritative parenting stimulates academic achievement, also partly via self-efficacy and intention towards getting good grades	85
CHAPTER 5	Increased Adherence to the Mediterranean Diet and Higher Efficacy Beliefs Are Associated with Better Academic Achievement: A Longitudinal Study of High School Adolescents in Lebanon	113
CHAPTER 6	General discussion	137
	Impact paragraph	173
	Summary	179
	Acknowledgements	185
	Curriculum Vitae	187
	List of publications for the thesis	189

CHAPTER 1



General introduction

Academic achievement

Academic achievement is well known today for being a foundation for a bright and successful future for youth as well as nations [1]. Academic achievement is the outcome of students' performance on specific school subjects and reflects the extent of knowledge and skills acquired and educational goals achieved [2]. Academic achievement is commonly indicated by a mark or grade and allows the student to either fail or pass a schooling level [3]. Academic achievement of adolescents, especially in secondary school, is important as it substantially influences their entry and acceptance into higher education institutions and subsequently influences their future employability, opportunity for a good career and good social status [4]. For that reason and beyond individual importance, academic achievement has also a great societal importance. It is a powerful determinant for positive socio-economic development and for a prosperous and wealthy nation [5]. Education helps people move up in the world, pursue better job opportunities, be more productive, have higher wages and consequently contribute to fueling the economy [5,6]. On the other hand, poor academic achievement can lead to school failure and dropout which have negative consequences for the individual, society and economy [7,8]. Individuals with lower education are more at risk of unemployment, poverty, low quality of life and rely more on public assistance [9]. In addition, poor achievement is associated with lower self-confidence and self-esteem and higher risk of delinquent and criminal behavior [10,11] incurring higher social cost and higher expenditure on crime, health welfare and public services [12]. Academic achievement is also significantly related to future health. Academically successful adolescents have better chances to lead healthier lives in the future [1,13]. Good academic achievement lay ground for lifelong health and overall quality of life through employment, better resources, better access to health information, healthcare and healthier lifestyle choices [4,14]. Well educated people adopt healthier behaviors; they are less likely to smoke, drink heavily and use drugs [15,16]. They are less likely to be overweight or obese and are more likely to eat healthy and exercise [14,17] and subsequently have improved life expectancy [18].

Given its societal and individual importance, academic achievement has been a high priority research area worldwide. Results from the last Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) show significant disparities in educational outcomes between Middle Eastern countries and other participating countries [19,20]. Arab countries such as Qatar, Saudi Arabia, Jordan and Lebanon have some of the lowest results on international student assessment scoring below the international median [21]. In Lebanon specifically, results show that Lebanese students are on average three to four years of schooling behind peers from other countries and Lebanon is among countries with the widest gap in achievement between top and bottom performers [21]. Although research on determinants of academic achievement has been done in several countries only a few have been done in the Arab region and in Lebanon particularly. Identifying factors that may explain and predict academic achievement in Arab countries in general and Lebanon in particular is needed

and may provide insight for fostering better academic achievements and reducing the performance gap.

In this dissertation, an approach suggested by the PRECEDE-PROCEED model – a model to plan health promotion programs [22] - was followed as a guiding framework for the identification of main determinants of academic achievement and that could be targeted in future focused interventions. This research focuses on the formative part of health promotion planning and focused mainly on identifying key behavioral and environmental factors associated with academic achievement allowing future prevention programs and strategies. Using the PRECEDE-PROCEED terminology, the factors identified to influence academic achievement of adolescents will be classified as behavioral or environmental factors.

Academic achievement- Influencing factors

In order to improve academic outcomes, a clear understanding of what factors influence academic achievement is needed. Those factors can be divided into modifiable and non-modifiable factors and gaining an understanding of both is crucial. Static or non-modifiable factors such as gender, age, parent's education and certain genetic factors are important to examine as they can be used to determine which individuals are at risk of poor academic achievement and consequently target initiative for enhancing schooling outcomes [23-25]. Modifiable factors, including lifestyle and motivational factors, are also important as they can be managed and optimized through tailored interventions in order to potentially improve performance and reduce the negative consequences of low achievement [26]. Studies have shown that targeting modifiable behaviors such as healthy eating and physical activity, can be effective in improving academic outcome [27]. Examples of interventions targeting modifiable factors include school health interventions attempting to improve both the health and academic achievement of students. Systematic reviews of controlled studies have shown that those interventions can be effective in improving academic grades, tests scores, student attendance and decrease drop-outs, but some more than others [27-29]. Interventions that promote healthy eating, through nutrition education, school meal provision or policy changes for healthier environments were among the most effective [28]. Programs targeting physical activity resulted in either positive or no effect on academic outcome suggesting that physical education will not impair academic performance even when provided at the expense of academic program [30-32]. Interventions for substance use were found to be less effective having small effects and leading to an only short-term reduction or delay in substance use [33]. Interventions designed to enhance motivational constructs such as academic efficacy beliefs have also showed promise for improving students' academic performance and are recommended strategies in the learning setting [34,35]. Large effect sizes found for nutrition interventions evidence the need to further investigate the role of nutrition and academic performance especially in an Arab setting such as Lebanon where nutritional

habits might be different. Nutrition research in Lebanon has mainly focused on studying prevalent dietary patterns among youth and their association with obesity [36,37] and studies on the association of nutrition and academic achievement is sparse. Furthermore, very little evidence regarding the association of other modifiable factors such as physical activity, substance use and motivational factors with academic performance is available in the Arab region including Lebanon. Hence more insights into those determinants is needed in order to understand the mechanisms by which they might exert their influence in different cultural context and to pave the way for the design of intervention strategies that specifically target Lebanese youth.

Behavioral factors

Nutrition and academic achievement

The relation of health behaviors particularly eating behaviors to academic outcome of children and adolescents have been widely investigated and the evidence support the association between healthy dietary behaviors and greater academic achievement [38,39]. Systematic reviews of both observational and longitudinal studies suggest a positive link between breakfast consumption, fruits and vegetables intake and a lower consumption of nutrient-poor food such as junk food with better cognitive function and higher academic performance [38,40-42]. However, it should be noted that even though reviews included evidence from prospective studies, most of the studies were cross-sectional in design and only a few adequately corrected for important confounding factors. As such, evidence from further longitudinal studies with comprehensive designs are needed in future research.

Beyond single foods and dietary constituents, some studies have also investigated more global measures of diet such as overall diet quality and whole dietary patterns [43,44]. One example of dietary pattern of which the role with academic performance has been recently studied is the Mediterranean diet [45,46]. The Mediterranean diet is described as the prevailing dietary pattern among the people in countries bordering the Mediterranean Sea [47]. The Mediterranean diet is mainly a plant-based dietary pattern characterized by a high consumption of legumes, unprocessed cereals, nuts, fish, fruits and vegetables, olive oil as a primary source of fat, a low to moderate intake of dairy products and low intake of meat, saturated fat and sweets [48]. The Mediterranean diet has been reported to be associated with better physical and cognitive health among Greek adults [49]. Evidence from longitudinal studies and randomized control trials have shown that high adherence to the Mediterranean diet might be protective against chronic diseases such as diabetes, heart disease [49,50] and certain types of cancer [51] and is associated with lower overall mortality [52]. In addition, studies that have examined the Mediterranean diet in relation to academic achievement of youth have reported positive associations [45,46]. Greater adherence to the Mediterranean diet has been found to be associated with higher grades and greater academic achievement among Spanish children and

adolescents aged 6 to 18 years [45,46,53,54]. The positive influence of the Mediterranean diet on academic outcome has been attributed to the beneficial effects of key nutrients as well as their synergetic effect on learning process, memory, cognitive capacity and mental well-being [55,56]. The Mediterranean diet is an important source of n-3 polyunsaturated fatty acids (PUFAs) and polyphenols with antioxidant and anti-inflammatory activities that are known to reduce stress and inflammation consequently preserving good cognitive function and mental health [57-60]. Nevertheless, it is important to note that longitudinal studies of the Mediterranean diet and academic achievement are scarce and evidence from well-designed randomized controlled trials and prospective studies is needed for demonstrating causal effects.

On another note, beneficial components and dietary behaviors that confer the beneficial effects associated with the Mediterranean diet can be found and obtained through many different dietary patterns. Correspondingly, in non-Mediterranean settings, diets that incorporates specific foods and combinations of foods that form a healthy eating pattern have been also found to be associated with positive health and academic outcomes [43,61,62]. Florence et al. [43] and McIsaac et al. [63] have shown that grade 5 Canadian children with a higher diet quality as measured by the Diet Quality Index had better performance on standardized tests and academically. Similarly, Correa-Burrows et al. [62] found that 16-year old Chilean adolescents with a healthy diet characterized by nutrient rich foods were more likely to perform well in school compared to those with a fair or unhealthy diet. In brief, reviews of the association of dietary behaviors and academic achievement of school-aged children and adolescents have found healthy eating behaviors and a higher quality diet to be consistently linked to better achievement [38,64].

With regards to Arab countries, very few studies have examined the effect of nutrition on academic achievement of youth. One review by Galal and Hulett [65] indicated that Emirati children are facing multiple forms of malnutrition including undernutrition, anemia and obesity and those nutritional problems are probably negatively affecting school related outcomes. Evidence of the association of dietary behaviors with academic achievement in Lebanon is limited. To the best of our knowledge, there are only two studies that have explored adherence to the Mediterranean diet and academic achievement of Lebanese youth [66,67]. One study examined the association of the Mediterranean diet with academic achievement among high school adolescents [66] and the other study examined this association among university students [67]. Both studies followed a cross-sectional design and found a positive relation between adherence to the Mediterranean diet and higher academic scores. The available evidence on nutrition and academic achievement for Arab countries is mainly from correlational studies or studies focusing on a single dietary aspect and further prospective evidence among the adolescent population in the Arab world and particularly Lebanon is needed to compare results in other cultures and guide the development of evidence-based interventions tailored to the Lebanese context.

Physical activity and academic achievement

In addition to diet, another health behavior that has been suggested to influence academic achievement is physical activity. Evidence from systematic reviews shows that physical activity can either have a positive or null effect on academic achievement [68-70]. Longitudinal and intervention studies that found a positive effect of physical activity on academic achievement, reported improvement in math, reading scores and overall cognitive performance [71-76]. In a three-year cluster randomized trial, Donnelly et al. [74] found that grade 2 and 3 elementary school United States (U.S.) children who were exposed to 90min/week of moderate to vigorous physical activity had significant improvements in math, reading and spelling scores. Similarly, Erwin et al. [73] found that incorporating 20 minutes of physical activity into the curricula of grade 3 U.S. elementary students resulted in improved reading and math achievement. Another randomized control trial showed that incorporating physical activity into math classes of 7-year old Danish students resulted in greater improvements in math skills over one school year [77]. In another study by Suchert et al. [78], secondary school German students (grade 8) with higher cardiorespiratory fitness and students who met the World Health Organization guidelines for physical activity accumulating at least 60 minutes of moderate to vigorous-intensity physical activity daily had improved educational attainment in Math and German one year later. In addition, some studies reported that different intensity levels of physical activity appear to have different effects [31,79]. Coe et al [31] found that engagement in vigorous physical activity was significantly associated with better academic achievement among U.S sixth grade students whereas moderate activity did not. One hypothesized mechanism by which physical activity may improve performance includes increased blood flow, oxygen and glucose transport to the brain, resulting in better cognitive performance because of the increased resources to the brain [69,80]. Additionally, higher fit children were found to have increased activation in frontal and parietal brain regions which are involved in the control of attention and memory which are in turn important skills for academic performance [75,81]. On the other hand, evidence also exists on the null association between physical activity and academic performance [82-84]. In their review, examining the evidence of an association between objective and self-reported physical activity with academic achievement of school-aged children 6 to 18 years, Marques et al. [74] found no association between objectively measured physical activity and academic achievement, whereas a positive association was found for self-reported activity. Inconsistencies in the findings are most likely due to differences in measuring physical activity; self-reported measures of physical activity are more prone to memory and social desirability bias and overestimating activity levels might be common [85,86]. Regardless the finding, reviews of the literature concluded that even with no positive effect, increased physical activity does not adversely affect academic performance and is important for overall health [68-70].

A review of the evidence on physical activity in the Arab region raises concern about the decreased activity level among children and adolescents [87]. Based on Global School-based Student Health Survey reports, prevalence of inactivity among Arab youth ranged

from a low of 65% in Lebanon to a high of 91% in Egypt [87]. Prevalence of inactivity was also found to be higher among girls [87]. Reported barriers to physical activity among Arab countries include the hot climate especially in Gulf countries such as Saudi Arabia and Qatar which limits outdoor activity [88,89]. Other barriers include lack of spaces and appropriate facilities to exercise, time constraints, low value for exercise and insufficient motivation [90,91]. Additionally, the lower physical activity among girls has been attributed to cultural and religious barriers, lack of social support, reserved dressing and the need to be chaperoned especially in more conservative countries such as Saudi Arabia, UAE and Jordan [90,92]. In Lebanon, the limited data on physical activity of Lebanese youth suggest that the majority fail to meet the physical activity guidelines [93] and to date no studies have explored its association with academic performance. Investigating physical activity of Lebanese adolescents and how it relates to academic achievement is therefore needed as it can serve as a foundation for interventions aimed at enhancing both their activity levels and academic achievement.

Alcohol and smoking and academic achievement

Engagement in risky behaviors, have been shown to adversely affect academic achievement. Health-risk behaviors, such as smoking and alcohol consumption, are highly prevalent in adolescents and were found to negatively impact several facets of their lives including school-related outcomes [94]. Both alcohol drinking and smoking have been linked with poor grades and lower academic achievement in longitudinal research [95,96]. Research by Tucker et al. [95] among U.S. grade 7 adolescents showed that smoking at age 13 and 16 was associated with lower grades at age 18. Koivusilta et al.'s [97] study showed that engaging in health-compromising behaviors such as smoking and drinking predicted lower education attainment in adulthood among Finnish adolescents aged 12 to 16 years. This association could be due to several mechanisms; alcohol can have harmful effects on brain development and activity, negatively affecting memory, attention and executive function [98,99]. In addition, drinking was also found to negatively prospectively affect performance by taking away from the hours dedicated to studying [99]. As for smoking, it has been found to be associated with various problematic behaviors that lead to poor academic performance and drop-out [100]. In a five-year long longitudinal study, U.S. adolescents at grade 7 who smoked were more likely to skip class, engage in violent behavior, have poor grades and be suspended from school [100]. Furthermore, evidence from longitudinal research indicate that smoking and alcohol are strongly associated and assumed to co-occur [101]. U.S. college students were found to drink more while smoking and smoke more when drinking [101,102]. Moreover, several longitudinal studies have suggested that the association of substance use to academic performance was bi-directional [95,96]. Results from two separate studies reported that Finnish and American grade 7 students who smoked achieved lower than peers who did not smoke and vice versa, students who performed poorly at school were more likely to smoke [95,96]. Hence it was found that smoking and drinking can adversely influence academic performance [94,100] and alternatively substance use could be the result of academic difficulties and poor achievement [103,104].

Evidence from Arab countries show increasing prevalence of tobacco use among youth and point to a rising public health problem [105]. In Lebanon, cigarette smoking among adolescents 13-15 years of age increased from 8.6% in 2005 [105] to 11.2% in 2017 [106] in light of poor tobacco surveillance and control policies which is an issue in the Arab region in general [107]. With regards to drinking behavior, research on alcohol in the Arab world is strikingly low probably because alcohol is prohibited in many countries or considered social stigma [108]. From the 22 Arab countries, 16 participated in the Global School-based Student Health Survey (GSHS) and only three (Lebanon, Morocco and Syria) collected data on alcohol consumption among middle school students [108]. In Lebanon, data from the GSHS showed that alcohol consumption among 7th and 9th graders increased by 40% between 2005 and 2011 and that 85% of Lebanese youth had their first drink before the age of 14 [109]. Although Lebanon has the highest number of publications on alcohol, being the most socially liberal among Arab countries, there are no studies examining its relationship with academic achievement. Similarly, the association of smoking with academic achievement of Lebanese youth remains unknown. Hence the need to explore those associations to allow for across country comparison and guide the development of culture specific interventions.

Social cognitive factors and academic achievement

Another emerging factor is the influence of socio-cognitive factors on academic performance. Social cognitive models have been used to explain why people engage in a specific behavior by understanding the psychosocial and motivational factors that influence this specific behavior [110-113]. This also applies to academic behavior such as engagement in school work, persistence, self-regulation, study habits and organizational skills [114-116]. Socio-cognitive factors such as attitude, social norms and self-efficacy are believed to influence behavioral intention, in this case academic intention, which in turn is an important determinant of adolescents' academic behavior [112,117]. Attitude reflects the perceived positive and negative feeling towards a behavior, social norms refers to perceived expectation from significant others to engage or not in a given behavior and self-efficacy refers to the belief in one's capability to perform a certain behavior [110-112]. A meta-analysis of 36 studies have found that adolescents' attitude and academic efficacy beliefs are highly predictive of academic achievement [118]. For instance, grade 6 and 7 Italian children (aged 11-14) with high perceived efficacy for self-regulated learning, and higher efficacy to plan and organize academic activities were found to have higher scholastic achievement [118,119]. Another longitudinal study among British university students has shown that higher self-efficacy in study-related skills and behaviors was found to predict higher academic performance [120]. In a study following Canadian students from their 4th to 6th grade, self-efficacy in math was also found to be positively associated with students' achievement in math [121]. The effect of self-efficacy on academic achievement is explained by its influence on both the use of specific cognitive activities as well as coping abilities and self-regulation skills [122]. Adolescents' beliefs in their efficacy to control their own learning activities and to master demanding school subjects influence their interest in their academic work and how much effort and motivation they will put

into it, all of which will ultimately impact their scholastic achievement [119]. Research by Bassi and colleagues [123] showed that secondary school Italian adolescents (15-19 years) who have high beliefs in their academic capabilities had higher academic aspirations and used more effective learning strategies than their low self-efficacy peers such as spending more time completing school assignments. High efficacious students also reported higher concentration, control and satisfaction while doing school work whereas low efficacy students reported low satisfaction and associated class work with anxiety [123].

Research concerning the impact of motivational factors on academic performance in Arab countries is scarce, but suggest that self-efficacy is a significant predictor of academic success in Iranian, Emirati and Saudi university students [124-126]. In the United Arab Emirates, Afari et al. [124] examined the cross-sectional relationship of academic self-efficacy to academic performance of Mathematics university students. Self-efficacy was found to be strongly correlated with math achievement. Similarly, Alyami et al. [125] found that Saudi university psychology student with higher academic efficacy beliefs were more likely to have higher GPA. A significant association was also observed between general self-efficacy and academic achievement of Iranian university students in a cross-sectional study by Asakereh and Yousofi [126]. Research on socio-cognitive factors and their impact on academic achievement of youth is still in its infancy in the Arab world and most studies are cross sectional in design. Furthermore, to date and to the best of our knowledge no studies have examined the association of social cognitive factors with academic achievement of Lebanese youth. Hence the need to explore those associations among Lebanese adolescents.

Environmental factors

Parenting styles and academic achievement

Academic performance may also be influenced by the immediate or microenvironment such as the home environment [127]. Parents who are part of the microenvironment, are key persons in adolescents' lives, they play a central role in the way their children develop [128,129]. They can either positively or negatively affect several child outcomes including academic performance [130]. They can directly influence performance as well as factors affecting performance such as health behaviors [131,132] and socio-cognitive factors [133,134]. Parents play an important role in instilling healthy lifestyle and dietary habits as well as nurturing motivational outcomes, which in turn can affect academic performance. One type of parental influence is parenting style. Parenting style is the general pattern used to raise children and prepare them to become functional members of society [135]. Two dimensions of parenting behavior are used to define parenting style: demandingness (control) and responsiveness (warmth). When combining the two dimensions four specific parenting styles can be defined: authoritative (high on demandingness and responsiveness), authoritarian (high on demandingness and low on responsiveness), permissive (high on responsiveness and low on demandingness) and

neglectful (low on demandingness and responsiveness) [136,137]. Authoritative parents have clear rules and boundaries for the child to follow, however, explain the reasons behind those rules. Authoritative parents have high maturity demands and encourage the child to be independent, but are loving, supporting and responsive to their child's needs at the same time. Authoritarian on the other hand are controlling and demanding and not responsive to their child's needs, they expect their child to comply to the rules without explanation and failure to do so results in punitive action. Permissive parents, also referred to as indulgent, have low maturity demands and expectations for the child. They do not monitor nor guide their child, are more tolerant of misbehavior and rarely use punishment. They often act as a friend and not as a parent. Lastly, neglectful parents are unresponsive to their child's needs and uninvolved in their life. They display low level of warmth and control, and have minimal interaction with their child [130,137,138].

The longitudinal scientific evidence suggests that a positive parenting style, namely authoritative parenting, has been found to promote healthier behaviors [139], better psychosocial functioning [133] and facilitate better academic achievement [140]. Oppositely, adolescents who perceived their parents as neglectful had the worst prospective outcomes among which the lowest grades [140,141]. However, it is worth noting that most studies are from Western societies and the influence of parenting may differ per culture [142,143]. Research on parenting style in the Arab world revealed that parenting varies across Arab societies. Parental styles tended to be more authoritarian and controlling in conservative countries such as Saudi Arabia and Yemen and more lenient with the authoritative and permissive style prevailing in modern societies such as Lebanon, Jordan and Algeria [144]. It was also found that male Arab adolescents perceived higher levels of authoritarian parenting than female adolescents [144]. Alsheikh et al. [145] examined the impact of parenting style on Emirati children's academic performance and self-esteem and found that parental demandingness was associated with higher GPA. In another study, Aldhafri et al. [146] examined parenting styles and academic efficacy beliefs in Omani school children (aged 10 to 17) and university students, it was found that authoritative and authoritarian parenting were the most predominant raising styles and that authoritative parenting style was significantly associated with higher self-efficacy beliefs. In addition, parenting impact on self-efficacy was found to be higher during school years compared to university suggesting a decreasing influence of parents as children grow. Parenting style research in Lebanon is very limited and while parenting styles have been examined in relation to mental health and psychological variables [147,148], they have not been studied in relation to health behaviors, social cognitive factors or academic achievement of youth. Further longitudinal research on parenting styles is desired in the Arab world, particularly Lebanon, and in relation to adolescent's academic achievement to compare results with similar research in other cultures and gain empirical verification of the associations found in Western culture.

The context of Lebanon

Lebanon is a small country located on the eastern coast of the Mediterranean Sea. Its geographic location linking the Mediterranean with Asia and Europe has granted it a multicultural character [149]. The Lebanese culture is diversified and characterized by a blend of Arab values and Western influence [149,150]. The Lebanese population is estimated at around 4 million with Christianity and Islam the two main religion [151]. Lebanon's location in a politically unstable region compounded with sectarian differences and weak governance are the cause of ongoing conflict and instability [152]. For the past years, Lebanon has been facing severe social, political and economical challenges with rising poverty rates. In light of this social and economic hardship Lebanon is going through, the hope of building a better Lebanon falls on its youth. Adolescents and youth have been indeed placed at the center of the Sustainable Development Goals (SDGs) [153] and are considered important stakeholders to realize change and transform countries and nations towards a sustainable future [154]. The latter is possible if youth are empowered with good education. Investing in the education of Lebanese adolescents and understanding what influences their academic achievement will potentially yield positive outcomes and advances for Lebanon's future social and economic development as well as the health of its population.

The Lebanese Educational system is divided into two sectors: public and private. Public schools are non-profitable, free of charge and managed by the Lebanese Ministry of Education and higher Education. Private schools are managed by individuals or organizations with the government having a weaker control and have usually higher tuition fees making them only accessible to well off individuals. The educational system is divided in three cycles, elementary intermediate and secondary. The secondary level is particularly important as it is concluded with official exams "Lebanese Baccalaureate" qualifying students for tertiary education. Results from international assessments such as the Programme for International Student Assessment (PISA) show that Lebanon perform significantly lower than the international average and is three to four years of school behind other countries [155]. Understanding what are the factors that affect academic performance of adolescents in Lebanon is thus crucial to shorten this gap and maximize Lebanese adolescents' academic competencies which will ultimately result in high returns and better prospect for the country.

The aims and outline of this dissertation

Although extensive research has been carried out internationally exploring potential determinants of academic achievements, much of the studies that have been conducted up to now are not comprehensive enough in revealing which factors are the most influential in affecting adolescents' academic achievement and rather have focused only on a few subset of factors, while clearly academic achievement is a byproduct of multiple

factors. In addition, as previously stated, empirical studies on this topic are scarce in Arab countries in general and in the Lebanese context in particular. Most research in Lebanon have examined some of those factors but separately, for example pediatric obesity [156] or health practices among adolescents [157] but not in relation to academic outcome. Hence the need to assess determinants of academic achievement in the Lebanese context to check whether the associations identified in Western countries also hold true for a country with a different lifestyle.

The present thesis extends on previous work by exploring the most important factors associated with academic achievement of Lebanese adolescents and how changes in those factors might affect changes in achievement longitudinally. These findings are outlined in *chapter 2* and *5*. *Chapter 2* provides an overall description of the main factors associated with academic achievement of Lebanese adolescents, namely socio-demographic, health behaviors and motivational factors. *Chapter 5* explores if and how changes in health behaviors and socio-cognitive factors affect change in academic achievement of Lebanese adolescents at 6 and 12 months follow up. Moreover, we outline whether the effect of change is different after 6 months than after 12 months from baseline. In addition, this thesis helps understand socialization practices in the Lebanese cultural context and the parental styles predominantly practiced. Parental styles have been found to directly influence academic performance [158] but also to influence determinants of academic achievement [159]. Hence this thesis investigates the prospective influence of parenting style on predictors of academic achievement of Lebanese adolescents, namely health behaviors (*Chapter 3*) and socio-cognitive factors (*Chapter 4*). In addition, this dissertation examines an integrated parental and socio-cognitive model to explain academic achievement of Lebanese adolescents. This is described in *Chapter 4* in which we discuss the direct and indirect link between parenting and academic achievement mediated through the effect of socio-cognitive factors. The studies outlined in this thesis will help our comprehensive understanding of factors important for fostering strong education among Lebanese adolescents. The results will help pave the way for evidence-based programs, interventions and policies that are specifically targeted at Lebanese adolescents in the aim of improving their academic achievement. Finally, *Chapter 6* provides an overview and a general discussion of the results from all the different chapters and discusses suggestions and practical and theoretical implications for future studies.

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CHAPTER 2



Is Academic Achievement Related to Mediterranean Diet, Substance Use and Social-Cognitive Factors: Findings from Lebanese Adolescents

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Abstract

There is substantial evidence that good academic performance significantly enhances the prospects of success for adolescents in terms of employment, social status, quality of life and health. Identifying which factors are correlated to good academic achievement and which factors may need to be addressed by policies is crucial. Despite its importance, there is insufficient data concerning factors associated with academic achievement in the Middle East, particularly Lebanon. This study assessed the association of lifestyle, socio-demographics and motivational factors with academic achievement of Lebanese adolescents. Grade 10 and 11 Lebanese adolescents aged 15 to 18 years ($n = 600$), from private and public schools in Beirut and the Mount Lebanon area, completed a multi-component questionnaire assessing health behaviors, socio-demographic characteristics and motivational factors. Height and weight were physically measured and, subsequently, Body Mass Index was calculated. Academic achievement was assessed using self-reported grades and was categorized into high and low. Associations between all factors and academic achievement were tested using logistic regression models. Adherence to the Mediterranean diet, high self-efficacy and intention were positively associated with academic achievement, whereas smoking was associated with poor achievement. Our findings support the need for targeting adolescents with an unhealthier lifestyle and focusing on socio-cognitive determinants interventions aimed at enhancing academic achievement.

Keywords: health behaviors; Mediterranean diet; socio-cognitive factors; academic achievement; adolescents; Lebanon.

1. Introduction

Academic performance is a subject of great importance to adolescents, parents, educators and researchers. Academically successful adolescents are believed to have better chances to be employed and earn better salaries [1]. In turn, higher income and social status were found to be linked to better health, for they allow privileged access to health care and health information, which helps individuals to better understand their health situation and therefore seek proper health services [2,3]. This is also true in the Lebanese context, as employment and higher income allows individuals to afford health insurance and access to quality health services which is not available for the unemployed or poor in the absence of universal health coverage [4]. Good academic performance is thus an essential precondition fostering the chances for later life in terms of employment and good health [5]. Yet, not all adolescents have the same opportunity for achieving good academic performances.

In Lebanon, academic performance has been found to range significantly; results from the Programme for International Student Assessment (PISA) measuring outcomes for math, science and reading showed that Lebanon performed significantly lower than the international average, and that Lebanese students are approximately four years of school behind other countries [6]. Lebanon's low performance could result in significant differences concerning the future prospects of adolescents concerning employment, social status, quality of life and health. It is therefore important to study which factors are related to academic performance, and which actions could be undertaken at the national level, in order to potentially reduce this academic divide.

Academic performance is associated with several different factors, such as socio-demographics, lifestyle factors and motivational factors. Concerning socio-demographic factors, research suggests a relationship between socio-economic status and adolescents' academic performance [7–9].

Adolescents from low socioeconomic status families tend to have poor academic performance, and are more likely to drop out of school [10,11]. This can be also influenced by living in poor neighborhoods and attending low quality and low-resourced schools and having restrained family resources [12,13]. Adolescents from a low socio-economic status (SES) are more likely to have parents with low levels of education [14] which can both negatively influence support from parents or setting academic performance goals [15,16]. Educated parents are more involved in their children's education; like assisting their children in their homework and school activities, leading to a higher academic outcome [17,18].

Another significant factor affecting academic performance concerns health-related behaviors [19]. Poor nutrition has been found to negatively affect cognition; undernourished children suffer from impaired intellectual functioning, are less responsive

and have difficulty concentrating [20]. This could be due to the role of some essential nutrients on brain function and cognitive capacity [21]. For instance, an insufficient intake of certain nutrients, such as iron and zinc, was found to be associated with short attention span and memory deficits [22,23]. Conversely, having a good quality diet was associated with higher academic scores [24–26]. Healthy eating habits such as breakfast consumption, higher fruit and vegetable intake and low intake of junk food have been associated with greater attention, better learning ability and higher academic achievement [27,28]. One of the dietary patterns that models healthy behaviors is the Mediterranean diet [29]. This dietary pattern is predominantly plant-based and rich in healthy fats and antioxidants [30]. Recent studies have linked greater adherence to the Mediterranean diet with higher academic achievement [31–34].

Academic achievement can also be positively associated with physical activity (PA). Although the evidence is not conclusive, studies showed that regular engagement in PA is associated with improved cognitive function, related to better attention, information processing and executive function [35,36]. Studies conducted on substance use and academic achievement indicated an inverse relationship; alcohol use and smoking are both associated with lower academic performance, and reciprocally low academic achievers are more likely to drink and smoke [37,38].

Socio-cognitive factors have been also linked to academic performance [39]. Adolescents who have strong beliefs in their academic capabilities were more motivated, worked harder and consequently performed better, compared to students with low self-efficacy [40–42]. In this study, we used the Integrated Change Model [43] by studying the role of attitudes, social norms, self-efficacy and intentions, as this model also posits influences of the distal variables described above. The I-Change Model integrates various social cognitive factors from various theories, such as Ajzen's Theory of Planned Behavior [44], Bandura's Social Cognitive Theory [45], the Transtheoretical Model [46], as well as the Health Belief Model [47]. The I-Change Model assumes, as many socio-cognitive models, that socio-cognitive factors and intention are important predictors of intentional behavior, as well as identifies factors determining these cognitions, such as the social cultural context, personal characteristics and engagement in other behaviors [43].

In conclusion, adolescents' academic performance is a multifactorial process determined by various factors and these factors differ from country to country [25,48–50]. Several studies assessed the importance of these factors, but most studies did not use a comprehensive model which allows correction for multicollinearity between factors. Very little evidence is available supporting the evidence of these factors for Arab countries in general and for Lebanon in particular [51–53]. In addition, the gap between Lebanon and the international average point to a learning crisis [6], and highlights the need to obtain an overall description of the most important factors associated with academic performance of Lebanese adolescents in order to identify which factors are related to academic achievements and a future academic divide.

Hence, the goal of this paper is to examine the relationship between academic performance of Lebanese adolescents with factors related to health behaviors, socio-demographics and motivational factors. This study will allow us to better understand which factors are associated with academic achievement of Lebanese adolescents in order to pave the way for evidence-based interventions that are culture based, as well as policies aiming at improving academic achievement on the long run.

2. Materials and Methods

2.1. Study Design and Participants

This was a descriptive study, with a cross-sectional design enrolling high school adolescents aged 15–18 years old, from grade 10 and 11, from private and public schools across Beirut and the Mount Lebanon area. These two regions were selected as they concentrate the majority of the Lebanese population, including approximately half of the Lebanese students, and are representative of the various religious and socio-demographic societies in Lebanon [54]. Ten schools (five private and five public) were randomly selected from the Ministry of Education's list of schools in Beirut and the Mount Lebanon area following a stratified sampling design, the strata being public and private schools. Five private schools and five public schools were randomly selected out of the total number of schools in Beirut and the Mount Lebanon area, using the random sample of cases option in SPSS. The directors of these schools were approached face-to-face and provided with the study questionnaire, along with the objective of the study and seven (four private and three public) agreed to participate in the study. From these schools, all students from grade 10 and 11 were invited to participate in the survey. The Lebanese Ministry of Education and Higher Education reviewed and approved the study questionnaire (10/684; date: 1 March 2017). This study followed the ethical guidelines laid down in the Declaration of Helsinki [55], and ethics approval was obtained from the Scientific Committee of the Lebanese University. Written informed consent was obtained from all students and their parents prior to participating in the study. All students who were approached agreed to partake in the study, resulting in a total sample of 600 adolescents.

2.2. Procedure

Trained dieticians visited the participating schools between March and April 2017, during school hours, to administer the questionnaire. All participating students completed the questionnaire by hand independently during class. The trained dieticians read aloud each question and the corresponding answers, and were present for any clarification. The questionnaire was completed by participants within approximately one hour. The trained dieticians also measured the heights and weights of participating students using standardized procedures [56] and calibrated equipment. Height was measured to the nearest 0.5 cm, using a portable stadiometer (ADE stadiometer, Germany), without shoes. Weight was measured to the nearest 0.1 kg, using a Secacalibrated electronic weighing scale (Hamburg, Germany) in light indoor clothes and barefoot. BMI was calculated as

weight in kilograms divided by the square of height in meters (kg/m^2). Overweight and obesity were defined according to cut-off values from the International Obesity Task Force for BMI of children aged 2–18 years, where centile curves were drawn, which, at age 18 years, passed through the widely used cut-off points of 30 and 25 kg/m^2 for adult obesity and overweight [57].

2.3. Questionnaire

The questionnaire originally developed in English was translated in Arabic by a translator and then back translated to English by a native English translator [58].

2.3.1. Socio-Demographics

Socio-demographic questions included information on students' sex (1 = male; 2 = female), age (1 = 15; 2 = 16; 3 = 17; 4 = 18), type of school (1 = public; 2 = private), educational level of parents (low = never went to school & primary school; medium = complementary & secondary school; high = technical school & university), working status of the parents (1 = working; 2 = not working), household crowding index, house ownership (1 = rented, 2 = privately owned), possession of a personal phone (1 = no; 2 = yes), having an internet connection (1 = no; 2 = yes), family structure (1 = living with both parents; 2 = other arrangements) and religion (1 = Christian; 2 = Muslim; 3 = atheist).

2.3.2. Health Behaviors

Diet Quality

Dietary intake was assessed using a semi-quantitative Food Frequency Questionnaire (FFQ), adapted from a previous questionnaire that has been used among Lebanese children [59]. The FFQ measured the food intake over the past year. It includes 64 food and beverages commonly consumed in Lebanon and categorized into 10 food groups: breads and cereals, potatoes, rice and pasta, dairy products, fruits and juices, vegetables and salads, meats and alternatives, fats and oils, sweets and desserts, fast food and beverages. For each food item listed, a standard portion size was indicated. Students were asked to record the frequency of consumption either per day, per week, per month, per year or never. Students had the choice to report their intake either in reference portion size or in grams. Dietary habits were assessed with questions inquiring about regular intake of meals, breakfast consumption, snacking and frequency of eating out.

Data from the FFQ and dietary habits questions were used to calculate the KIDMED index (Mediterranean Quality Index for children and adolescents) [60]. The KIDMED index measures the degree of adherence to the Mediterranean diet (MeD) by measuring the consumption of 16 items, of which 12 are positively scored and four negatively scored. Items denoting a positive association to the MeD are assigned a value of +1: (1) fruit/fruit juice every day, (2) second fruit every day, (3) vegetables regularly once a day, (4) vegetables more than once a day, (5) fish at least 2–3 times/week, (6) pulses more than once a week, (7) pasta or rice consumption $\geq 5/\text{week}$, (8) cereals or grains for breakfast, (9)

nuts at least 2–3 times/week, (10) regular use of olive oil, (11) a dairy product for breakfast and (12) two yoghurts and/or some cheese (40 g) daily.

Items denoting a negative association to the MeD are assigned a value of –1: (1) fast food >1/week, (2) skipping breakfast, (3) commercially baked goods or pastries for breakfast, (4) taking sweets and candy several times every day.

The total score ranges from 0 to 12, with higher scores indicating higher adherence to the MeD [61].

Smoking and Alcohol

Smoking status was assessed by two questions: 'Have you ever smoked 100 cigarettes in your life?' (yes or no) and 'During the past 30 days, on how many days did you smoke cigarettes?' [62]. Participants were categorized as (1) never smokers (those who had not smoked 100 cigarettes in their lifetime and had not smoked in the last 30 days), (2) former smokers (those who had smoked 100 cigarettes in their lifetime but had not smoked in the last 30 days), (3) current smokers (those who had smoked 100 cigarettes in their lifetime and had smoked in the last 30 days) [63].

Prevalence of alcohol consumption in the past 30 days was assessed with the question: 'During the past month, on how many days did you drink alcohol?' the responses were '0 days; 1 or 2 days; 3 to 5 days; 6 to 9 days; 10 to 19 days; 20 to 29 days; All 30 days'. In line with the categorization used in the Global School Health Survey, the responses were then dichotomized into (1) no = 0 days and (2) yes = 1–30 days [62].

Breakfast Intake

The breakfast questions inquired about breakfast intake and frequency. Breakfast consumers were defined as adolescents who consumed any food from at least one food group, and within three hours of waking up [64]. Frequency of intake was assessed with the question: 'How many days of the week do you eat breakfast?', and was categorized as: (1) rare (0–2 days/week), (2) occasional (3–4 days/week) and (3) frequent (5–7 days/week).

Physical Activity

Physical activity was assessed using the short version of the International physical activity questionnaire (IPAQ). The IPAQ has been shown to be a reliable and valid tool to obtain estimates of PA [65–67]. The questionnaire asks about three specific levels of activity: walking, moderate and vigorous-intensity activities and their frequency (days per week) and duration (minutes per day). Total PA was calculated by multiplying time spent in each activity intensity by its estimate metabolic equivalent METs estimated at 3.3 for walking, 4.0 for moderate intensity activity and 8.0 for vigorous intensity activity (e.g., walking MET-minutes/week = 3.3 x walking minutes x walking days). MET-minutes/week for each activity are summed to derive the total PA MET-minutes/week [68]. Three categories of PA

were assigned on the basis of MET-min/week: (1) low: <600, (2) moderate: at least 600 and (3) high: at least 3000.

2.3.3. Socio-Cognitive Factors

The questionnaire was based on the I-Change Model addressing socio-demographic, cultural, ecological and motivational factors [43]. The I-Change Model has been used to assess a variety of health behaviors, including nutrition behavior [69,70].

Attitude was measured by using the responses to four questions addressing the pros and cons of getting good academic grades. Two questions measured positive attitudes towards getting good grades ('Getting good academic grades is a good help for getting a good job/will get me compliment from my parents'). The responses were coded from -2 to +2 (-2 = strongly disagree to +2 = strongly agree). Two questions measured the negative attitude towards getting good grades ('Getting good academic grades means that I have to work too hard/will cause disapproval among my friends'). For the negative statement, responses were reverse coded from +2 to -2 (2 = strongly disagree to -2 = strongly agree), so that higher scores indicate a more positive attitude toward getting good academic grades.

Social norms were measured using the responses to three questions asking if important people in their environment (both parents and teachers) expect them to get good academic grades ('My father/my mother/my teacher expects me to get good academic grades') on a five-point Likert scale (+2 = strongly agree, -2 = strongly disagree).

Adolescents' academic self-efficacy was measured using five question scale ('I find it easy to get good academic grades/to concentrate at school for getting good academic grades/to master the skills that are taught in class this year/to concentrate on school work when I am at home/to finish all my school work'). All the questions were measured on a five-point Likert scale (+2 = strongly agree, -2 = strongly disagree), with higher scores indicating higher self-efficacy. A mean score for self-efficacy was composed ($\alpha = 0.76$).

Intention to get good academic grades was assessed by one question: 'I intend to get good academic grades' on a five-point Likert scale (+2 = strongly agree, -2 = strongly disagree) [71,72].

2.3.4. Main Outcome Measure

Academic achievement was measured using the student's general average, which is the result of the performance of the student in all school subjects during a specific semester. The general average is the standard instrument for the assessment of the academic achievement of students in Lebanese schools. Most schools use a 0–20 scale, where the

passing grade is 10 out of 20. This means that if students score lower than 10 out of 20, they fail their academic semester, whereas if they score 10 or above they pass. Students were asked to report their general average of the last semester. Academic achievement was dichotomized into (1) high ≥ 10 and (0) low < 10 .

2.4. Statistical Analysis

Data entry and analysis were performed on SPSS statistical software, version 21. (SPSS Inc. Chicago, IL, USA) and a p value < 0.05 was considered to be significant.

Data cleaning was performed on a sample of 50 questionnaires that were completely checked for errors. The error rate was lower than 1%; thus, data entry was considered adequate. Missing data were not replaced for this analysis, due to their low percentage ($< 10\%$) [73].

A descriptive analysis was performed using means and standard deviations for all continuous variables, whereas numbers and percentages were used for categorical variables.

The Pearson Chi-square was used to examine the associations between categorical variables and both categories of academic achievement. Fisher's exact test was also used when the expected frequency was less than 5. Independent Samples T-test was used to evaluate the differences between the means of continuous measures for both categories of academic achievement.

A multivariate logistic regression (high academic achievement = 1/low academic achievement = 0) was carried out to identify which factors were independently associated with academic achievement using the Enter method. Variables which obtained $p < 0.2$ in the bivariate analysis were entered in the model [74,75]. Independent variables were introduced by blocks: Model 1 included socio-demographic and school variables. Model 2 also contained BMI classes and health behaviors variables, and in Model 3, the socio-cognitive variables were added. Adjusted Odds ratios (aOR) were presented in tables with 95% confidence intervals (CI). We evaluated the models using Nagelkerke R², the Omnibus test, Hosmer-Lemeshow goodness-of-fit tests and the percentage of correctly classified cases [76].

3. Results

3.1. Description of the Sample

Out of the 600 distributed questionnaires, 563 (94%) were used for data analysis and 36 (6%) were removed for being almost empty or incomplete. The final sample consisted of 50.1% male and 49.9% female participants, with a mean age of 15.8. Out of the study participants, 66% were in grade 10 and 34% in grade 11, while 62.5% of subjects attended private school and 37.5% attended public school. The proportion of parents with high educational level was of 52.5% for fathers and 55.1% for mothers. In all, 95.1% of fathers and 47.1% of mothers were working. The average BMI for the subjects in the study was 23.67 (SD = 4.48), and 39.2% of the participants were overweight/obese. Out of the 563 participants, 80.6% had an average grade of 10 or above and 19.4% scored lower than 10 (Table 1).

Table 1. Association of Socio-demographics and Anthropometric Measurements with Academic Achievement.

Variables	Total Number 563 (100%) N (%)	Low Academic Achievement 109 (19.4%) N (%)	High Academic Achievement 454 (80.6%) N (%)	Test Statistic (df)	<i>p</i>
Type of school					
- Public	211 (37.5%)	57 (27%)	154 (73.0%)	χ^2 (1) = 12.663	<0.001 ^a
- Private	352 (62.5%)	52 (14.8%)	300 (85.2%)		
Gender					
- Boys	282 (50.1%)	65 (23%)	217 (77.0%)	χ^2 (1) = 4.925	0.026 ^a
- Girls	281 (49.9%)	44 (15.7%)	237 (84.3%)		
Age					
-15	234 (41.6%)	44 (18.8%)	190 (81.2%)	χ^2 (3) = 0.270	0.966 ^a
-16	225 (40%)	43 (19.1%)	182 (80.9%)		
-17	85 (15.1%)	18 (21.2%)	67 (78.8%)		
-18	19 (3.4%)	4 (21.1%)	15 (78.9%)		
Crowding index					
- <1 person/room	182 (32.5%)	30 (16.5%)	152 (83.5%)	χ^2 (1) = 1.201	0.273 ^a
- ≥1 person/room	378 (67.5%)	77 (20.4%)	301 (79.6%)		
House ownership					
- Rented	108 (19.3%)	23 (21.3%)	85 (78.7%)	χ^2 (1) = 0.360	0.549 ^a
- Privately owned	453 (80.7%)	85 (18.8%)	368 (81.2%)		
Internet connection					
- No	29 (5.2%)	3 (10.3%)	26 (89.7%)	χ^2 (1) = 1.592	0.207 ^a
- Yes	534 (94.8%)	106 (19.9%)	428 (80.1%)		
Personal smart phone					
- No	20 (3.6%)	3 (15%)	17 (85.0%)	χ^2 (1) = 0.253	0.778 ^c
- Yes	543 (96.4%)	106 (19.5%)	437 (80.5%)		

Variables	Total Number 563 (100%) N (%)	Low Academic Achievement 109 (19.4%) N (%)	High Academic Achievement 454 (80.6%) N (%)	Test Statistic (df)	p
Father's educational level					
- Low (Illiterate & Primary school)	31 (6.5%)	5 (16.1%)	26 (83.9%)	χ^2 (2) = 0.471	0.790 ^a
- Moderate (Complementary & Secondary school)	195 (41%)	38 (19.5%)	157 (80.5%)		
-High (Technical & University)	250 (52.5%)	43 (17.2%)	207 (82.8%)		
Mother's educational level					
- Low (Illiterate & Primary school)	22 (4.4%)	6 (27.3%)	16 (72.7%)	χ^2 (2) = 4.529	0.104 ^a
- Moderate (Complementary & Secondary school)	204 (40.6%)	43 (21.1%)	161 (78.9%)		
-High (Technical & University)	277 (55.1%)	41 (14.8%)	236 (85.2%)		
Father work					
- Not working	27 (4.9%)	4 (14.8%)	23 (85.2%)	χ^2 (1) = 0.326	0.568 ^a
- Working	525 (95.1%)	101 (19.2%)	424 (80.8%)		
Mother work					
- Not working	296 (52.9%)	59 (19.9%)	237 (80.1%)	χ^2 (1) = 0.088	0.767 ^a
- Working	264 (47.1%)	50 (18.9%)	214 (81.1%)		
Family structure					
- Live with both parents	507 (90.4%)	92 (18.1%)	415 (81.9%)	χ^2 (1) = 4.140	0.042 ^a
- Other arrangements	54 (9.6%)	16 (29.6%)	38 (70.4%)		
Religion					
- Christian	434 (78.1%)	77 (17.7%)	357 (82.3%)	χ^2 (3) = 5.552	0.115 ^c
- Muslim	110 (19.8%)	27 (24.5%)	83 (75.5%)		
- Atheist	10 (1.8%)	4 (40%)	6 (60%)		
- Druze	2 (0.4%)	0 (0%)	2 (100%)		
Weight (kg)	66.44 ± 15.50	69.67 ± 16.00	65.65 ± 15.30	t (559) = 2.440	0.015 ^b
Height (cm)	167.12 ± 8.85	168.51 ± 8.61	166.77 ± 8.89	t (561) = 1.845	0.066 ^b
BMI (kg/m²)					
-Underweight	25 (4.5%)	6 (24.0%)	19 (76.0%)	χ^2 (2) = 6.013	0.049 ^a
- Normal	316 (56.3%)	50 (15.8%)	266 (84.2%)		
- Overweight/Obese	220 (39.2%)	53 (24.1%)	167 (75.9%)		

Notes: ^a p-value for the chi-square test, ^b p-value for the Independent Samples T-test, ^c p-value for Fisher's exact

3.2. Socio-Demographics and Academic Achievement

The prevalence of high academic achievement was significantly greater among females compared to males ($p = 0.026$). High academic achievement was also more prevalent in private school student ($p < 0.001$), adolescents living with both parents ($p = 0.042$) and adolescents with normal weight ($p = 0.049$). No significant effects were found for factors such as parents' education, working status and religion (Table 1).

3.3. Health Behavior and Academic Achievement

Adherence to the MeD was particularly low (3.77 ± 2.51). Diet quality assessed by adherence to the MeD was significantly correlated with academic achievement (Table 2): the higher the adherence to the MeD, the higher the probability to have high academic achievement ($p < 0.001$). Additionally, the prevalence of high academic achievement was significantly greater among adolescents with medium levels of PA compared to low levels ($p < 0.001$). Non-smokers and past smokers were also significantly more likely to have high academic achievement compared to current smokers ($p = 0.002$) (Table 2). No significant associations of academic achievement with snacking frequency and type, alcohol consumption and breakfast intake were found.

Table 2. Association between Health Behaviors and Academic Achievement.

Variables	Total Number N (%)	Low Academic Achievement	High Academic Achievement	Test Statistic (df)	p
Regular meal pattern					
- No	406 (72.1%)	85 (20.9%)	321 (79.1%)	$\chi^2 (1) = 2.314$	0.128 ^a
- Yes	157 (27.9%)	24 (15.3%)	133 (84.7%)		
Snacking frequency per day					
- No	36 (6.4%)	8 (22.2%)	28 (77.8%)	$\chi^2 (3) = 2.283$	0.516 ^a
-Once	153 (27.2%)	34 (22.2%)	119 (77.8%)		
-Twice	236 (41.9%)	39 (16.5%)	197 (83.5%)		
-3 times or more	138 (24.5%)	28 (20.3%)	110 (79.7%)		
Type of snack					
-Sandwich	76 (14.4%)	17 (22.4%)	59 (77.6%)	$\chi^2 (2) = 1.763$	0.414 ^a
-Fruits & Vegetables	124 (23.4%)	19 (15.3%)	105 (84.7%)		
-Sweets, Candies & Salty crackers	329 (62.2%)	65 (19.8%)	264 (80.2%)		
Smoking status					
-Never	505 (90.3%)	89 (17.6%)	416 (82.4%)	$\chi^2 (2) = 11.851$	0.002 ^b
-Past	6 (1.1%)	1 (16.7%)	5 (83.3%)		
-Current	48 (8.6%)	19 (39.6%)	29 (60.4%)		
Do you drink alcohol					
- No	229 (40.7%)	50 (21.8%)	179 (78.2%)	$\chi^2 (1) = 1.513$	0.219 ^a
- Yes	334 (59.3%)	59 (17.7%)	275 (82.3%)		

Variables	Total Number N (%)	Low Academic Achievement	High Academic Achievement	Test Statistic (df)	<i>p</i>
Prevalence of Alcohol consumption in the past 30 days					
- No	255 (45.3%)	56 (22%)	199 (78.0%)	χ^2 (1) = 2.019	0.155 ^a
- Yes	308 (54.7%)	53 (17.2%)	255 (82.8%)		
Sleeping hours					
-<8 h	371 (65.9%)	74 (19.9%)	297 (80.1%)	χ^2 (1) = 0.239	0.625 ^a
-≥8 h	192 (34.1%)	35 (18.2%)	157 (81.8%)		
KIDMED Index Adherence to MeD	3.77 ± 2.51	2.30 ± 2.07	4.11 ± 2.46	t (561) = −7.090	<0.001 ^c
Breakfast intake					
- No	139 (25.6%)	31 (22.3%)	108 (77.7%)	χ^2 (1) = 1.053	0.305 ^a
- Yes	404 (74.4%)	74 (18.3%)	330 (81.7%)		
Habitual breakfast consumption					
-Rare (0–2 days)	48 (8.5%)	10 (20.8%)	38 (79.2%)	χ^2 (2) = 5.338	0.069 ^a
-Occasional (3–4 days)	135 (24.0%)	35 (25.9%)	100 (74.1%)		
-Frequent (5–7 days)	380 (67.5%)	64 (16.8%)	316 (83.2%)		
PA level					
- Low	184 (32.8%)	39 (21.2%)	145 (78.8%)	χ^2 (2) = 15.834	<0.001 ^a
- Medium	155(27.6%)	14 (9.0%)	141 (91.0%)		
- High	222 (39.6%)	56 (25.2%)	166 (74.8%)		

Notes: ^a p-value for the chi-square test, ^b p-value for Fisher's exact test, ^c p-value for the Independent Samples T-test.

3.4. Socio-Cognitive Factors and Academic Achievement

The prevalence of having high academic achievement was highest among students who reported the highest level of social norms towards getting good grades from their teacher, compared to their parents ($p = 0.028$). Moreover, students with greater reported academic self-efficacy towards being able to achieve academic performances and with stronger intentions toward getting good grades were more likely to have high academic achievement ($p < 0.001$) (Table 3). No significant associations of academic achievement and attitude were found.

Table 3. Association of Socio-cognitive Factors and Academic Achievement.

	Total Number	Low Academic Achievement	High Academic Achievement	Test Statistic (df)	<i>p</i> ^a
Getting good grades is a good help for getting a good job	0.87 ± 0.98	0.97 ± 0.94	0.85 ± 0.98	t (559) = 1.213	0.226
Getting good grades will get me compliment from my parents	1.15 ± 0.89	1.13 ± 0.90	1.15 ± 0.89	t (558) = -0.194	0.846
Getting good grades means that I have to work too hard	-0.68 ± 0.96	-0.83 ± 1.00	-0.65 ± 0.94	t (561) = -1.710	0.088
Getting good grades means will cause disapproval among my friends	1.05 ± 1.05	0.88 ± 1.14	1.09 ± 1.03	t (561) = -1.831	0.068
My father expects that I get good academic grades	1.03 ± 0.98	1.11 ± 0.99	1.02 ± 0.97	t (556) = 0.923	0.357
My mother expects that I get good academic grades	1.15 ± 0.91	1.24 ± 0.80	1.13 ± 0.94	t (559) = 1.176	0.240
My teacher expects that I get good academic grades	0.69 ± 0.90	0.48 ± 1.13	0.73 ± 0.83	t (135) = -2.216	0.028
Self-efficacy Total	0.25 ± 0.74	-0.17 ± 0.81	0.35 ± 0.68	t (140) = -6.002	<0.001
Intention	1.15 ± 0.90	0.75 ± 1.19	1.25 ± 0.80	t (132) = -4.116	<0.001

Notes: ^a *p*-value for the Independent Samples T-test.

3.5. Multivariate Analysis

Three multivariate regressions are shown in Table 4. The first model including all socio-demographic factors revealed that adolescents from private schools and girls were more likely to have high academic achievements. In the second model, adding health behaviors to Model 1, type of school and gender were no longer significant. The odds of having high academic achievement were significantly lower for overweight and obese adolescents (aOR: 0.52; 95% CI 0.28–0.95), as well as for current smokers (aOR: 0.29; 95% CI 0.13–0.67). Adolescents with medium levels of PA were 2.73 times more likely to have high academic achievement compared to low level groups. Finally, the odds of having high academic achievement were significantly greater with higher adherence to the MeD (aOR: 1.39; 95% CI 1.21–1.59). In the third and final model, in which socio-cognitive factors were also added, the odds of having high academic achievement remained significantly greater for students with high adherence to the MeD (aOR:1.34; 95% CI 1.15–1.56). Similarly, current smokers remained less likely to have high academic achievement compared to those who do not smoke (aOR: 0.38; 95% CI 0.15–0.93), but PA and BMI were no longer significant. Self-efficacy seemed to have the most prominent effect (aOR: 1.81; 95% CI 1.15–2.84) followed by intention (aOR: 1.40; 95% CI 1.01–1.95).

Table 4. Association of Socio-demographics, Health Behaviors, Socio-cognitive Factors with Academic Achievement in Lebanese Adolescents.

Variables	Model 1			Model 2			Model 3		
	aOR	95% CI	p	aOR	95% CI	p	aOR	95% CI	p
Type of school									
- Public	1			1			1		
- Private	2.39	1.30–4.39	0.005	1.80	0.90–3.60	0.097	2.02	0.96–4.25	0.064
Gender									
- Boys	1			1			1		
- Girls	1.96	1.17–3.29	0.011	1.35	0.74–2.48	0.311	1.53	0.77–3.03	0.224
Mother's educational level									
- High (Technical & University)	1			1			1		
- Low (Illiterate & Primary school)	0.68	0.21–2.21	0.523	0.50	0.13–1.93	0.317	0.64	0.16–2.58	0.533
- Moderate (Complementary & Secondary school)	0.82	0.47–1.45	0.501	0.72	0.38–1.36	0.309	0.74	0.37–1.45	0.375
Family structure									
- Other arrangements	1			1			1		
- Live with both parents	1.43	0.64–3.20	0.385	1.21	0.48–3.08	0.682	0.82	0.30–2.23	0.698
Religion									
- Christian	1			1			1		
- Muslim - Druze - Atheist	0.78	0.43–1.42	0.417	0.82	0.40–1.71	0.599	0.81	0.37–1.77	0.592
BMI (kg/m²)									
- Normal	1			1			1		
- Underweight				0.32	0.09–1.11	0.073	0.31	0.08–1.13	0.076
- Overweight/Obese				0.52	0.28–0.95	0.032	0.55	0.29–1.04	0.068
Regular meal pattern									
- No	1			1			1		
- Yes				0.70	0.34–1.45	0.341	0.63	0.29–1.36	0.236
Smoking status									
- Never	1			1			1		
- Past				2.52	0.12–52.28	0.550	2.23	0.12–41.42	0.592
- Current				0.29	0.13–0.67	0.004	0.38	0.15–0.93	0.034
Prevalence of Alcohol consumption in the past 30 days									
- No	1			1			1		
- Yes				1.44	0.75–2.77	0.272	1.31	0.65–2.62	0.446
Habitual breakfast consumption									
- Rare (0–2 days)	1			1			1		
- Occasional (3–4 days)				0.47	0.15–1.48	0.199	0.30	0.08–1.06	0.061
- Frequent (5–7 days)				0.55	0.18–1.67	0.290	0.38	0.11–1.29	0.121
PA level									
- Low	1			1			1		
- Medium				2.73	1.13–6.60	0.026	2.34	0.91–6.03	0.077
- High				0.68	0.36–1.30	0.243	0.59	0.29–1.18	0.132
KIDMED Index Adherence to the Med Diet									
	1.39	1.21–1.59	<0.001	1.34	1.15–1.56	<0.001			
Getting good grades means that I have to work too hard									
							1.15	0.83–1.59	0.412

Variables	Model 1			Model 2			Model 3		
	aOR	95% CI	p	aOR	95% CI	p	aOR	95% CI	p
Getting good grades means will cause disapproval among my friends							1.03	0.76–1.39	0.866
My teacher expects that I get good academic grades							1.38	0.99–1.92	0.061
Self-efficacy Total							1.81	1.15–2.84	0.010
Intention							1.40	1.01–1.95	0.047

aOR = adjusted Odds Ratio; CI = confidence interval; BMI = Body Mass Index. Dependent variable: High/low Academic Achievement

Variables with a *p*-value < 0.2 in the bivariate analysis were included in the multivariate analysis, to make sure that all pertinent and potentially predictive variables are studied.

Model 1: Variables entered: Type of school, Gender, Mother's educational level, Family structure, Religion. Omnibus test *p*-value < 0.001/Hosmer-Lemeshow test *p*-value = 0.341. Nagelkerke R^2 = 0.167/Overall predicted percentage = 81.9%.

Model 2: Variables entered: Variables in Model 1 + BMI classes, Regular meal pattern, Smoking status, Prevalence of Alcohol consumption in the past 30 days, Habitual breakfast consumption, PA level/ TOTAL MET_MIN/WEEK, KIDMED Index Adherence to the MeD Diet. Omnibus test *p*-value < 0.001/Hosmer-Lemeshow test *p*-value = 0.599. Nagelkerke R^2 = 0.360/Overall predicted percentage = 85.1%.

Model 3: Variables entered: Variables in Model 2 + Getting good grades means that I have to work too hard, Getting good grades means will cause disapproval among my friends, My teacher expects that I get good academic grades, Self-efficacy Total, Intention. Omnibus test *p*-value < 0.001/Hosmer-Lemeshow test *p*-value = 0.760. Nagelkerke R^2 = 0.429/Overall predicted percentage = 88.0%.

4. Discussion

Even though, several studies have been conducted to examine the factors associated with academic performance of adolescents [24,48,77], very few assess the factors in one comprehensive model, and may not correct for overlap between potential factors. The current study examined the relationship between academic achievement of Lebanese adolescents with health behaviors, socio-demographics and motivational factors in order to identify modifiable factors to foster future academic achievements in this group of adolescents.

4.1. Socio-Demographics and Academic Achievement

In the bivariate analysis, and when entered in the multivariate model alone, gender and type of school were significantly associated with achievement. Academic achievement was significantly higher in girls and adolescents from private schools. The result that girls outperformed boys is a common finding [77,78], and has been explained by several theories, among which are the differences between girls and boys in interests and attitudes towards learning [79]. Regarding the type of school, in Lebanon, the two sectors public and private are an indicator of the different socio-economic backgrounds. Private schools have high tuition fees and, thus, are more likely to attract adolescents from higher SES, whereas public schools are practically free of charge and usually adolescents enrolled in the public sector come from low SES families. Our finding that adolescents from private schools were found to have higher achievement is in line with previous studies [80], and

might be explained by the fact that adolescents enrolled in private schools benefit from cultural capital and material resources leading to higher performance [81]. However, gender and type of school were overshadowed when health behaviors were added to the model, and became insignificant.

4.2. Health Behavior and Academic Achievement

Our results extend the findings of previous research, and demonstrate a significant association between diet quality and academic achievement [34,82,83]. A higher adherence to the MeD was positively associated with high academic achievement. Our observations are in agreement with prior research, where high adherence to the MeD was related to critical thinking, greater capacity for effort [31], higher academic performance, and the higher the adherence, the better the academic scores [32,33]. It is notable that, in our study, this finding was also found after correcting for parental SES, thus suggesting an independent effect of MeD. The MeD is a healthy eating pattern characterized by high intakes of plant food, olive oil, fish and limited intake of meat, dairies and sweets [84]. The positive association between MeD and academic achievement could be related to the richness of this diet in key nutrients, with antioxidant and anti-inflammatory properties which were found to positively influence cognitive function [85–87]. High adherence to the MeD is associated with a higher intake of antioxidant rich foods, such as fruits and vegetables and phytochemicals, particularly polyphenols [88], which were found to reduce inflammation and oxidative stress thus leading to better cognitive performance [88,89]. Other predominant nutrients in the MeD are omega-3 fatty acids, known for their neuroprotective properties and importance in brain development and function [87,88]. On another note, and beyond the effect of distinct dietary components, the MeD diet is considered an overall healthy and balanced diet [90]. A healthy diet was found to positively relate to better mental well-being, self-esteem, lower anxiety and stress [91,92] which, in turn, can improve cognition and performance. The latter implies that the promotion of MeD is worth considering for enhancing academic performances, as well as overall better health. It is important to note that adherence to MeD among our sample was mainly low (mean score 3.77); in fact, a recent study showed that Lebanese adolescents were mostly following a Western dietary pattern, characterized by high intakes of fast food and refined sweets [93], which has been found to negatively impact academic performance [94]. These findings highlight the need for further work on identifying the determinants of adherence to the MeD in order to preserve and promote this cultural healthy dietary pattern in Lebanon.

Furthermore, this study confirms existing evidence that substance use predicts poor educational achievement [37]. Our results indicate that adolescents who smoke were more likely to have low academic achievement. The association of smoking and poor performance is well established [95]; however, the underlying mechanisms remain unclear. What is recognized is that smoking and poor academic achievement mutually influence each other [38]. Smoking is associated with a higher likelihood of poor academic achievement, conversely, academic failure is associated, through psychosocial

mediating factors (like favorable attitude towards smoking and weaker self-efficacy to refuse smoking), with a higher probability of smoking [96]. Consequently, efforts aimed at preventing the onset of smoking among adolescents in Lebanon should be pursued, as they not only foster good physical health but also cognitive health.

4.3. Socio-Cognitive Factors and Academic Achievement

With regards to socio-cognitive factors, our results show that having a higher academic self-efficacy and stronger intention towards getting good grades are positively associated with higher academic achievement. These findings are supported by the past literature, indicating that the higher the self-efficacy, the better the academic performance [97,98]. In fact, self-efficacy and intentions are linked [99]; individuals with high self-efficacy are more likely to set higher goals and develop a stronger intention to achieve these goals [100], in this case, getting good academic grades. Personal beliefs about efficacy can be stronger predictors of academic achievement than actual abilities [101]; students often have poor academic achievement not because they are incompetent, but rather due to not believing they have the capabilities to succeed [102]. Highly efficacious students are highly motivated, work harder and more persistently towards achieving academic tasks, and consequently perform better than students with lower efficacy beliefs [103]. The literature also suggests a reciprocal relation between self-efficacy and academic performance; past academic success enhances students' efficacy beliefs, while experiencing failure lowers it [104]. Mastery experience is indeed one of the most influential factors affecting self-efficacy but not the only source. Vicarious experience, verbal persuasion and physiological reactions can also foster self-efficacy [102,105]. Sources of self-efficacy can differ across culture [106]; consequently, future research is needed to investigate which factor has the greatest impact on self-efficacy of Lebanese adolescents, so as to best realize positive efficacy beliefs and consequently intentions toward achieving academic grades.

Although borderline significant, our results suggest that negative attitudes towards academic achievements and disapproval by friends may play a role. Consequently, our findings underline the need for a more in-depth research towards the role of these socio-cognitive factors, and how to change them.

4.4. Strength and Limitations

Very few studies have done this kind of research in youth from developing countries [24,52,53] and evidence from Lebanon is much needed. To the best of our knowledge, this is the first study to examine the association of academic achievement with health behaviors, socio-demographics and socio-cognitive factors among Lebanese adolescents. The strengths of this descriptive study also include the comprehensive model used comprising of a wide range of factors and the objective method to measure weight and height. More studies in Arab cultures are needed, to identify whether similar patterns can also be observed in related countries. One limitation of this study was that grades were self-reported and the possibility of students overestimating their academic performance should be considered. However, previous research indicates that self-reported grades can

be a reliable measure of academic performance, since they are comparable to academic transcripts [26,107]. Furthermore, our results showing that the majority of students (80.6%) had a high achievement level, scoring higher than 10 and passing the school semester, is comparable to those of the Center for Educational Research and Development, in which 83.3% are succeeding vs. 16.7% who are failing [108].

In addition, our study had a cross-sectional design, allowing us to test associations rather than infer causal relationships, further longitudinal studies recruiting schools to engage in research for several measurements is needed to confirm the associations. Finally, the majority of our sample comes from private schools (62.5% vs. 37.5% from public schools), which is comparable with statistics showing that private schools in Lebanon account for the majority of total enrollment [108]. However, caution should be exerted in generalizing the results to the whole adolescents' population in Lebanon. The sample population was selected from Beirut, the capital, and Mount Lebanon, these two areas have the highest concentration of people and are representative of the various religious and socio-demographic societies in Lebanon. While the distribution of the study sample by sex and school sector was similar to that of the Lebanese secondary student population [108], the sample is not at a national level and, consequently, this limit the generalizability of the results.

5. Conclusions and Implications

Our findings of an association between diet, smoking and academic achievement adds to the long-existing evidence on the relation of health to academic success, and provides further rationale on the importance of promoting healthy lifestyle habits among youth. Most importantly, this study shows a sub-optimal level of adherence to the MeD (mean score 3.77). Lebanese adolescents are moving away from this traditional healthy dietary pattern towards a more Westernized diet. The latter highlights the need to raise awareness among Lebanese youth on the benefits of the MeD and its importance for both physical and cognitive health.

At the school level, this can be done by incorporating nutrition education into the school curriculum, educating adolescents about the nutritional benefits of the MeD and encouraging greater adherence by minimizing the sale of low nutrient, high energy foods in school shops, and instead provide healthy alternatives to students. Nutrition sessions should also target parents, as they are key players in helping their children adopt healthy behaviors and maintain healthy habits in the home environment [109]. Health educators need to also tackle the subject of smoking, discuss the negative effect of tobacco use, the hazards of smoking, teach adolescents how to be aware of social influences and how to resist them. School programs are considered amongst the most effective strategies to reduce smoking prevalence in adolescents.

By integrating health and nutrition education into the regular school curriculum, schools are not only improving students' cognitive health and learning, but are also supporting adolescents' long-term health and wellness as to chronic diseases prevention, healthy weight and long life-expectancy. Our results also show a high proportion of overweight and obesity (39.2%). Promoting healthy eating and participation in regular activity within schools can help adolescents acquire healthy habits and curb the progression of obesity.

Furthermore, given the strong association of self-efficacy with academic achievement, it is important to promote the development of students' self-efficacy. Educators can foster students' academic self-efficacy by providing frequent positive feedback, encouragement and guidance. Group activities can be also beneficial; observing peers succeeding will motivate them to try and do the same [110]. Parents can play a role too in nurturing their children's self-efficacy by engaging in their academic activities, praising their efforts when deserved and showing recognition for a job well done, but also providing honest feedback when they fail and encouraging and challenging them to do better.

Lastly, to carry over and complement the efforts done at the school and home level, national policies and strategies addressing access to healthy food, physical activity and tobacco use need to be established. Local authorities have the power and responsibility to shape the environment into a healthy one and enable adolescents to make healthy choices. Community-based interventions and environmental support involving all sectors of society are recommended to facilitate sustainable healthy behavioral change.

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CHAPTER 3

Parenting style as longitudinal predictor of adolescents' health behaviors in Lebanon

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Abstract

This prospective study aimed to examine how parenting style relates to health behaviors and body mass index of Lebanese adolescents while checking for interactive effect of child characteristics (age and gender). About 341 students from private and public schools in Mount Lebanon and Beirut area, aged between 16 and 18 years, completed a self-administered survey assessing socio-demographics, parenting styles and health behaviors. Adolescents were surveyed at two time points, six months apart. Anthropometric measurements were also taken. Authoritative parenting was associated with better outcomes compared to the neglectful style. Adolescents raised with an authoritative style had higher adherence to the Mediterranean diet and lower consumption of alcohol intake. Parenting style was a significant predictor of eating behavior and alcohol intake of Lebanese adolescent. Interventions aiming at improving health behaviors should also encompass healthy parenting style strategies.

Introduction

Adolescence is considered a critical developmental phase during which adolescents engage in lifestyle behaviors that can affect their health and lead to long-term health implications [1]. Unhealthy eating, lack of physical activity (PA), alcohol and substance use are all health-related risk behaviors that negatively impact adolescents' life, both physically and mentally [2, 3]. Harmful drinking substantially increases the risk of illness, violence and injury [4]. Moreover, tobacco, alcohol, unhealthy eating and sedentary behaviors are all important risk factors for the development of non-communicable diseases in later life and consequently are linked to higher morbidity and mortality [5, 6].

The World Health Organization estimated that globally one in six adolescents was overweight in 2016, four in five adolescents do not meet the guidelines for daily activity level and at least 1 in 10 adolescents uses tobacco [7]. These problematic behaviors also affect Lebanese adolescents. The latest Global School-based Student Health Survey shows that 24.6% of Lebanese adolescents aged 13–17 years are overweight, 36.6% currently use tobacco products and 18.9% consume alcohol beverages [8]. Furthermore, Lebanon has been witnessing a nutritional transition from the traditional Mediterranean diet into a Westernized dietary pattern [9]. Adolescents' diets are becoming higher in fats and sugar and lower in nutrient density [10]. This dietary transition coupled with an unhealthy lifestyle such as sedentarity, smoking and drinking has been associated with an increased risk of obesity among Lebanese adolescents and are reportedly leading causes for non-communicable diseases in later-life [11, 12]. Lebanon has been also found to have one of the highest estimated prevalence of metabolic syndrome among both adolescents and adults in the East Mediterranean region [13, 14]. Non-communicable diseases and obesity have subsequently emerged as primary cause for morbidity and mortality in Lebanon [15]. Health compromising behaviors may not only affect Lebanese adolescent health today but are known to extend into adulthood and affect their future health [16, 17], hence the importance of addressing these behaviors early and understand what influence them. Adolescent health and well-being have indeed been the focus of many studies and interventions and are now on the global agenda for sustainable development [18]. Investing in adolescents' health will bring benefits for adolescents now, into their future lives and for the next generations [16, 17].

From an ecological perspective, parents—being a part of the immediate or microenvironment of adolescents— can have a strong influence on their children's outcomes and development of behaviors [19,20]. Parents can influence their children's health behaviors in various ways; such as modeling of behaviors [21] or controlling availability and accessibility to healthy food or activity opportunities [22,23]. Parents might also exert their influence through specific parenting practices (such as rules related to dietary intake or limiting screen time) or more global aspect of parental behavior referred to as general parenting style [24]. Parenting style is described as the emotional climate in which parents communicate or interact with their children [25]. Parenting style can be

categorized into four prototypes based on the combination of two dimensions of parental behavior: responsiveness and demandingness [26,27]. The four types being authoritative (demanding but responsive), authoritarian (highly demanding but unresponsive), permissive (more responsive than demanding) and neglectful (unresponsive and undemanding) [25].

Compared to the other styles, authoritative parenting is considered as the most optimal style with positive and protective effects on the child's development. Authoritative parenting has been shown to have a protective role for adolescents by decreasing their engagement in health-risk behaviors such as smoking [28, 29], alcohol consumption [30, 31] and substance use [32, 33]. Moreover, children of authoritative parents were found to have healthier dietary behaviors: higher intake of fruits [34], fewer unhealthy snacks [35] and have lower body mass index (BMI) values [36–39]. However, inconsistencies exist among studies; while the latter showed positive associations of parenting styles with health behaviors, other studies failed to find any association at all. De Bourdeaudhuij et al. [40] and Vereecken et al. [41] found that general parenting was not related to dietary habits including fruit and vegetable consumption, it is rather food specific parenting practices that have an impact on eating habits. In addition, different associations were found for different populations; when comparing relationships between parenting and BMI between a sample of American and Czech children, Humenikova and Gates [42], found that among American children permissive parenting was related to higher BMI, whereas, for Czech children authoritative parenting appeared to be associated with higher BMI. Hence, the influence of parenting styles may thus differ per culture.

The influence of parenting style may also depend on child characteristics. For example, some studies suggest that gender moderates the effect of parenting style on health behaviors. A controlling parenting style was found to be associated with unhealthier eating in girls but not in boys [43]. Similarly, authoritative parenting was found to have positive effect on PA for boys, whereas authoritarian parenting had the most positive effect in girls [44].

Parents are notably a major source of influence and consequently important targets for interventions. However, the impact of parenting styles on nutrition habits of their children remains understudied in Lebanon with only one cross-regional study that examined parenting in eight Middle Eastern countries including Lebanon [45]. This study revealed that compared to conservative countries such as Saudi Arabia in which authoritarian parenting prevail, Lebanese parents have a more lenient parenting pattern which is a combination of authoritative and permissive parenting comparable to the styles found in Jordan and Algeria [45]. Additionally, it was found that male Arab adolescents, including Lebanese, reported to experience higher levels of authoritarian parenting compared to females [45]. Parenting style in Lebanon and its influence on future behavior is yet to be understood; longitudinal studies on parental styles and how they relate to the development of health behaviors of Lebanese youth are lacking. Studies on parenting

are mainly focused on Western countries and more recently Asian culture [46, 47]. Since parenting styles may differ across cultures and community context [48], it is important to explore the patterns of parenting in the Lebanese cultural context as this will help guide interventions targeting this particular group.

Hence, the purpose of this article is to examine the prospective influence of parenting styles on health behaviors (diet, PA, smoking and alcohol) and BMI of Lebanese adolescents at 6-month follow up. In addition, we will examine whether child characteristics (age and gender) influence the impact of parenting styles on health behaviors. This study will improve our understanding of the parental styles used in Lebanon and its impact on Lebanese adolescent's health behaviors and may help to provide directions for the development of interventions in Lebanon aiming at optimizing both parenting styles and health behaviors.

Methods

Study design

This longitudinal prospective study was based on a secondary analysis of data from a larger research project that took place between March 2017 and March 2018 investigating the predictors of academic achievement in Lebanese adolescents. As part of this project, adolescents aged 15–18 years, from private and public schools completed a survey assessing lifestyle factors, school-related factors, socio-demographics, and motivational factors. The students were surveyed at baseline (t1) and after 6 months (t2) and 12 months (t3). The study questionnaire was reviewed and approved by the Lebanese Ministry of Education and Higher Education and the study design and conduct were performed according to the guidelines laid down in the Declaration of Helsinki [49]. Informed consent was obtained from adolescents and parents before participation and ethical approval was obtained from Al Hayat Hospital ethical committee. For the purpose of the current study, data were drawn from the second (t2) and third wave (t3) of data collection as parenting style was not assessed at baseline. The predictor variable parenting style was taken at t2, the control variables socio-demographics were also taken at t2 and the outcome variables health behaviors and BMI were taken at t3.

Participants and recruitment

Ten schools in Beirut and Mount Lebanon area were randomly selected from the Ministry of Education's list. The school directors were approached with the study questionnaire and seven (four private and three public) agreed to take part in the study. From these schools, all students enrolled in the 10th and 11th grades were invited to partake in the survey. All students agreed to participate resulting in a total baseline sample of 600 adolescents of which 563 (94%) with valid data. For the current study, only participants with complete measurements at t2 (64.3%) and t3 (61.3%) were included resulting in a total sample of 341 adolescents (60.56%).

Procedure

Students individually completed the questionnaire by hand inside their classroom. Trained dietitians read aloud each question and the corresponding answers to the entire class and were present for any clarification and assistance. The survey was completed in ~1 h. The dietitians collected the students' anthropometric measurements in the classroom using standardized procedures and calibrated equipment [50]. Height was measured to the nearest 0.5 cm using a portable stadiometer (ADE stadiometer, Germany) and after removal of shoes. Weight was taken to the nearest 0.1 kg using a Seca calibrated electronic weighing scale (Hamburg, Germany) without shoes and in light indoor clothing. All measurements were taken twice and the average of the two values was used.

Instruments and measures

Demographic variables

Socio-demographic variables measured at t2 included students' gender (1 = male; 2 = female), age (1 = 15; 2 = 16; 3 = 17; 4 = 18), type of school (1 = public; 2 = private), educational level of parents (1 = low [never went to school & primary school]; 2 = medium [complementary & secondary school]; 3 = high [technical school & university]) and religion (1 = Christian; 2 = non-Christian). The categories male, public school, high educational level of parents and Christian, were taken as referent groups.

Parenting style

Parenting styles measured at t2 were assessed using the Authoritative Parenting Index (API) [30]. The API measures students' perception of parenting behavior and more specifically two dimensions: responsiveness and demandingness. Scores on the two dimensions are used to categorize parents into four styles: authoritative, neglectful, permissive and authoritarian. The responsive dimension consists of nine items measuring indicators of parental warmth, acceptance, involvement and supportiveness (e.g. 'She/he listens to what I have to say'). The demanding dimension consists of seven items measuring indicators of parental supervision, assertive control, monitoring and permissiveness (e.g. 'She/he has rules that I must follow'). In this study, the items were worded in reference for both parents (e.g. 'They make sure I go to bed on time'). The response categories for all items were (1 = Not like them, 2 = Sort of like them, 3 = A lot like them and 4 = Just like them) indicating how well the statements are like their parents, with higher scores indicating higher levels of responsiveness and demandingness. The final scales were coded 9–36 (responsiveness) and 7–28 (demandingness). Parenting styles were created using median splits on demandingness and responsiveness. That is, we divided the responsiveness and demandingness scales into high and low levels of responsiveness and demandingness. The four parenting style categories were established based on combination of the levels of responsiveness and demandingness. The four parenting styles were categorized as authoritative (high on both), authoritarian (high demandingness and low responsiveness), permissive (low demandingness and high responsiveness) and neglectful (low on both).

Based on previous research that authoritative parenting is related to the best outcomes [30], authoritative was used as the referent group in the multivariate regression.

Outcome variables: health behaviors

Diet quality

In this study, adherence to the Mediterranean diet, known as one of the healthiest eating patterns, was used as an indicator of diet quality. Students completed a semi-quantitative Food Frequency Questionnaire (FFQ) that included 64 food and beverage items commonly consumed in Lebanon [51] and answered questions on food habits (breakfast consumption, snacking and frequency of eating fast-food). KIDMED index (Mediterranean Quality Index for children and adolescents) was calculated using data from the FFQ and food habits questions (breakfast consumption and frequency of fast-food intake) measured at t3.

The KIDMED index evaluates the adherence to the Mediterranean diet by measuring the consumption of 16 items, of which 12 are positively scored and four negatively scored. Items denoting a concordance with the Mediterranean diet are assigned a value of +1: (1) fruit/fruit juice every day, (2) second fruit every day, (3) vegetables regularly once a day, (4) vegetables more than once a day, (5) fish at least 2–3 times/week, (6) pulses more than once a week, (7) pasta or rice consumption ≥ 5 /week, (8) cereals or grains for breakfast, (9) nuts at least 2–3 times/week, (10) regular use of olive oil, (11) a dairy product for breakfast and (12) two yoghurts and/or some cheese (40 g) daily. Items denoting a negative association to the Mediterranean diet are assigned a value of -1: (1) fast food >1 /week, (2) skipping breakfast, (3) commercially baked goods or pastries for breakfast, (4) eating sweets and candy several times every day. The total score ranges from 0 to 12 with higher score reflecting a higher adherence to the Mediterranean diet. The score can be taken as continuous variable or classified into three levels: 0–3 reflects poor adherence to the MeD, 4–7 average adherence and 8–12 high adherence to the Mediterranean diet [52].

Physical activity

Physical activity was measured at t3 using the short version of the International Physical Activity Questionnaire (IPAQ). The IPAQ has been shown to be a reliable and valid tool to obtain estimates of PA [53]. The questionnaire covers three specific levels of activity: walking, moderate and vigorous-intensity activities and their frequency (days per week) and duration (minutes per day). Total PA was calculated by multiplying time spent in each activity intensity by its metabolic equivalent of task (MET) estimated at 3.3 for walking, 4.0 for moderate intensity activity and 8.0 for vigorous intensity activity (e.g. walking MET-minutes/week = $3.3 \times \text{walking minutes} \times \text{walking days}$). MET-minutes/week for each activity are summed to derive the total PA MET-minutes/week. Three categories of PA were assigned on the basis of MET min/week: (i) low: <600 , (ii) moderate: ≥ 600 to <3000 and (iii) high ≥ 3000 [54].

Smoking and alcohol

Prevalence of smoking in the past 30 days was assessed at t3 with the question: 'During the past month, on how many days did you smoke?' the responses were '0 days; 1 or 2 days; 3–5 days; 6–9 days; 10–19 days; 20–29 days; All 30 days'. For comparability to the reported prevalence used in the Global School-based Student Health Survey, the responses were then dichotomized into (i) no = 0 days and (ii) yes = 1–30 days [8, 55].

Prevalence of alcohol consumption in the past 30 days was assessed at t3 with the question: 'During the past month, on how many days did you drink alcohol?' the responses were '0 days; 1 or 2 days; 3–5 days; 6–9 days; 10–19 days; 20–29 days; All 30 days'. In line with the reported prevalence used in the Global School-based Student Health Survey, the responses were then dichotomized into (i) no = 0 days and (ii) yes = 1–30 days [8, 55].

Not smoking and not drinking were taken as reference group as they are hypothesized as the groups with less risk.

Body mass index

Body mass index was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). Overweight and obesity were defined according to cut-off values from the International Obesity Task Force for BMI of children aged 2–18 years, where centile curves were drawn, which at age 18 years passed through the widely used cut-off points of 30 and 25 kg/m^2 for adult obesity and overweight [56]. BMI was classified as overweight versus not overweight, the group overweight included adolescents who are overweight and obese and the group not overweight included underweight (n=11) and normal-weight adolescents. The category not overweight was used as the referent group.

Statistical analysis

The Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois), version 24.0 was used for data entry, management, cleaning and analyses. Data cleaning was performed on a sample of 50 questionnaires (from the included sample) that were completely checked for errors. The error rate was <1%; thus, data entry was considered adequate. Missing data were not replaced for this analysis, due to their low prevalence (<5%) [57].

Data were described as number and percent for categorical variables, whereas the mean and standard deviation ($\pm\text{SD}$) were calculated for continuous ones. Bivariate analyses to determine the association between parenting style and other categorical variables were carried out by using Pearson chi-square. ANOVA test was used for the association with continuous variables.

Multivariate regression analyses were used to assess the association of parenting style at t2 with smoking, alcohol, KIDMED and PA at t3 as dependent variables while adjusting for potentially confounding variables (age; gender; type of school; religion; father education and mother education at t2). Logistic regression was used for the outcomes

smoking and alcohol and a linear regression was carried out for the outcomes KIDMED and PA. To test whether child characteristics moderate the influence of parenting styles on health behaviors, we calculated interaction terms between the parenting styles and child characteristics (age and gender). The interaction terms Parenting Style x age and Parenting Style x gender were added to the regression analyses. P-values of 0.05 was set for the entry of potential predictors into the model, whereas a P-values of 0.1 was set for removal from the model. Results are presented as adjusted odds ratios (AOR) and their corresponding 95% confidence intervals (CI) for the logistic regression and Unstandardized Beta coefficients with their 95% CI for the linear regressions. For all statistical analyses performed, values with a P-values ≤ 0.05 were considered statistically significant.

Results

Sample characteristics

The study sample consisted of 341 adolescents, with a mean age of 16.56 (SD = 0.75). Of the study participants, 53.7% were girls, 66% attended private school. Only 12.6% of the study participants reported smoking in the past month and 60.1% reported drinking. Adolescents had an average adherence to the Mediterranean diet (5.51 ± 2.30) and 39.4% of the participants were overweight or obese. Most adolescents reported an authoritative parenting style (31.4%) versus 29.3% for authoritarian, 19.4% for neglectful and 19.9% for permissive. In all, 53.7% of mothers had a high educational level versus 42.8% for fathers (Table 1).

Table 1. Demographic and lifestyle characteristics of study participants (n=341)

Characteristics	Frequency (%)
Gender	
Male	158 (46.3)
Female	183 (53.7)
Age	
Mean (\pm SD)	16.56 \pm 0.75
Type of school	
Public	116 (34)
Private	225 (66)
BMI	
Not overweight	206 (60.6)
Overweight	134 (39.4)
Religion	
Christian	299 (87.7)
non-Christian	42 (12.3)
Having snacks during the day	
No	9 (2.6)
Yes	332 (97.4)

Characteristics	Frequency (%)
Type of snacks consumed	
Sandwich	40 (12)
Fruit and veg	96 (28.9)
Candies / Choco & cookies	158 (47.6)
Chips, crackers, and nuts	38 (11.4)
Frequency of eating fast-food (per week)	
Never/once	185 (54.3)
Twice or more	156 (45.7)
Smoking cigarette	
No	298 (87.4)
Yes	43 (12.6)
Alcohol drinking	
No	136 (39.9)
Yes	205 (60.1)
Breakfast intake	
No	61 (18)
Yes	277 (82)
Physical activity	
Low	106 (31.1)
Moderate	142 (41.6)
High	93 (27.3)
KIDMED Score	
Mean (\pm SD)	5.51 \pm 2.30
<3 poor	66 (19.5)
4-7 average	198 (58.6)
\geq 8 high	74 (21.9)
Father education	
Low	28 (8.2)
Medium	148 (43.4)
High	146 (42.8)
Mother education	
Low	12 (3.5)
Medium	139 (40.8)
High	183 (53.7)
Parenting Style	
Neglectful	66 (19.4)
Permissive	68 (19.9)
Authoritarian	100 (29.3)
Authoritative	107 (31.4)

Bivariate associations between parenting styles (t2) and health behaviors (t3) and socio-demographics (t2)

Girls were more likely to perceive their parents as authoritative (41%) whereas boys were more likely to report authoritarian parenting (30.4%) ($P < 0.0001$). In addition, parenting style was significantly associated with type of school; adolescents attending private schools were significantly more likely to report authoritarian (29.3%) parenting ($P = 0.035$). Regarding health behaviors, adolescents who reported not drinking in the past 30 days

were more likely to report authoritative parenting (38.2%) ($P = 0.047$). Finally, adolescents whose father have a high educational level were more likely to report authoritative parenting (32.2%) ($P = 0.011$) (Table 2).

Table 2. Association of parenting style (t2) with demographics (t2) and health behaviors (t3) of Lebanese adolescent (n = 341)

	Parenting style				p-value
	Neglectful N=66 (19.4%)	Permissive N=68 (19.9%)	Authoritarian N=100 (29.3%)	Authoritative N=107 (31.4%)	
Gender					
Male	45 (28.5)	33 (20.9)	48 (30.4)	32 (20.3)	<0.0001
Female	21 (11.5)	35 (19.1)	52 (28.4)	75 (41)	
Age					
Mean (\pm SD)	16.72 \pm 0.75	16.67 \pm 0.74	16.47 \pm 0.70	16.48 \pm 0.80	0.065
Type of school					
Public	16 (13.8)	19 (16.4)	34 (29.3)	47 (40.5)	0.035
Private	50 (22.2)	49 (21.8)	66 (29.3)	60 (26.7)	
BMI					
Not overweight	37 (18)	36 (17.5)	69 (33.5)	64 (31.1)	0.127
Overweight	29 (21.6)	32 (23.9)	30 (22.4)	43 (32.1)	
Religion					
Christian	60 (20.1)	61 (20.4)	82 (27.4)	96 (32.1)	0.231
non-Christian	6 (14.3)	7 (16.7)	18 (42.9)	11 (26.2)	
Having snacks during the day					
Yes	66 (19.9)	66 (19.9)	95 (28.6)	105 (31.6)	0.238
Type of snacks consumed					
Sandwich	11 (27.5)	6 (15)	10 (25)	13 (32.5)	0.254
Fruit and veg	13 (13.5)	21 (21.9)	32 (33.3)	30 (31.3)	
Candies /Choco & cookies	35 (22.2)	26 (16.5)	44 (27.8)	53 (33.5)	
Chips, crackers, and nuts	7 (18.4)	13 (34.2)	9 (23.7)	9 (23.7)	
Frequency of eating fast-food (per week)					
Never/once	29 (15.7)	35 (18.9)	56 (30.3)	65 (35.1)	0.173
Twice or more	37 (23.7)	33 (21.2)	44 (28.2)	42 (26.9)	
Smoking cigarette in the past 30 days					
Yes	11 (25.6)	8 (18.6)	15 (34.9)	9 (20.9)	0.353
No	55 (18.5)	60 (20.1)	85 (28.5)	98 (32.9)	
Alcohol consumption in the past 30 days					
Yes	48 (23.4)	40 (19.5)	62 (30.2)	55 (26.8)	0.047
No	18 (13.2)	28 (20.6)	38 (27.9)	52 (38.2)	
Breakfast intake					
Yes	55 (19.9)	52 (18.8)	83 (30.3)	87 (31.4)	0.528
No	10 (16.4)	16 (26.2)	15 (24.6)	20 (32.8)	
Physical activity					
Mean (\pm SD)	2411.98 \pm 2149.36	2510.18 \pm 2471.26	2054.90 \pm 2654.63	2115.12 \pm 2715.76	0.605

	Parenting style				p-value
	Neglectful N=66 (19.4%)	Permissive N=68 (19.9%)	Authoritarian N=100 (29.3%)	Authoritative N=107 (31.4%)	
Low	17 (16)	16 (15.1)	36 (34)	37 (34.9)	0.415
Moderate	28 (19.7)	30 (22.1)	43 (30.3)	41 (28.9)	
High	21 (22.6)	22 (23.7)	21 (22.6)	29 (31.2)	
KIDMED Score					
Mean (\pm SD)	5.02 \pm 2.18	5.70 \pm 2.67	5.53 \pm 2.16	5.67 \pm 2.21	0.255
<3 poor	18 (27.3)	13 (19.7)	16 (24.2)	19 (28.8)	0.102
4-7 average	40 (20.2)	34 (17.2)	64 (32.3)	60 (30.3)	
\geq 8 high	8 (10.8)	20 (27)	18 (24.3)	28 (37.8)	
Father education					
Low	2 (7.1)	3 (10.7)	16 (57.1)	7 (25)	0.011
Medium	35 (23.6)	36 (24.3)	34 (23)	43 (29.1)	
High	26 (17.8)	26 (17.8)	47 (32.2)	47 (32.2)	
Mother education					
Low	2 (16.7)	3 (25)	3 (25)	4 (33.3)	0.422
Medium	32 (23)	22 (15.8)	47 (33.8)	38 (27.3)	
High	32 (17.5)	42 (23)	48 (26.2)	61 (33.3)	

Notes: p-values were derived from Anova and Chi Square test for continuous and categorical variables respectively

Multivariate analysis (influence of parenting style at t2 on health behaviors at t3)

Parenting style was associated with diet quality and alcohol consumption 6 months later, with authoritative parenting having protective effects for both behaviors. There was no interaction between parenting styles and adolescents' gender or age. Adolescents of neglectful parents (β : -0.84; 95% CI -1.53, -0.15) were significantly less likely to adhere to the Mediterranean diet at t3 compared to adolescents of authoritative parents. Adolescents of neglectful (AOR: 2.39; 95% CI 1.12, 5.09) parents were significantly more likely to report drinking alcohol 6 months later compared to adolescents of authoritative parents. No significant effects for parenting style with smoking and PA were found ($P > 0.05$) (Tables 3 and 4).

Table 3. Multivariate Analysis of Parenting style (t2) with Smoking and Alcohol (t3) of Lebanese Adolescents.

Variables	Smoking (reference: no)		Alcohol (reference: no)	
	AOR (95 % CI)	P-value	AOR (95 % CI)	P-value
Stepwise Method				
Parenting Style - authoritarian	1.06 (0.37 – 3.02)	0.915	1.77 (0.92 – 3.40)	0.089
Parenting Style - neglectful	0.70 (0.23 – 2.16)	0.536	2.39 (1.12 – 5.09)	0.024
Parenting Style - permissive	0.83 (0.26 – 2.69)	0.760	1.42 (0.69 – 2.88)	0.337
Age	2.01 (1.19 – 3.38)	0.008	-	-
Gender (female)	0.29 (0.12 – 0.70)	0.006	-	-
Religion (non-Christian)	6.58 (1.19 – 36.23)	0.030	0.02 (0.006 – 0.115)	<0.0001
KIDMED	0.79 (0.66 – 0.94)	0.010	-	-

Variables	Smoking (reference: no)	P-value	Alcohol (reference: no)	P-value
	AOR (95 % CI)		AOR (95 % CI)	
Alcohol	22.88 (4.12 -126.89)	<0.0001	-	-
Smoking	-	-	32.71 (5.83 - 183.63)	<0.0001

AOR = Adjusted Odds Ratio; CI = confidence interval. Outcome variables: Smoking, Alcohol

Results of the final models of stepwise logistics regression analyses (only showing regression coefficients for the significant independent variables in each model).

Imposed: Parenting style (reference: Authoritative)

Association was significant: $p < 0.05$

Variables included in the model were: Age; gender (reference: male); type of school (reference: public); religion (reference: Christian); mother education (reference: high educational level); father education (reference: high educational level); BMI (reference: not overweight); smoking (reference: no); alcohol (reference: no); physical activity; KIDMED, Parenting Style*age and Parenting Style* gender

Table 4. Multivariate Analysis of Parenting style (t2) with KIDMED and PA (t3) of Lebanese Adolescents.

Variables	KIDMED		Physical activity	
	β (95 % CI)	P-value	β (95 % CI)	P-value
Stepwise Method				
Parenting Style - authoritarian	-0.19 (-0.81 ; 0.41)	0.527	-267.14 (-980.35 ; 446.07)	0.462
Parenting Style - neglectful	-0.84 (-1.53 ; -0.15)	0.017	-275.05 (-1090.94 ; 540.83)	0.508
Parenting Style - permissive	-0.15 (-0.83 ; 0.53)	0.664	-1.289 (-795.95 ; 793.37)	0.997
Age	-0.33 (-0.65 ; 0.0001)	0.050	-	-
Gender (female)	-	-	-1244.09 (-1812.43 ; -675.77)	<0.0001
Type of school (private)	1.43 (0.92 ; 1.93)	<0.0001	-	-
Smoking	-1.08 (-1.80 ; -0.36)	<0.003	-	-

β = Unstandardized Coefficient; CI = confidence interval. Outcome variables: KIDMED, PA

Results of the final models of stepwise linear regression analyses (only showing regression coefficients for the significant independent variables in each model).

Imposed: Parenting style (reference: Authoritative)

Association was significant: $p < 0.05$

Variables included in the model were: Age; gender (reference: male); type of school (reference: public); religion (reference: Christian); mother education (reference: high educational level); father education (reference: high educational level); BMI (reference: not overweight); smoking (reference: no); alcohol (reference: no); physical activity; KIDMED, Parenting Style*age and Parenting Style* gender

Discussion

The distribution of the study sample by sex and school sector was comparable to that of the Lebanese secondary student population [58]. In addition, the percent of overweight and obese in our study was similar to that reported in other studies on Lebanese adolescents [59]. The percentage of adolescents who reported smoking was also comparable to the findings of the latest Global School-based Student Health Survey (GSHS) (12.6% versus 13.7%), however, the percentage of adolescents who reported drinking was higher in our sample compared to the GSHS (60.1% versus 18.9%) [8]. A possible explanation to the high percentage of drinking adolescents may be related to the difference in the ages included between the samples. The GSHS included also younger adolescents starting from Grade

7, whereas the current study reports the prevalence for older adolescents from Grades 11 and 12. Previous research has shown that late adolescence is marked by an increase in alcohol consumption compared to the young teenage years associated with other life transitions such as physical changes, identity exploration and increased independence [60–62]. Additionally, our sample is mainly from an urban setting where prevalence of alcohol consumption is presumably higher [63, 64]. Moreover, a study conducted in neighborhoods of the capital Beirut pointed to a high alcogenic environment with alcohol outlets located near educational establishments creating conditions conducive to increased access to alcohol and drinking among youth [65].

This is the first study to longitudinally assess the influence of parenting styles on health behaviors (diet, PA, smoking and alcohol) and BMI in Lebanese adolescents. The findings of the present study indicate that parenting style is prospectively associated with diet and alcohol consumption of Lebanese adolescents.

The distribution of cases by parenting style was 31.4% for authoritative parenting which is comparable to percentage in Western countries [30, 66], followed by 29.3% for authoritarian, 19.9% for permissive and 19.4% for neglectful parenting. Lebanon is mainly a country of patriarchal nature, hence, one would expect a more authoritarian model of parenting. However, our results showed that authoritative parenting was the most adopted parenting style. This might be explained by the sociocultural diversity within the Lebanese society allowing a blend of Western and Arab values [67]. Compared to other Arab countries, Lebanon is considered more liberal and open to Western influence which might explain the high prevalence of perceived authoritative parenting (31.4%) [45, 68]. However, the coexistence of both traditional and modern societies in Lebanon is also reflected by authoritarian parenting being the second highest parenting style reported (29.3%). Additionally, our results showed that girls reported more authoritative parenting (41%) while boys perceived a more authoritarian style (30.4%). This is in line with previous studies reporting that the parenting styles applied to girls tend to be more authoritative and less authoritarian than those applied to boys [45]. One explanation could be related to boys having more behavior problem and consequently require stricter discipline [69]. Another possible explanation is that in some Lebanese families still, males are identified as head of the household and expected to have more responsibilities [70], subsequently parents may be exerting higher control.

Regarding dietary behaviors, our findings support and extend those of past research showing an association between general parenting and adolescents eating behaviors. Adolescents who perceived their parents as authoritative, had higher adherence to the Mediterranean diet in comparison to adolescents who reported that their parents were neglectful. Importantly, this association held even after controlling for potential confounders such as socioeconomical status. Our results are consistent with previous studies suggesting that a warm yet firm parental style (authoritative) is associated with positive eating behaviors namely higher fruit and vegetable intake [34, 71], lower junk

food consumption and irregular meal eating [72], lower fat intake [37,73], fewer unhealthy snacks and a more regular breakfast consumption [22]. Compared to authoritative parenting, adolescents of neglectful parents were less likely to adhere to the Mediterranean diet. It is noticeable from our findings that having parents who lack both parental control and warmth is a risk factor for an unhealthier eating pattern. In the present study, diet quality was measured by adherence to the Mediterranean diet. The Mediterranean diet is a healthy dietary pattern high in fruits, vegetables, whole grain cereals, fish and olive oil and consequently rich in fiber, healthy fat, antioxidants and polyphenols with anti-inflammatory properties [74]. This eating pattern is known to contribute to good present and future health and have a protective effect against chronic diseases, certain types of cancer and neurodegenerative diseases [75]. The latter implies that parental styles are an important area of intervention when targeting eating behaviors of Lebanese adolescents such as increasing compliance to the Mediterranean diet. What's more, our results show an average adherence to the Mediterranean diet, Lebanon has in fact been found to be among the countries facing a nutrition transition toward Western diets [76], hence promoting positive parenting such as authoritative style is worthwhile considering for increasing adherence to The Mediterranean diet heritage.

Regarding health-risk behaviors, our findings show that parenting styles were only prospectively associated with adolescents' alcohol consumption. In the households with authoritative parents, the probability of adolescent drinking was lower than that of households of neglectful parents. This is in line with previous research; adolescents from authoritative households were less likely to report alcohol use [30, 77], whereas neglectful and permissive parenting were associated with greater risk of drinking [33, 78]. The protective effect of authoritative parenting in relation to adolescent drinking pertains to the underlying characteristics of this style: Authoritative parents are involved in their children's life, consistently monitoring their activities while setting appropriate limits. Perceived parental monitoring and control have been inversely associated with substance and alcohol use [79, 80]. In addition, authoritative parents use open communication and reasoning when discussing rules and values with their children, which makes it easier for the child to acknowledge and accept their authority, in this case, parental authority regarding alcohol use [81, 82]. Jackson et al. [28] found that compared to adolescents from authoritative parents, adolescents with neglectful parents are less likely to acknowledge parental authority regarding substance use. Moreover, the authoritative parenting style fosters self-regulation skills, helping adolescents be less susceptible to peer influence, able to resist temptations and defer from harmful behavior such as drinking [83, 84]. Parents should thus be important targets in substance use prevention programs, particularly training in authoritative parenting can have a fundamental role in the prevention against alcohol consumption among Lebanese adolescents. Even though parenting style was not found to be significantly associated with adolescent smoking, what is worth noting is the reciprocal association between alcohol consumption and smoking; adolescents who reported drinking were more prone to report smoking and vice versa. In fact, the co-use of alcohol and smoking is well known [85], as such, interventions aiming at addressing

alcohol use may concomitantly promote smoking cessation [86]. Furthermore, the high prevalence of alcohol drinking among adolescents is alarming and point to a rising public health concern. Previous research shows that 85% of Lebanese youth had their first drink before the age of 14 years and that alcohol drinking increased by 40% in less than a decade [87]. Lebanon lacks proper alcohol control policies and regulations. Enforcing a legal age for alcohol purchasing and drinking as well as decreasing alcohol marketing and affordability are needed to protect Lebanese adolescents' health.

Past literature suggests that authoritative parenting might serve as a protective factor against unhealthy behaviors [28–39]. This was partly confirmed in our case for alcohol consumption and eating behavior as this protective effect was only significant in comparison to neglectful parenting. This may be explained by the parenting dimensions underlying the styles. Parental styles can be placed on a continuum between responsiveness and demandingness based on how responsive and demanding parents are toward their children [26]. Authoritative parenting is characterized by being on the high end of both parenting behaviors (demandingness and responsiveness or warmth and control) creating a healthy balance. By contrast, neglectful parenting is low on both of these dimensions by being neither responsive nor demanding. Whereas permissive and authoritarian share only one of the desirable traits of authoritative parenting and lack the balance of the other trait placing them between the best (authoritative) and worst (neglectful) parenting styles. The latter might explain why in general better outcomes appear to result for children of authoritative parents, while neglectful parenting by lacking both desirable parenting characteristics is consistently associated with the worst outcomes [88, 89] and outcomes for children of indulgent and authoritarian fall somewhere between the two extremes [66].

With regards to PA, our study did not find an association between parenting styles and PA levels. In fact, research on PA and parenting styles have yielded mixed results. A previous review by Sleddens et al. [90], found that children raised by authoritative and nurturing parents were generally more physically active [37, 91]. Nonetheless, some studies found that permissive parenting was positively associated with child's PA [92] while other studies failed to find any association at all [38, 93–95].

The evidence regarding PA and parenting style is not conclusive and may differ depending on the method of measurements of PA (recall survey or accelerometer) and is influenced by the gender of the children and parents [96]. In a study by Schmitz et al. [97], maternal authoritative was associated with PA in girls, whereas maternal non-authoritative style was associated with higher levels of PA among boys. Another study found that authoritative parenting was positively associated with PA in boys while an authoritarian style was associated with increased PA in girls [44]. Our findings of an absence of a significant association between parenting and PA is in line with previous research indicating that there is limited support that a specific parenting style is an important predictor of PA [96]. Parents might instead influence their children's activity levels through

activity-related parenting practices such as modeling and parental reinforcement of PA [98]. However, too few studies were conducted to draw firm conclusions, hence the need for more longitudinal research using objective measurements for PA and taking account of the mediating role of parenting practices.

BMI and parenting styles were not significantly associated in this study. Past literature examining the latter association has produced conflicting results. Authoritative parenting is generally associated with a healthier weight [36, 38, 99]. Nevertheless, there is no consensus on which parenting style is associated with the greatest risk of obesity. Rhee et al. [36] found that children of authoritarian parents had the highest prevalence of overweight, whereas, Olvera and Power [39] found that children of permissive parents were more likely to be overweight, in contrast Humenikova and Gates [42] indicated that authoritative parenting was associated with higher BMI in a sample of Czech children. Our findings, however, are consistent with other studies, indicating a lack of association of parenting style to BMI [93, 98, 100–102]. There are several explanations to these equivocal findings. Parenting styles may vary across different cultural backgrounds; a specific parenting style may be viewed as normative in one culture as opposed to detrimental or less acceptable in another, consequently parenting style influence may differ according to the sample and cultural context [103, 104]. Additionally, it has been suggested that parenting styles may not influence adolescents' weight directly but rather influence domain-specific parenting practices such as food- or activity-related parenting practices which in turn affects weight directly [105]. Lastly, several other factors need to be taken into consideration when studying weight such as psychological, hormonal, genetic and biological factors, thus the importance of including other confounding variables such as parents' characteristics' (e.g. parents' BMI) [99, 106].

Strength and limitations

Several strengths exist in this study. First and to the best of our knowledge, this is the first study in Lebanon to prospectively examine the association of parenting styles with health behaviors and BMI of adolescents. Second, anthropometric data collection was objectively measured by trained dietitians using standardized techniques. Third, this study targeted an important age group, one that is at risk for increased engagement in risky behaviors. On the other hand, some limitations should be considered when interpreting the findings. Firstly, data were self-reported and thus respondent and information bias cannot be ruled out. Secondly, the use of FFQ might be limited by measurement errors, reliance upon memory and the pre-specified list of food items included [107]. In this study, to overcome the limitation imposed by the fixed food list, an open-ended question about 'other food consumed' was added at the end of the FFQ. In addition, the dietitians were present in the classroom with food models to assist participants in portion size estimation. Despite these limitations, FFQ remains one of the most widely tools used in epidemiological studies as it provides information of food intake over an extended period of time while having a lower respondent burden and being cost effective [108,109]. Thirdly, an additional limitation was the relatively low retention rate (60.56%), yet our analysis showed that participants who

dropped had similar baseline characteristics to those who completed the study. Fourthly, the sample was taken from only two geographical areas: Mount Lebanon and Beirut. Beirut is the capital and largest city in Lebanon and together with Mount Lebanon they have the highest concentration of people and are representative of the various religious and socio-demographic societies in Lebanon. However, the sample is not on a national level limiting the generalizability of the findings. Finally, even though the study controlled for the influence of a variety of factors such as age, gender, type of school, parents' education and religion, we did not control for parental BMI. The potential influence of genetics is well known, having one obese parent increases the risk for obesity in the child [110], hence the need to consider parental weight status as well.

Conclusion and recommendations for future research

Even though it was suggested that with age the influence of parents decreases while peers become the reference group, however, our findings show that parents remain a major source of influence for Lebanese adolescents aged 15–18 years, especially in the Lebanese culture where family approval and opinion still matter. In this study, parents—and in particular their authoritative parenting style—significantly influenced two aspects of adolescents' lifestyle: a healthy diet and moderate/less alcohol consumption. Our results replicate previous findings about the protective effect of authoritative parenting on health risk behaviors and highlight the importance of targeting the home environment and accounting for parenting styles in interventions aiming at promoting healthier behaviors of adolescent. Specifically, interventions aiming at encouraging better adherence to the Mediterranean diet and awareness raising on alcohol consumption should be conducted among Lebanese youth. Such interventions may target positive parenting style strategies for improving Lebanese adolescents' eating and drinking behaviors. Parenting interventions have been proven to be successful and a promising approach for positively influencing several child outcomes among which health behaviors and obesity [111, 112].

Future research should be conducted on a more representative sample and for a longer duration. Future studies conducted on Lebanese adolescent may also want to examine the impact of e-cigarettes and other types of substance use such as marijuana and illicit drugs and their relation to parenting styles. Furthermore, much of the existing research focused on either parenting style or parenting practices separately. Parenting style has been suggested to have a moderating role between parenting practices and health behaviors. Future research examining the interaction (moderation or mediation) of parenting style and parenting practices using a longitudinal design is needed. Cross-cultural research is also needed to ultimately yield a better understanding of the similarities and differences of parenting across different populations and tailor culturally appropriate interventions and guidelines accordingly.

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CHAPTER 4



Authoritative parenting stimulates academic achievement, also partly via self-efficacy and intention towards getting good grades

This chapter is under review as:

Hayek J, Schneider F, Lahoud N, Tueni M, de Vries H. Authoritative parenting stimulates academic achievement, also partly via self-efficacy and intention towards getting good grades

Abstract

Background: The aim of this prospective study is to examine how parenting style relates to academic achievement of Lebanese adolescents and test the mediating effect of self-efficacy and intention towards getting good grades. Potential moderation by demographic factors (age, gender, school type, religion and parents' education) was also examined.

Methods: Students (n=345) from private and public schools in Mount Lebanon and Beirut area, aged between 15 and 18, participated in a two-wave longitudinal study and completed a self-administered questionnaire based on the I-Change Model assessing socio-demographics (age, gender, school type, parents' education, family structure, religion), socio-cognitive factors (attitude, social norms, self-efficacy, intention), parenting styles and academic achievement. Adolescents were surveyed at two time points, six months apart. A multiple linear regression was carried out to identify baseline factors independently associated with academic achievement 6 months later. Moderation was examined using Hayes's SPSS macro PROCESS. A serial mediation model was employed to test for the sequential mediating effect of self-efficacy and intention between parenting style and academic achievement.

Results: Authoritative parenting was prospectively associated with better academic achievement and higher self-efficacy and intention at 6 months follow up. In addition, self-efficacy and intention towards getting good grades were found to mediate the relationship of parenting style to academic achievement. Adolescents who perceive their parents as authoritative are more likely to develop high efficacy beliefs and higher intention and subsequently are more likely to achieve better in school compared to peers of neglectful parents. Socio-demographics did not moderate the effect of parenting on academic achievement.

Conclusion: Authoritative parenting influenced both directly and indirectly the academic achievement of their children. Interventions aiming at improving academic performance of adolescents should also encompass positive parenting style strategies.

Key words: Parenting style, academic achievement, socio-cognitive factors, self-efficacy, serial mediation, adolescents, Lebanon.

Introduction

Good academic achievement increases the chances for a successful future for both individuals and societies [1,2]. Addressing key factors that influence academic performance would help in creating better opportunities for youth and securing a better future in terms of better health and higher quality of life [3]. According to Bronfenbrenner ecological model, adolescents' behaviors and outcomes are influenced by various levels of environment [4]. The microenvironment is the most immediate environment in which adolescents live, such as the school or home environment, and is considered to have the strongest impact on adolescent development [5]. Parents who are part of the home environment may have a direct and indirect influence on their children's outcomes via their parenting styles [6]. Parenting style is the emotional context in which parents' behaviors are expressed in the effort to socialize their child [7]. Four parenting styles can be defined based on the combination of two dimensions of parenting behavior – demandingness and responsiveness: authoritative parenting (high on demandingness and responsiveness), authoritarian (high on demandingness and low on responsiveness), permissive (high on responsiveness and low on demandingness) and neglectful (low on demandingness and responsiveness) [8,9].

Parenting style influence on academic achievement and the role of social cognitions-Literature review

Parenting styles have been found to significantly influence several child outcomes among which eating behaviors [10], substance use [11], psychological outcome [12] and educational outcome [13]. In regard to academic performance, and while findings may vary across cultures and social groups [14,15], authoritative parenting has been generally found to have the most positive outcomes and promote higher academic achievement [16,17,18] while neglectful parenting has been consistently linked with the poorest outcomes and lower grades [19]. Evidence also exists on the indirect effect of parenting on adolescent's achievement [20,21] pointing to a dual influence of parents both direct and indirect. The family environment is assumed to influence behavior both directly as well as indirectly through mediating variables such as cognitive mediators reflecting a dual process view [22,23,24]. The dual process suggests that environmental factors, in this case parents, can have a direct automatic influence on behavior and an indirect mediated effect via behavior-specific cognition [24]. According to social cognitions theories, attitude, subjective norm and perceived self-efficacy are the central cognitions that are believed to influence behavioral intention which is considered the primary determinant of behavior [25,26]. Intention reflects the motivation and intent to perform a given behavior and is determined by three constructs; Attitude refers to the perceived pros and cons of a certain behavior, social norms indicates the perceived social pressure to engage or not in a given behavior and self-efficacy refers to the belief in one's capabilities to execute specific behaviors to produce positive outcomes [25,27]. The more favorable the attitude, perceived social norms and efficacy beliefs, the strongest the intention to engage in the behavior in question [25]. Another construct that is believed to influence

intentional behavior is motivation [28]. Motivation explains why individuals decide to do something, how hard they would work to achieve it and how long they would persevere to sustain it [29]. According to the Self-Determination Theory, motivation which can be intrinsic (emerging from personal interest) or extrinsic (prompted by external force and social values) can determine the strength of intentional behavior [29,30]. Autonomous intentions that are driven by intrinsic motivation are more likely to be translated into behavior and more likely to be sustained than controlled intentions [28]. Parenting style can impact academic performance through its influence on social-cognitive factors. For instance, a certain parenting style may promote positive attitudes toward education or a higher academic self-efficacy which will influence the intention to obtain good grades and subsequently impact academic outcome. Indeed, many studies have demonstrated that parenting styles can help foster the development of healthy psychosocial competencies which in turn affect scholastic performance [17,31,32]. Adolescents from authoritative parents were found to have higher self-efficacy beliefs compared to adolescents from authoritarian and permissive parents [18,33]. Adolescents' achievement beliefs can influence their achievement-related behaviors [34], adolescent with high beliefs are more motivated, set higher challenging academic goals, put more effort working towards those goals and are more resilient in the face of difficulties and subsequently perform higher [35,36,37].

Gap-Building on previous research

Several studies describe the relation of parenting on academic outcome of their offspring [15,17,38,39], including the role of socio-cognitive factors on academic performance [40,41]. Even though there are many studies on the dual influence of the environment on general behaviors such as health behaviors [42], research examining the dual effect of parenting, the direct and indirect effect through the mediating effect of cognitive factors on academic performance is limited. Hence, our study aims to further elucidate the mechanism by which parenting influence adolescent's achievement using an integrated approach. Gaining insight into the direct relation of parenting to academic achievement and how cognitions may mediate this relation is highly relevant in order to inform targeted intervention development. In addition, there is a need to study the influence of parenting styles in different cultures such as the MENA region and specifically in the Lebanese context where empirical evidence of this kind is lacking. The latter will add to the existing literature and expand our knowledge on parenting socialization in different cultural context. On the other hand, student performance in Lebanon, as measured by international assessments such as the Programme for International Student Assessment (PISA) has been shown to be significantly lower than other countries and point to a learning gap [43]. Lebanese were on average three to four years of school behind peers from other countries. Results also showed that 60% of Lebanese students did not achieve basic proficiency in math, 62% in science and 68% in reading, placing them at high risk of exclusion from secondary school [43]. Understanding how parenting style may influence academic achievement of Lebanese adolescents will help practitioners and policymakers understand how to capacitate Lebanese adolescent reach their full academic potential.

Study objectives

Hence, the first objective of this study is to examine if parenting style prospectively influences academic performance of Lebanese adolescents. The second objective is to explore which social-cognitive factor mediates the influence of parenting on academic achievement. In addition, since it has been postulated that parenting may have a differential impact on adolescent outcome depending on socio-demographic characteristics [44], the third objective is to investigate whether adolescent age, gender, religion, the type of school they are enrolled in as well as their parent's education might moderate the influence of parenting style on academic achievement of Lebanese adolescents.

Materials and Methods

Design

This prospective study was based on a secondary analysis of data from a larger three-wave longitudinal research project investigating the predictors of academic achievement in Lebanese adolescents [45]. As part of this project, adolescents aged 15 to 18 from private and public schools completed a survey assessing socio-demographics, lifestyle factors and motivational factors. The students were surveyed at three-point time: time 1 (t1), after six months (t2) and after 12 months (t3). For the present study data from the second (t2) and third wave (t3) of the survey were utilized as parenting style was not assessed at baseline. The predictor variable parenting style was taken at t2, the control variables socio-demographics and the potential mediators socio-cognitive variables were also taken at t2 and the outcome variable academic achievement was taken at t3.

Participants

The baseline sample was a total of 600 adolescents out of which 563 (94%) with valid data, aged 15 to 18, from public and private schools across Beirut and Mount Lebanon area. Participating schools were randomly selected from the Ministry of Education's list. The directors of these schools were approached face-to-face and provided with the study questionnaire and seven (four private and three public) agreed to partake in the study. From these schools, all students enrolled in grade 10 and 11 were invited to participate in the survey. For the current study only participants with complete data set at t2 and t3 were included resulting in a total sample of 345 adolescents (61.27%).

Procedure

After obtaining the school director's consent to conduct the study, trained dietitians visited the schools that agreed to participate and distributed pen-paper survey to all students. The trained dietitians were present at all time in the classroom and read aloud each question with the corresponding answers and were available for any help or clarification. The survey took approximately one hour to be completed. The study questionnaire was reviewed and approved by the Lebanese Ministry of Education and Higher Education and the study was conducted in accordance with the Declaration of Helsinki [46]. Written

informed consent was obtained from all students and their parents prior to participating in the study and ethical approval was obtained from Al Hayat Hospital ethical committee.

Measurements

Demographic Factors (t2)

Socio-demographic variables included students' sex (1=male; 2=female), age (1=15; 2=16; 3=17; 4=18), type of school (1=public; 2=private), educational level of parents (1= low: never went to school & primary school; 2= medium: complementary & secondary school; 3= high: technical school & university), family structure (1 = living with both parents; 2 = other arrangements) and religion (0= Non-Christian, 1= Christian).

Parenting Style (t2)

The Authoritative Parenting Index (API) was used to assess parenting styles [47]. The API measures the responsive and demanding dimensions of parenting behavior as perceived by the adolescents. Nine items measured responsiveness (e.g. "She/he listens to what I have to say") and seven items measured demandingness (e.g. "She/he has rules that I must follow"). In this study the items were presented once in reference for both parents (e.g. "They make sure I go to bed on time"). Students used a four-point response scale (1= Not like them, 2=Sort of like them, 3= A lot like them and 4= Just like them) to indicate how well the statements describe their parents' parenting styles with higher scores indicating higher levels of responsiveness and demandingness. The latter yielded two separate scores for each participant, namely responsiveness and demandingness. The final scale scores could range from 9-36 for responsiveness (Cronbach's $\alpha = 0.80$) and 7-28 for demandingness (Cronbach's $\alpha = 0.70$). Parenting styles were created using median splits on demandingness and responsiveness. A parent who was rated high on both responsiveness and demandingness (above the median 30 for responsiveness, 16 for demandingness) was categorized as authoritative (N= 107). A parent who was rated low on both responsiveness and demandingness (below the median) was categorized as neglectful (N= 66). A parent who was rated high in responsiveness and low in demandingness was categorized as permissive (N=68). A parent rated as low on responsiveness and low in demandingness was categorized as authoritarian (N=100).

Socio-cognitive factors (t2)

The I-Change model [26] was used as a framework for including socio-cognitive variables as determinants and potential mediators for academic achievement. Attitude was measured with four questions assessing the pros and cons of getting good grades. Two questions measured positive attitudes "Getting good academic grades is a good help for getting a good job/will get me compliment from my parents". The responses were coded from -2 (strongly disagree) to +2 (strongly agree). Two questions measured negative attitudes "Getting good academic grades means that I have to work too hard/will cause disapproval among my friends" using the same scale reverse coded from +2 (strongly agree) to -2

(strongly disagree) so that higher scores reflect a more positive attitude towards getting good grade.

Social norms were measured using the responses to three questions asking if parents or teacher expect adolescents to get good academic grades "My father/my mother/my teacher expects me to get good academic grades" on a five-point Likert scale ranging from +2 (strongly agree) to -2 (strongly disagree).

Self-efficacy was assessed using responses to five questions "I find it easy to get good academic grades/to concentrate at school for getting good academic grades/to master the skills that are taught in class this year/to concentrate on school work when I am at home/to finish all my school work" on a scale ranging from +2 (strongly agree) to -2 (strongly disagree). A mean score for self-efficacy was composed (Cronbach's $\alpha = 0.7$).

Intention to get good academic grades was measured by using the response to one statement as it is done with most studies [10,48], 'I intend to get good academic grades' on a five-point Likert scale from +2 (strongly agree) to -2 (strongly disagree).

Academic performance (t3)

Academic achievement was measured using student's general average of the student's self-reported performance in all school subjects during a specific semester. The general average is the standard instrument for the assessment of the academic achievement of students in Lebanese schools [49]. All participating schools use a 0-20 scale where the passing grade is 10 out of 20.

Statistical Analysis

All analyses were done using SPSS, version 23 (SPSS Inc., Chicago, Illinois) and statistical significance was set at a p value < 0.05. Data management and cleaning was carried out prior to analysis and revealed that less than 1% of values were missing. Data were presented as means and standard deviations for continuous variables whereas, categorical data were presented as frequencies and percentages.

In order to analyze the first objective, to examine whether parenting style is associated with academic achievement of Lebanese adolescents, bivariate and multivariate analysis were conducted. Bivariate analyses examining the association between academic performance and other continuous variables were carried out using Pearson or Spearman correlation tests. ANOVA test was used for the association between academic achievement and polytomous variables (i.e. parents' educational level and parenting style). Independent T-test was run to determine if there were differences in academic achievement between males and females, Christians and non- Christians, adolescents living with both parents or not, and adolescents from private schools versus public schools. A multivariate linear regression was carried out to identify which factors were independently associated with academic achievement using the Enter method. Variables which obtained $p < 0.1$ in the

bivariate analysis were entered in the model [50]. Independent variables were introduced by blocks: Model 1 included parenting styles. Model 2 also contained socio-demographic variables. In model 3 the socio-cognitive variables attitude, social norm-teacher and self-efficacy were added. Finally, in model 4, the variable intention was added. Unstandardized Beta coefficients were then reported with their 95% confidence intervals (CI).

In order to analyze the second objective, to examine whether socio-cognitive factors mediate the effect of parenting style on academic achievement, we conducted the mediation analysis using Hayes's (2013) SPSS macro PROCESS with 95% bias corrected confidence interval (CI) based on 5000 bootstrap samples [51]. The indirect effect is considered statistically significant if the CI does not include 0. We first started with a simple mediation model using SPSS macro PROCESS (model 4), evaluating one mediator at a time. Among the four socio-cognitive variables (attitude, social norm, self-efficacy and intention) we only obtained significant mediation for self-efficacy and intention. Significant mediators were then entered into a serial mediation model (SPSS macro PROCESS, model 6) to check for significant sequential mediation. We hypothesized a serial mediation model where parenting style influences self-efficacy which in turn influences intention which impacts on academic achievement (Fig 1). In all Hayes models, adjustment was made for the following variables: age, type of school, religion, father and mother education. Confounders were chosen based on the results of the multivariate analysis and the models' adequacy or goodness of fit. Unstandardized coefficients and standard errors (SE) of the final model were reported alongside their CIs. Direct and indirect effects (DE and IE) were also shown for the final mediation model.

In order to analyze the third objective, to investigate whether adolescent age, gender, school type, religion and parent's education might moderate the influence of parenting style on academic achievement of Lebanese adolescents, SPSS macro PROCESS model 1 was used. For each potential moderator, four interactions were tested: 1) an interaction with parenting style on academic achievement, 2) an interaction with parenting style on the mediator (socio-cognitive factor), 3) an interaction with the mediator on parenting style, 4) an interaction with the mediator on the sequential mediator. There was no significant interaction with any of the chosen demographic variables.

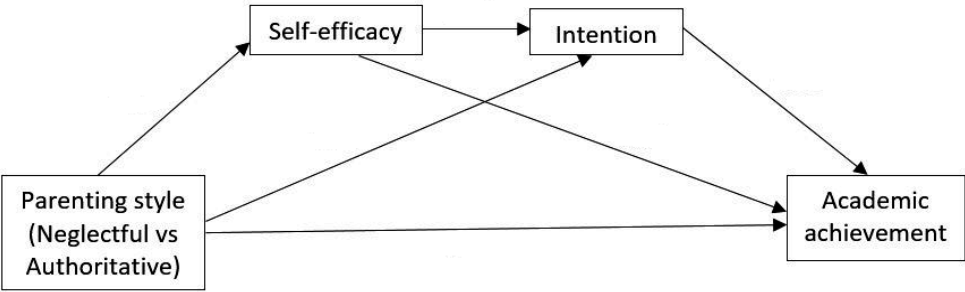


Figure 1. Research framework.

Results

Description of sample

The study sample consisted of 345 adolescents with a mean age of 16.57 ± 0.76 years. Of the study participants 53.3% were girls and 65.8% attended private school. The majority of adolescents reported an authoritative (31.4%) or authoritarian parenting style (29.3%), followed by permissive (19.9%) and neglectful (19.4%) (Table 1).

Table 1. Descriptive characteristics of the sample (N=345)

Characteristics	Frequency (%)
Gender	
Male	161 (46.7)
Female	184 (53.3)
Age	
Mean (\pm SD)	16.57 \pm 0.76
Type of school	
Public	118 (34.2)
Private	227 (65.8)
Religion	
Christian	302 (87.5)
Non-Christian	43 (12.5)
Father education	
Low	29 (8.9)
Medium	149 (45.7)
High	148 (45.4)
Mother education	
Low	12 (3.6)
Medium	141 (41.8)
High	184 (54.6)
Family Structure	
Live with both parents	317 (91.9)
Other arrangements	28 (8.1)

Characteristics	Frequency (%)
Getting good grades is a good help for getting a good job Mean (\pm SD)	0.69 \pm 1.05
Getting good grades will get me compliment from my parents Mean (\pm SD)	1.05 \pm 0.87
Getting good grades means that I have to work too hard Mean (\pm SD)	-0.61 \pm 1.02
Getting good grades means will cause disapproval among my friends Mean (\pm SD)	1.18 \pm 0.94
Social norm-father Mean (\pm SD)	1.02 \pm 0.91
Social norm-mother Mean (\pm SD)	1.18 \pm 0.77
Social norm-teacher Mean (\pm SD)	0.61 \pm 0.87
Self-efficacy Total Mean (\pm SD)	0.15 \pm 0.65
Intention Mean (\pm SD)	1.24 \pm 0.77
Academic achievement Mean (\pm SD) Range (over 20)	12.89 \pm 2.13 [6.7;18.5]
Parenting Style	
Neglectful	66 (19.4)
Permissive	68 (19.9)
Authoritarian	100 (29.3)
Authoritative	107 (31.4)

Correlations between academic achievement and parenting styles and socio-demographics: Bivariate analysis.

As shown in table 2, a significantly better academic achievement at t3 was reported for younger adolescents ($p=0.003$), those living with both parents ($p=0.035$), and adolescents from private schools ($p<0.001$). Adolescents whose father ($p=0.001$) and mother ($p<0.001$) had a high level of education were also significantly more likely to have higher academic achievement at t3. Adolescents with higher reported self-efficacy and with stronger intention at t2 were significantly more likely to have greater academic achievement at t3 ($p<0.001$). No significant association of academic achievement with attitude and social norm were found.

Table 2. Correlations between academic achievement and parenting styles and socio-demographics: Bivariate associations

Variables	Academic Achievement Mean \pm SD	Test statistic (df)	p
Gender			
- Males	12.77 \pm 2.25	-1.010	0.313 ^a
- Females	13.00 \pm 2.02		
Age	-	-0.163	0.003 ^b
Type of school			
- Public	11.65 \pm 2.02	-8.589	<0.001 ^a
- Private	13.54 \pm 1.89		
Religion			
- Christian	13.02 \pm 2.11	-2.906	0.004 ^a
- Non-Christian	12.02 \pm 2.09		
Father's educational level			
- Low	11.95 \pm 1.77	6.899	0.001 ^c
- Medium	12.62 \pm 2.23		
- High	13.33 \pm 2.07		
Mother's educational level			
- Low	11.72 \pm 1.31	10.165	<0.001 ^c
- Medium	12.42 \pm 2.19		
- High	13.36 \pm 1.99		
Family structure			
- Live with both parents	12.96 \pm 2.08	2.119	0.035 ^a
- Other arrangements	12.08 \pm 2.51		
Getting good grades is a good help for getting a good job	-	0.102	0.059 ^b
Getting good grades will get me compliment from my parents	-	-0.015	0.780 ^b
Getting good grades means that I have to work too hard	-	0.066	0.227 ^b
Getting good grades means will cause disapproval among my friends	-	0.020	0.706 ^b
My father expects that I get good academic grades	-	-0.066	0.224 ^b
My mother expects that I get good academic grades	-	-0.005	0.923 ^b
My teacher expects that I get good academic grades	-	0.097	0.074 ^b
Self-efficacy	-	0.272	<0.001 ^d
Intention	-	0.252	<0.001 ^b
Parenting style			
-Neglectful	12.56 \pm 2.20	2.243	0.083 ^c
-Permissive	12.88 \pm 2.20		
-Authoritarian	12.69 \pm 2.05		
-Authoritative	13.31 \pm 2.09		

Notes: ^a p-value for the Independent Samples T-test, ^b p-value for the Spearman correlation, ^c p-value for ANOVA, ^d p-value for the Pearson correlation.

Associations between academic achievement and parenting styles and demographics: Multivariate Analysis.

In model 1, consisting of parenting styles and academic achievement, the results show that parenting style significantly predicted academic achievement of adolescents six months later. Adolescents whose parents are authoritative were significantly more likely to achieve higher academic achievement six months later compared to adolescents of neglectful (β : -0.87; 95% CI -1.55, -0.19), and authoritarian parents (β : -0.62; 95% CI -1.23, -0.01). Model 2, including model 1 and adding demographic variables, showed that age and type of school were statistically significantly associated with academic achievement at t3. Younger adolescents (p = 0.010) and students from private schools (p < 0.001) were significantly more likely to achieve higher. Parenting remained statistically significantly associated with academic performance at t3. Adolescents of authoritative parents were significantly more likely to have higher academic achievement at six months follow-up compared to adolescents of neglectful (β : -1.07; 95% CI -1.69, -0.45), permissive (β : -0.68; 95% CI -1.29, -0.07) and authoritarian parents (β : -0.83; 95% CI -1.39, -0.27). In model 3, adding the socio-cognitive variables attitude, social norm-teacher and self-efficacy to model 2 resulted in the same significant effect of parenting, age and type of school. It also showed that self-efficacy was positively significantly associated with academic achievement at t3 (p < 0.001). Adolescent with higher self-efficacy had an average grade higher by 0.72 relatively to adolescents with lower self-efficacy. In the last model 4, adding the variable intention to model 3, parenting style, age, school type and self-efficacy remained significant and adding intention as a statistically positively significant predictor of achievement six months later (p <0.001) (Table 3).

Table 3. Associations between academic achievement and Demographics: Multivariate Analysis.

Variables	Model 1			Model 2			Model 3			Model 4		
	β	95% CI	p	β	95% CI	p	β	95% CI	p	β	95% CI	p
Parenting style												
- Authoritative	1			1			1			1		
- Neglectful	-0.87	[-1.55, -0.19]	0.012	-1.07	[-1.69, -0.45]	0.001	-0.82	[-1.43, -0.21]	0.008	-0.66	[-1.26, -0.06]	0.032
- Permissive	-0.47	[-1.15, 0.21]	0.173	-0.68	[-1.29, -0.07]	0.029	-0.70	[-1.29, -0.11]	0.020	-0.64	[-1.22, -0.07]	0.029
- Authoritarian	-0.62	[-1.23, -0.01]	0.045	-0.83	[-1.39, -0.27]	0.004	-0.69	[-1.24, -0.16]	0.012	-0.62	[-1.15, -0.09]	0.023
Age				-0.38	[-0.67, -0.09]	0.010	-0.35	[-0.63, -0.07]	0.015	-0.31	[-0.59, -0.04]	0.025
Type of school												
- Public				1			1			1		
- Private				1.96	[1.42, 2.50]	<0.001	1.86	[1.33, 2.39]	<0.001	1.84	[1.32, 2.36]	<0.001
Religion												
- Non-Christian				1			1			1		
- Christian				-0.25	[-0.98, 0.48]	0.502	0.009	[-0.70, 0.72]	0.981	0.09	[-0.60, 0.79]	0.787
Father's educational level												
- Low				1			1			1		
- Moderate				-0.18	[-1.04, 0.67]	0.670	-0.12	[-0.94, 0.71]	0.780	-0.17	[-0.97, 0.64]	0.684
- High				-0.001	[-0.89, 0.88]	0.998	0.07	[-0.78, 0.94]	0.860	-0.004	[-0.85, 0.84]	0.993
Mother's educational level												
- Low				1			1			1		
- Moderate				0.32	[-0.88, 1.52]	0.603	0.08	[-1.07, 1.25]	0.880	-0.08	[-1.22, 1.06]	0.892
- High				0.43	[-0.79, 1.66]	0.487	0.29	[-0.89, 1.49]	0.621	0.19	[-0.98, 1.35]	0.750
Family structure												
- Live with both parents				1			1			1		
- Other arrangements				-0.48	[-1.32, 0.35]	0.259	-0.48	[-1.29, 0.32]	0.238	-0.46	[-1.25, 0.33]	0.252

Variables	Model 1			Model 2			Model 3			Model 4		
	β	95% CI	p	β	95% CI	p	β	95% CI	p	β	95% CI	p
Getting good grades is a good help for getting a good job							0.13	[-0.07, 0.33]	0.199	0.09	[-0.10, 0.29]	0.359
My teacher expects that I get good academic grades							0.14	[-0.10, 0.38]	0.261	0.09	[-0.14, 0.34]	0.436
Self-efficacy							0.72	[0.39, 1.05]	<0.001	0.60	[0.28, 0.93]	<0.001
Intention										0.51	[0.24, 0.79]	<0.001

β = Unstandardized Coefficient; CI = confidence interval. Dependent variable: Academic Achievement.

Model 1: Variables entered: Parenting style (Permissive, authoritarian, neglectful). Association was significant: $p < 0.05$
R2 = 0.023

Model 2: Variables entered: Variables in Model 1 + Age, Type of school, Religion, Father's educational level Mother's educational level, Family structure. Association was significant: $p < 0.05$
R2 = 0.257

Model 3: Variables entered: Variables in Model 2 + Attitude, Social norm-teacher, Self-efficacy. Association was significant: $p < 0.05$
R2 = 0.323

Model 4: Variables entered: Variables in Model 3+ Intention Association was significant: $p < 0.05$
R2= 0.352

Serial Mediation Analysis

In the serial mediation model, we postulated that our predictor variable parenting style (X) influences academic achievement (Y) six months later via two mediators: self-efficacy (M1) and intention (M2) sequentially. To demonstrate this, parenting style (Y) should be significantly associated with the first mediator (M1) self-efficacy. In turn, self-efficacy (M1) should be significantly associated with the second mediator (M2) intention and finally intention (M2) should be significantly related to academic achievement (Y). Table 4 shows a series of three regression analysis. In the first regression the goal was to examine if our independent variable parenting style (X) measured at t2 is associated with the first mediator (M1) self-efficacy (t2). The results show that parenting style was statistically significantly associated with self-efficacy. Adolescents of neglectful parents were significantly less likely to have high self-efficacy compared to the reference style authoritative ($p = 0.022$). The second regression, regressed intention (M2) on both self-efficacy (M1) and parenting style (X). The results show that the first mediator M1 (self-efficacy) was statistically significantly associated with the second mediator M2 (intention), with higher efficacy beliefs predicting higher intention ($p < 0.001$). Additionally, parenting was also statistically significantly associated with intention; adolescents of neglectful parents were significantly less likely to report strong intentions ($p = 0.006$). The last regression analysis regressed academic achievement (Y) on all antecedent variables: intention (M2), self-efficacy (M1) and parenting (X). The goal was to explore if intention (M2) is associated with academic achievement (Y) six months later. The results show that intention (M2) was significantly associated with achievement (Y). Adolescents with greater intention were significantly more likely to have higher achievement ($p < 0.001$).

Table 4. Serial mediation modelling linking parenting style and academic achievement (n=338)

Self-efficacy (Mediator 1) †					
	Coefficient	SE	P-value	LLCI	ULCI
Parenting Style			<i>Authoritative (ref)</i>		
- Authoritarian	-0.16	0.09	0.107	-0.35	0.03
- Permissive	0.04	0.11	0.713	-0.17	0.25
- Neglectful	-0.25	0.11	0.022	-0.47	-0.03
Intention (Mediator 2) †					
Self-efficacy	0.29	0.06	<0.001	0.03	0.08
Parenting style			<i>Authoritative (ref)</i>		
- Authoritarian	-0.14	0.11	0.190	-0.36	0.07
- Permissive	-0.13	0.12	0.281	-0.37	0.11
- Neglectful	-0.34	0.12	0.006	-0.58	-0.09
Academic achievement (Outcome) †					
Intention	0.53	0.14	<0.001	0.26	0.80
Self-efficacy	0.65	0.16	<0.001	0.34	0.96
Parenting style			<i>Authoritative (ref)</i>		
- Authoritarian	-0.62	0.26	0.020	-1.14	-0.09
- Permissive	-0.64	0.29	0.027	-1.22	-0.07
- Neglectful	-0.73	0.30	0.016	-1.32	-0.13

Serial mediation model taking parenting style as X, academic achievement as Y, and self-efficacy and intention as mediators 1 and 2.

†All models adjusted for age, type of school, religion, father education and mother education. Models using Process Macro model #6 (Hayes, 2013).

The last table (5), shows the direct effect of parenting style on academic achievement and the three indirect effects: (i) the indirect effect of parenting on achievement through the first mediator self-efficacy (M1), (ii) the indirect effect of parenting on achievement through the second mediator intention (M2) and (iii) the indirect effect of parenting on achievement through the sequence of self-efficacy (M1) and intention (M2). The direct effect of parenting style on the outcome academic achievement is statistically significant (neglectful vs authoritative: DE= -0.73; p= 0.016). In addition, the indirect effect of parenting style (neglectful vs authoritative) on academic performance through the mediator self-efficacy (M1) alone is statistically significant (IE= -0.16; CI= -0.37, -0.002). The second indirect effect of parenting style (neglectful vs authoritative) on academic performance via the second mediator intention (M2) is also statistically significant (IE= -0.18; CI= -0.39, -0.04). Finally, the last indirect effect of parenting style (neglectful vs authoritative) via the sequence of self-efficacy (M1) and intention (M2) leading to academic achievement is statistically significant (IE= -0.04; CI= -0.11, -0.003). Thus, the relationship between parenting style (neglectful vs authoritative) and academic achievement is partially mediated by self-efficacy and intention, sequentially.

Table 5. Direct and indirect effects of parenting style on academic achievement

Direct effect				
	Effect	P-value	LLCI	ULCI
Parenting Style	Authoritative (ref)			
- Authoritarian	-0.62	0.020	-1.14	-0.09
- Permissive	-0.64	0.027	-1.22	-0.07
- Neglectful	-0.73	0.016	-1.32	-0.13
Indirect effects				
Parenting style => Self-efficacy => Academic Achievement				
	Effect		Boot LLCI	Boot ULCI
Parenting Style	Authoritative (ref)			
- Authoritarian	-0.10		-0.25	0.02
- Permissive	0.02		-0.09	0.16
- Neglectful	-0.16		-0.37	-0.002
Parenting style => Intention => Academic Achievement				
Parenting Style	Authoritative (ref)			
- Authoritarian	-0.08		-0.24	0.04
- Permissive	-0.07		-0.25	0.05
- Neglectful	-0.18		-0.39	-0.04
Parenting style => Self-efficacy => Intention => Academic Achievement				
Parenting Style	Authoritative (ref)			
- Authoritarian	-0.02		-0.07	0.005
- Permissive	0.01		-0.03	0.03
- Neglectful	-0.04		-0.11	-0.003

Discussion

The first goal of our study was to examine the longitudinal influence of parenting style on academic achievement of adolescents in Lebanon. Secondly, we examined the theoretical mediating role of social cognitive factors in the relationship between parenting style and academic achievement. Thirdly, we examined whether the association between parenting and academic achievement was moderated by age, gender, religion, school type and parents' education. Our findings indicate that parenting styles was prospectively associated with academic achievement of Lebanese adolescents six months later, this influence was partly mediated by self-efficacy and intention to get good grades. Demographic variables did not moderate the effect of parenting style on academic achievement.

The findings of the present research both support and extend those of previous studies. Our results indicate that authoritative parenting promotes higher academic achievement in adolescents compared to neglectful parenting. The positive influence of authoritative parenting is both direct as well as mediated in part through the effect of self-efficacy and intention. The findings are consistent with other studies showing that self-efficacy act as a mediator between parenting and academic achievement [18,32,52]. In addition, this study brings new insight into the literature by suggesting the sequential and causal pathway of self-efficacy and intention in explaining the relation between parenting and achievement which has not been studied before. The association between parenting style and adolescents' academic achievement was not moderated by age, religion, school type, parents' education or gender of the adolescents. This is in line with previous research indicating that the influence of parenting on school achievement does not depend on parents' educational level [53] and that for the most part the influence of parenting styles does not differ across demographic groups [54,55,56].

Our results from the serial mediation model supports that parenting style significantly influences academic achievement of adolescents both directly and indirectly through proximal cognitive variables. These findings support the dual-process view assumption that the environment-in our case the home environment- may influence behavior directly as well as indirectly through cognitions [24]. Our results show that parenting style influences self-efficacy, which in turn influences intention which subsequently influences academic achievement.

When looking at the direct association of parenting on academic performance, our results show that authoritative parenting had the most positive influence on academic achievement compared to all the other styles. This in line with previous research, even though there are some discrepancies in the findings, the majority of studies report a beneficial effect of authoritative parenting on academic outcome of adolescents [57,58] and a negative effect of neglectful parenting [19]. Our results indicate that this association is also true for the Lebanese context. Adolescents of neglectful parents were significantly less likely to have high academic achievement than adolescents whose parents are

authoritative. Importantly, this association held even after adjusting for socio-demographic and socio-cognitive factors suggesting an independent direct effect of parenting style. The latter implies that parenting programs and interventions aimed at fostering effective and positive parenting is worthwhile considering for improving adolescents' academic achievement regardless the socio-economical background. Moreover, our findings are also in line with previous studies documenting a positive effect of authoritative parenting on school outcomes among younger children [59,60]. Hence, even though with age there may be other social influences such as peer relations, parents continue to largely impact their children's outcomes across adolescence.

Further to the direct effect, our results revealed the indirect mediated effect of parenting on achievement via socio-cognitive factors. Firstly, parenting style was found to significantly directly predict socio-cognitive factors. Adolescents from authoritative parents were more likely to have high academic efficacy beliefs and more likely to have strong intentions towards getting good grades compared to adolescents of neglectful parents. This is in line with previous research showing that authoritative parenting fosters the highest levels of self-efficacy beliefs compared to non-authoritative parenting [18,61]. This positive influence can be explained by the favorable characteristics of the authoritative style that are assumed to contribute to healthy psychosocial development [20,62]. Authoritative parents are supportive and responsive towards their children's need, they foster self-reliance, critical thinking and more positive attitudes towards school [62,63]. Hence adolescents who describe their parents as being authoritative are more likely to develop positive beliefs about their achievement and be successful in their academic life [64]. Whereas adolescents from neglectful families were found to adopt maladaptive behaviors and task avoidant strategies which inhibit academic achievement [52].

Moreover, socio-cognitive factors were in turn found to be significantly associated with academic achievement. Adolescents with high self-efficacy were more likely to have stronger intention and consequently more likely to perform better compared to their counterparts with lower efficacy beliefs. The latter corroborates previous findings indicating that social cognitive factors are strong determinants of academic success [65,66]. Adolescents who have strong beliefs in their academic capabilities are more motivated, work harder and with greater persistence even in the face of difficulties and consequently are more likely to set higher goals and develop stronger intention to achieve these goals [67,68]. On another note, research also suggests that the more students achieve well academically the more they feel confident and the greater their efficacy beliefs [69]. Hence the need for interventions targeting both psychosocial cognitions and academic performance for they are a product of each other. In fact, one of the most influential sources of self-efficacy is mastery experience, past successes enhance efficacy beliefs while experiencing failure lowers it [27]. Interventions that induced successful performances were effective in strengthening adolescents' self-efficacy and eventually led to academic improvements [70].

In conclusion, our results indicate that authoritative parenting may have a direct positive influence on academic achievement of adolescent as well as indirect influence through psychosocial competencies, namely higher self-efficacy, which influence intention which most likely translate into direct action to get good academic achievement. Our findings suggest the need for interventions aiming at encouraging positive parenting styles and promoting positive relationship with adolescent for enhancing efficacy beliefs which may subsequently result in improved academic achievement. Parenting interventions are considered a promising approach and the recommended strategy for enhancing parent-child relationship [71,72]. Several parenting training programs exist today such as the Triple P-Positive Parenting Program [73] and Parent Management Training [74]. Those programs are aimed at empowering parents and supporting them to adopt positive parenting techniques, reduce parental stress and strengthen parent-child relationship [75]. Consequently, good parent-child relationship and competent parenting may positively influence several child emotional and behavioral outcomes [76,77] among which academic outcomes [78].

It is important to note that the association between parenting and achievement was partly mediated by cognitions which implies the presence of other potential mediators, such as context-specific parenting practices which have been found to be significantly linked to academic achievement [15,79]. Positive parenting practices aimed at improving school success such as parental involvement, have been suggested to positively influence academic outcome when occurring under a positive parenting style such as an authoritative home environment [80]. Therefore, specific parenting practices may mediate the influence of general parenting style on academic achievement and should be included when examining the relation of general parenting to student's achievement. Another important factor to consider is motivation, prior work has found that motivation prospectively influence academic achievement [81] and is influenced by parenting style [82]. Hence the importance of examining the moderating or mediating role of motivation in the relation of parenting to intention and academic achievement in future research.

Strength & Limitations

To the best of our knowledge this is the first study to prospectively examine the direct and indirect influence of parenting style on academic achievement of Lebanese adolescents. The current research presents new evidence on parenting socialization in the Lebanese culture and highlights the importance of the home environment in influencing Lebanese adolescents school outcomes. In addition, testing both the direct and indirect effect of parenting styles brings new insight in understanding the potential mechanisms by which the family environment influences adolescent academic achievement. An important contribution of this study is the sequential pathway of self-efficacy and intention, as examined by the serial mediation model, that provides a new explanation into the direct and indirect link between parenting style and academic achievement through the mediator effect of self-efficacy and intention. An additional strength of this study is the methodological approach used to test mediation using Hayes's macro PROCESS based on

bootstrapping which bypasses the problem of distributional assumption and provides more power in detecting indirect effect even in small samples [83].

Nonetheless, a number of limitations of this study need attention. First, due to the fact that grades were self-reported, common response bias cannot be ruled out. However, previous research indicate that self-reported grades are accurate indicators of actual grades and are comparable to academic transcript [84,85]. In addition, our sample was taken from two areas in Lebanon, Beirut the Capital city and Mount Lebanon area. These two regions concentrate the majority of the Lebanese population, including approximately half of the Lebanese students, and are representative of the various religious and socio-demographic societies in Lebanon. However, the sample is not at a national level and, consequently, the findings cannot be generalized to the whole adolescent population in Lebanon. Furthermore, our study examines parenting style in relation to both parents rather than individually and thus we were unable to explore the ways in which mothers and fathers differed in their parenting styles. Future studies examining the parenting styles of the mother and father separately are recommended as the cultural socializing pattern might differ. Finally, our research focused on the more global aspect of parental behavior that is parenting style and did not include behavior-specific parenting practices aimed at directly promoting school achievement. The inclusion of parenting practices is recommended in future research as domain-specific parenting behaviors (such as monitoring school activities) might produce larger effects than general parenting. In addition, examining both parenting styles and parenting practices will enable us to examine how general parenting may moderate the influence of specific parenting practices on academic achievement.

Conclusion

Our findings extend previous evidence on the positive influence of authoritative parenting on academic achievement both directly and indirectly through the mediating effect of self-efficacy and intention and highlight the importance of promoting this style for enhancing academic performances as well as psychosocial well-being among Lebanese adolescents. Future research may incorporate, motivation, peer relations and parenting practices as additional potential mediators as they have been found to be influenced by parenting style and significantly relate to school achievement.

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CHAPTER 5

5

Increased Adherence to the Mediterranean Diet and Higher Efficacy Beliefs Are Associated with Better Academic Achievement: A Longitudinal Study of High School Adolescents in Lebanon

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Abstract

This longitudinal study aims to examine how changes in health behaviors and socio-cognitive factors influence the academic achievement of Lebanese adolescents over a period of 12 months. Adolescents ($n = 563$) from private and public schools in Mount Lebanon and the Beirut area, aged between 15 and 18, participated in a three-wave longitudinal study and completed a self-administered questionnaire assessing socio-demographics, health behaviors, socio-cognitive factors, parenting styles, and academic achievement. A linear mixed model was carried out to examine if changes in health behaviors and cognitive factors affect changes in academic achievement after 6 and 12 months from the baseline, adjusting for demographic variables and parenting style. Results show that improved adherence to the Mediterranean diet and an increase in self-efficacy were associated with an increase in academic achievement. An increase in adherence to the Mediterranean diet had the same effect on academic achievement 6 and 12 months from the baseline, whereas an increase in efficacy beliefs was only significantly associated with achievement at 12 months from the baseline. This study supports the longitudinal link between diet quality and efficacy beliefs with the academic achievement of adolescents. This relationship is independent of sex, age, religion, parents' education, and raising styles.

Keywords: health behaviors; socio-cognitive factors; academic achievement; adolescents; Lebanon

1. Introduction

Youth has been recognized as important advocates and agents of change for more sustainable communities and prosperous future societies [1,2]. One way of empowering adolescents is through education [3]. Good education and academic achievement of adolescents have been a growing area of research, as it brings reward to the individual as well as to society as a whole [4]. Academic achievement represents performance outcomes on academic subjects and reflects the acquisition of knowledge and skills, and is usually measured in terms of grades attained [5].

Good academic achievement has been linked to several positive outcomes for the adolescent in both the short and long term. Academically successful adolescents have more chances to get into good universities, which opens up doors to better career opportunities, financial security, and overall better quality of life [6–8]. In addition, academic achievement has positive impacts on different social outcomes; academically successful adolescents are more confident, have higher self-esteem [9–11], are more engaged citizens, and are less dependent on social assistance [12]. On the other hand, low achievers are more likely to fail and repeat their grades, leave school early, and are less likely to pursue higher education [13]. Consequently, individuals with lower educational attainment have fewer employment opportunities, earn lower wages, pay fewer taxes [14,15], and are more likely to suffer from negative attitudes, lower self-esteem [16], and delinquent involvement [17].

Additionally, educational failure can have negative effects on the country's economy and growth by limiting productivity and innovation [18]. Despite an improvement in overall literacy rates, school failure and dropouts are still problems faced by low- and high-income countries. The latest data shows that on average, 15% of young adults aged 25 to 34 have not attained upper secondary education [19]. It has also been found that for those individuals, unemployment rates are twice as high compared to those with a university degree [19]. Investigating and understanding determinants of academic achievement is thus imperative to improve academic outcomes and prevent school failure and dropouts, and their adverse consequences for both individuals and society.

Academic performance is associated with several different factors, including non-modifiable factors such as genetic predisposition [20], and partially modifiable factors such as lifestyle and motivational factors [21]. In the present study, the focus is on changeable determinants of academic achievement as they can be targeted and improved in tailored interventions to foster future academic achievement. Among the most important studied changeable determinants of achievement are health behaviors [22]. Healthy behaviors such as being physically active, following a healthy dietary pattern, fruit and vegetable consumption have been linked to good cognitive functioning and better achievements [23–25]. In addition, health-risk behaviors such as unhealthy eating, smoking, and alcohol consumption have been found to adversely affect academic achievement [26,27]. In turn,

good academic achievement has been found to predict better future health through greater exposure to resources and information and greater health awareness, all of which leads to a healthier lifestyle [28].

Other factors known to influence the academic achievement of adolescents are socio-demographics [29], social-cognitive [30], and environmental factors [31]. Social cognitions such as self-efficacy and intentional behavior are known to influence academic achievement [32]. Adolescents with high efficacy beliefs would put more effort into their academic work and consequently perform better [33,34]. Moreover, a nurturing home environment has also been found to be vital to a child's education [35,36]. Parents can influence their adolescent offspring through parenting styles [37]. Parenting style has been described as a constellation of two underlying dimensions: responsiveness and demandingness [38]. Based on these two dimensions, a four-typology classification has been identified: authoritative parents are responsive and demanding, authoritarian is demanding but not responsive, permissive are responsive but not demanding, and neglectful are neither responsive nor demanding [39,40]. Findings from previous studies have majorly shown that having an authoritative parent fosters a better outcome for the child which includes academic outcomes [41,42].

Previous research examining predictors of academic performance has focused on one factor or explored the influence of limited subsets of behaviors, instead of including multiple factors comprehensively. Additionally, most of the existing research used a cross-sectional design highlighting the need to conduct more longitudinal research. Academic achievement of adolescents, particularly in secondary school, is crucial as it will set the stage for university entry and better future prospects. In Lebanon, very few studies have investigated the health behaviors of adolescents and only one recent study explored their relation to academic achievement [43]. Moreover, according to the results of international tests, Lebanese adolescents are lagging behind peers from other countries, pointing toward growing disparities in academic performance [44]. Investigating determinants of academic achievement and how they affect it will pave the way for evidence-based interventions to enhance the achievement of adolescents in Lebanon. Existing literature provides preliminary evidence that it is possible to improve school outcomes through improving health behaviors and motivational factors [45,46]. Hence, gaining further insight into those factors will help develop targeted multicomponent intervention programs that are culture specific to promote academic achievement.

To our knowledge, no prospective study has examined the association between changes in health behaviors and motivational factors and changes in the academic achievement of adolescents while controlling for demographic and environmental factors. Therefore, this study aimed to investigate how changes in health behaviors and motivational factors affect changes in the academic achievement of Lebanese adolescents at a follow-up after 6- and 12-months while controlling for socio-demographics and parental styles. Secondly,

this study examined if associations were the same at 6 months from baseline compared to 12 months from baseline.

2. Materials and Methods

2.1. Design

The study had a longitudinal design: the baseline survey (t1) was administered in Spring 2017, and follow-up surveys were distributed again six months (t2) and 12 months after the baseline (t3). This study was conducted in accordance with the Declaration of Helsinki [47], and the protocol was approved by the Lebanese Ministry of Education and Higher Education (10/684; date: 1 March 2017), and the Al Hayat Hospital ethical committee (ETC112018). Written consent forms were obtained from all students and their parents before participation.

2.2. Participants and Procedure

The study was conducted in private and public schools in Beirut and the Mount Lebanon area. The Lebanese Educational system is divided into two sectors: public and private. Public schools are non-profitable, free of charge, and under government authority. Private schools are operated by individuals or organizations with the government having a weaker control and have usually higher tuition fees, making them only accessible to well-off individuals. The educational system is divided into three cycles, elementary intermediate, and secondary. The secondary level is particularly important as it is concluded with official exams, "Lebanese Baccalaureate", qualifying students for tertiary education. A total of ten schools (five private and five public) were randomly selected from the Ministry of Education's list of schools based on the stratified sampling design, the strata being public and private schools. From the initial 10 schools approached, seven (four private and three public) agreed to participate in the study. G*Power version 3.1.9.7 was used to compute the sample size. We fixed the study power and the confidence level at 95%. We assumed that a linear multiple regression (fixed model; R² deviation from zero) with a medium effect size of Cohen of 0.15 would be an appropriate strategy to answer our primary objective (determinants of academic performance taken as a continuous variable). Thus, to study around 20 variables (age, gender, religion, parents' education, school type, diet, physical activity, smoking, cognitive variables, etc.), a minimum sample size of 222 was required. In order to take failure to follow-up and incomplete questionnaires into account, we recruited over 500 participants to, at a minimum, double the sample size. All students in Grade 10 and 11 (aged 15 to 18) were invited to participate in the survey. The baseline sample was a total of 600 adolescents, out of which 563 (94%) provided valid data. Participants with complete measurements at the six-month follow-up and 12-month follow-up totaled 362 (64.3%) and 345 adolescents (61.3%), respectively. Apart from adolescence being a period of significant development where lasting behaviors are adopted, this particular group was studied because it represents the last years of school (secondary level) prior to entering university, and is considered important and decisive of student's future

academic endeavors. Paper and pencil self-administered questionnaires were filled out by the students in the classroom. The questionnaire collected socio-demographic, lifestyle, and motivational data. Trained dieticians were present for any clarification and to measure students' height and weight using calibrated equipment [48]. Students were weighed to the nearest 0.1 kg, using a Seca-calibrated electronic weighing scale (Hamburg, Germany) and height was measured to the nearest 0.5 cm by using a portable stadiometer (ADE stadiometer, Germany). All measurements were carried out in light indoor clothes and without shoes. BMI was calculated as weight in kilograms divided by the square of height in meters (kg/m^2).

2.3. Questionnaire

2.3.1. Socio-Demographics

Socio-demographic data included information on students' sex (1 = male; 2 = female), age (1 = 15; 2 = 16; 3 = 17; 4 = 18), type of school (1 = public; 2 = private), educational level of parents (low = never went to school & primary school; medium = complementary & secondary school; high = technical school & university), family structure (1 = living with both parents; 2 = other arrangements) and religion (0 = Not Christian; 1 = Christian).

2.3.2. Parenting Styles

Parenting styles were assessed using the Authoritative Parenting Index (API) [49]. The API measures the two dimensions of parenting behavior, responsiveness, and demandingness, as perceived by the adolescents. Nine items measured responsiveness (e.g., "She/he listens to what I have to say") and seven items measured demandingness (e.g., "She/he has rules that I must follow"). In this study, the items were worded in reference to both parents (e.g., "They make sure I go to bed on time"). Students used a four-point response scale (1 = Not like them, 2 = Sort of like them, 3 = A lot like them, and 4 = Just like them) to indicate how closely the statement matches their parents. The final scale scores could range from 9–36 for responsiveness (Cronbach's $\alpha = 0.80$) and 7–28 for demandingness (Cronbach's $\alpha = 0.70$).

Parenting styles were created using median splits on demandingness and responsiveness. Based on the combination of the levels of responsiveness and demandingness the four parenting styles were categorized as authoritative (high on both responsiveness and demandingness), authoritarian (high demandingness and low responsiveness), permissive (low demandingness and high responsiveness), and neglectful (low on both responsiveness and demandingness).

2.3.3. Lifestyle Factors

KIDMED

Students completed a semi-quantitative Food Frequency Questionnaire (FFQ) that included 64 food and beverage items commonly consumed in Lebanon [50] and food habits questions (breakfast consumption, snacking, and frequency of eating fast food).

The collected data were used to calculate the KIDMED index (Mediterranean Quality Index for children and adolescents) [51]. The KIDMED evaluates adherence to the Mediterranean diet in children and adolescents based on the consumption of 16 items, of which 12 are positively scored and four negatively scored [52]. Items denoting a negative connotation to the Mediterranean diet are assigned a value of -1 (consumption of fast food, baked goods, and pastries for breakfast, consumption of sweets and candies several times a day, and skipping breakfast). Items denoting a concordance to the Mediterranean diet are scored +1 (consumption of fruits, vegetables, fish, pulses, nuts, cereals and grains, dairy products, and olive oil). The total score ranges from 0 (very poor) to 12 (high adherence) [52].

Physical Activity

Physical activity (PA) was measured using the short version of the International Physical Activity Questionnaire (IPAQ) [53]. Adolescents provided information on the time spent walking, in moderate and vigorous activity over the past seven days. For each activity intensity, time spent performing the activity is multiplied by the metabolic equivalent of task (MET) estimated at 3.3 for walking, 4.0 for moderate-intensity activity, and 8.0 for vigorous-intensity activity. The total activity score is calculated by summing the MET-minutes/week for each activity. The total score was reported as a continuous measure and converted into MET-hr/day [54,55].

Smoking and Alcohol

Prevalence of smoking and drinking in the past 30 days was assessed with the following questions: "During the past month, on how many days did you smoke?" and "During the past month, on how many days did you drink alcohol?" the responses were "0 days; 1 or 2 days; 3 to 5 days; 6 to 9 days; 10 to 19 days; 20 to 29 days; All 30 days". In line with the reported prevalence used in the Global School-based Student Health Survey, the responses were then dichotomized into (1) no = 0 days and (2) yes = 1–30 days [56,57].

2.3.4. Socio-Cognitive Factors

Four questions assessed adolescents' favorable and unfavorable attitudes towards getting good academic grades. Two items measured favorable attitudes "Getting good academic grades is a good help for getting a good job/will get me compliments from my parents". The responses were coded from -2 (strongly disagree) to +2 (strongly agree). Two items assessed unfavorable attitudes 'Getting good academic grades means that I have to work too hard/will cause disapproval among my friends' using the same scale reverse coded from +2 (strongly agree) to -2 (strongly disagree) so that higher scores reflect a more favorable attitude towards getting good grade ($\alpha = 0.15$).

Three questions assessed the subjective norms of mother, father, and teacher on a five-point scale from +2 (strongly agree) to -2 (strongly disagree): 'My father/my mother/my teacher expects me to get good academic grades' ($\alpha = 0.56$).

Five questions assessed the extent to which adolescents thought they were able to get good grades: 'I find it easy to get good academic grades/to concentrate at school for getting good academic grades/to master the skills that are taught in class this year/to concentrate on schoolwork when I am at home/to finish all my school work'. Responses ranged from strongly agree (+2) to strongly disagree (-2) ($\alpha = 0.76$).

One statement assessed the intention to get good academic grades: 'I intend to get good academic grades' on a five-point Likert scale from +2 (strongly agree) to -2 (strongly disagree) [58].

2.3.5. Outcome Measure: Academic Performance

Academic achievement was measured by asking adolescents to report their general average which is the result of the performance of the student in all school subjects during a specific semester. The general average is the standard instrument for the assessment of the academic achievement of students in Lebanese schools [43]. All participating schools use a 0–20 scale where the passing grade is 10 out of 20.

2.4. Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, version 23 (Armonk, NY, USA: IBM Corp.). Mean \pm standard deviation (SD) was used to present numerical variables, while the number of participants (%) was used for categorical variables. Changes from baseline were assessed using the McNemar–Bowker test for categorical variables and paired-samples t-test for numerical variables. Normality was checked using a histogram.

The first research question was to examine how the change in our independent variables (health behaviors and socio-cognitive variables) affect the change in our outcome variable (academic performance) between baseline and 6 months (Δt_2) and baseline and 12 months (Δt_3). To account for repeated measures two-level linear mixed model analyses were performed with repeated measurements as the first level and adolescents as the second level, where an unstructured covariance structure was considered for the repeated measures. No missing data were imputed as the likelihood-based approach was used to deal with missing outcome data. This approach assumes the missingness to be at random (MAR).

An attrition analysis was performed to check which variables were related to missingness using logistic regression analysis; variables related to missingness were included in the linear mixed model analyses. The fixed part of the model consisted of the socio-demographics, parenting style, change scores of health behaviors and socio-cognitive variables, and time (Δt_2 , Δt_3), where interactions between these change scores and time were included to examine the second research question, i.e., whether the effect of these change scores is different after 6 months (Δt_2) than after 12 months (Δt_3). A top-down procedure was performed to assess the significance of the interaction terms. In case an interaction term was statistically significant, the effect of the corresponding variable was

reported for both time points separately. Otherwise, the interaction term was removed from the model, where the effect at both time points was combined into one effect estimate. The effect estimates were reported with 95% confidence intervals and p values, where a two-sided p-value ≤ 0.05 was deemed as statistically significant.

3. Results

3.1. Demographics

The study sample consisted of 49.7% male and 50.3% female participants, with a mean age of 16.8 years. Out of the study participants, 62.5% of subjects attended private school. The proportion of parents with a high educational level was 52.5% for fathers and 55.1% for mothers. Adolescents had low adherence to the Mediterranean diet (mean \pm SD: 3.76 \pm 2.49). In all, 9.2% of adolescents reported smoking in the previous month and 54.7% reported drinking (Table 1).

Table 1. Descriptive characteristics of the baseline sample (N = 563).

Characteristics	Frequency (%)
Type of school	
Public	211 (37.5)
Private	352 (62.5)
Gender	
Male	283 (50.3)
Female	280 (49.7)
Religion	
Christian	435 (77.3)
Non-Christian	128 (22.7)
Family Structure	
Living with both parents	507 (90.1)
Other arrangements	56 (9.9)
Father education	
Low	31 (6.5)
Medium	195 (41.0)
High	250 (52.5)
Mother education	
Low	22 (4.4)
Medium	204 (40.6)
High	277 (55.1)
Age	
15	232 (41.2)
16	227 (40.3)
17	85 (15.1)
18	19 (3.4)
Mean (\pm SD)	16.76 \pm 0.73

Characteristics	Frequency (%)
Parenting Style	
Authoritative	107 (31.4)
Authoritarian	100 (29.3)
Permissive	68 (19.9)
Neglectful	66 (19.4)
Smoking	
No	511 (90.8)
Yes	52 (9.2)
Alcohol	
No	255 (45.3)
Yes	308 (54.7)
PA	
Mean (\pm SD)	6.20 \pm 6.98
BMI	
Mean (\pm SD)	23.6 \pm 4.50
KIDMED	
Mean (\pm SD)	3.76 \pm 2.49
Attitude	
Mean (\pm SD)	0.59 \pm 0.47
Social norm	
Mean (\pm SD)	0.95 \pm 0.67
Self-efficacy Total	
Mean (\pm SD)	0.25 \pm 0.73
Intention	
Mean (\pm SD)	1.15 \pm 0.90
Academic achievement	
Mean (\pm SD)	12.05 \pm 2.45

3.2. Change in Health Behaviors, Socio-Cognitive Factors, and Academic Achievement at $\Delta t2$ and $\Delta t3$

At $\Delta t2$ an increase in the mean score of the following variables was reported for the study population: Academic achievement (0.51 ± 1.19), KIDMED (1.30 ± 2.13), BMI (0.25 ± 1.49), and intention (0.06 ± 0.95). A decrease was reported for physical activity (-1.02 ± 5.28), attitude (-0.02 ± 0.50), social norms (-0.007 ± 0.70), and self-efficacy (-0.18 ± 0.67). At $\Delta t3$ the following variables showed an increase in the mean score: academic achievement (0.35 ± 1.49), KIDMED (1.58 ± 2.25), BMI (0.31 ± 1.72), whereas a decrease was reported for physical activity (-0.47 ± 6.18), attitude (-0.06 ± 0.52), social norms (-0.012 ± 0.70), self-efficacy (-0.13 ± 0.73) and intention (-0.01 ± 0.93). At both $\Delta t2$ and $\Delta t3$, the majority of adolescents reported to be still not smoking (89.5% and 87.5% respectively) whereas most adolescents were reported to still be drinking (59.6 at $\Delta t2$ and 59.9% at $\Delta t3$) (Table 2).

Table 2. Mean change scores of health behaviors and socio-cognitive factors of Lebanese adolescents at the 6- and 12-months follow-up.

Characteristics	$\Delta t2$	p	$\Delta t3$	p
Smoking				
- Stopped smoking	6 (1.7)	0.005 ^a	5 (1.5)	<0.001 ^a
- Still smoking	17 (4.7)		16 (4.7)	
- Started smoking	21 (5.8)		27 (7.9)	
- Still not smoking	317 (87.8)		295 (86)	
Alcohol				
- Stopped drinking	29 (8.0)	1.000 ^a	30 (8.7)	0.708 ^a
- Still drinking	187 (51.8)		173 (50.3)	
- Started drinking	28 (7.8)		33 (9.6)	
- Still not drinking	117 (32.4)		108 (31.4)	
PA				
Mean (\pm SD)	-1.02 \pm 5.28	<0.001 ^b	-0.47 \pm 6.18	0.152 ^b
BMI				
Mean (\pm SD)	0.25 \pm 1.49	0.002 ^b	0.31 \pm 1.72	0.001 ^b
KIDMED				
Mean (\pm SD)	1.30 \pm 2.13	<0.001 ^b	1.58 \pm 2.25	<0.001 ^b
Attitude				
Mean (\pm SD)	-0.02 \pm 0.50	0.450 ^b	-0.06 \pm 0.52	0.018 ^b
Social norms				
Mean (\pm SD)	-0.007 \pm 0.70	0.842 ^b	-0.012 \pm 0.70	0.741 ^b
Self-efficacy Total				
Mean (\pm SD)	-0.18 \pm 0.67	<0.001 ^b	-0.13 \pm 0.73	<0.001 ^b
Intention				
Mean (\pm SD)	0.06 \pm 0.95	0.170 ^b	-0.01 \pm 0.93	0.818 ^b
Academic achievement				
Mean (\pm SD)	0.51 \pm 1.19	<0.001 ^b	0.35 \pm 1.49	<0.001 ^b

Notes: ^a *p*-value for the McNemar-Bowker test, ^b *p*-value for the paired-samples *t*-test.

3.3. Effect of Change in Socio-Cognitive Variables and Health Behaviors on Academic Achievement

Our results show that the interaction between change scores of our independent variables (health behaviors and socio-cognitive variables) and time was only statistically significant for self-efficacy ($p < 0.001$), indicating different effects of self-efficacy to achieve good grades on the outcome at 6 months and 12 months after baseline. At 12-month follow-up we found that higher levels of self-efficacy to achieve good grades were related to higher academic achievement after correction for baseline; for every additional unit increase in self-efficacy, academic achievement additionally increased by 0.48 (effect estimate (B) 0.48; 95% CI 0.32, 0.65). Yet, at 6 months we did not find this effect (B 0.13, 95% CI -0.04, 0.30) (Table 3). Attitude, social norms, and intention change were not significantly related to change in academic achievement ($p \geq 0.364$).

Table 3. Six and 12 months estimated change scores effects on the academic performance of Lebanese adolescents.

Variables	β	95% CI	<i>p</i>
Type of school			
- Public	-0.13	[-0.49, 0.23]	0.473
- Private	0		
Gender			
- Male	-0.06	[-0.36, 0.22]	0.650
- Female	0		
Religion			
- Not Christian	0.08	[-0.43, 0.61]	0.735
- Christian	0		
Family Structure			
-Living with both parents	-0.05	[-0.63, 0.53]	0.858
-Other arrangements	0		
Father's educational level			
			0.268
- Low	-0.46	[-1.06, 0.12]	0.124
- Moderate	0.002	[-0.29, 0.29]	0.989
- High	0		
Mother's educational level			
			0.663
- Low	0.27	[-0.45, 1.10]	0.493
- Moderate	-0.06	[-0.36, 0.24]	0.699
- High	0		
Age			
			0.006
- 15	1.52	[0.54, 2.51]	0.003
- 16	1.23	[0.27, 2.19]	0.012
- 17	1.55	[0.58, 2.52]	0.002
- 18	0		
Parenting style			
			0.795
- Neglectful	-0.03	[-0.43, 0.40]	0.886
- Permissive	-0.18	[-0.56, 0.23]	0.351
- Authoritarian	-0.10	[-0.44, 0.26]	0.564
- Authoritative	0		
Smoking status change			
			0.701
- Stopped smoking	-0.37	[-1.19, 0.43]	0.361
- Still smoking	-0.27	[-0.92, 0.37]	0.408
- Started smoking	0.08	[-0.34, 0.51]	0.708
- Still not smoking	0		
Alcohol status change			
			0.444
- Stopped drinking	0.13	[-0.28, 0.55]	0.524
- Still drinking	-0.05	[-0.38, 0.27]	0.744
- Started drinking	0.20	[-0.19, 0.59]	0.322
- Still not drinking	0		
PA Change			
	0.01	[-0.01, 0.03]	0.175
BMI Change			
	-0.01	[-0.08, 0.05]	0.651
KIDMED change			
	0.25	[0.19, 0.30]	<0.001
Attitude change			
	0.86	[-0.10, 0.27]	0.364
Social norms change			
	-0.02	[-0.16, 0.12]	0.780

Variables	β	95% CI	p
Self-efficacy change	0.14	[-0.03, 0.32]	0.113
$\Delta t2\Delta t3$	0.48	[0.31, 0.64]	<0.001 *
Intention change	-0.02	[-0.12, 0.08]	0.686

β = Effect size; CI = confidence interval. Dependent variable: Academic Achievement. $\Delta t2 = t2 - t1$, where $t1$ = baseline and $t2$ = 6 months after baseline. $\Delta t3 = t3 - t1$, where $t1$ = baseline and $t3$ = 12 months after baseline. Association was significant: $p < 0.05$ * Effects significantly different ($p < 0.001$).

A significant effect of adhering to the Mediterranean diet on academic achievement was found. As no time interaction was found this implies that this pattern was similar at 6- and 12-months follow-up and therefore combined into one effect estimate. An increase in the adherence to the Mediterranean diet was significantly associated with an increase in academic achievement (B 0.25; 95% CI 0.19, 0.30). Changes in BMI, PA, alcohol, and smoking status did not significantly influence change in academic achievement ($p \geq 0.175$) (Table 3).

4. Discussion

The purpose of this study was to examine how changes in health behaviors and motivational factors affect academic achievement in a sample of adolescents from Lebanon using a longitudinal approach. After controlling for demographic factors (age, gender, school type, family structure, religion, and parents' education) and parenting style, adherence to the Mediterranean diet and efficacy beliefs were significantly associated with academic performance of Lebanese adolescents after 6- and 12-months follow-up. More specifically, an increase in diet quality and efficacy beliefs was associated with an increase in adolescents' academic achievement. Changes in PA, BMI, smoking, alcohol status, attitude, social norm, and intention were not statistically significantly associated with a change in academic achievement.

With regards to health behaviors, our findings show that adolescents with improved adherence to the Mediterranean diet had a better academic achievement 6- and 12-months later. Similar findings were reported in previous studies of the longitudinal association of diet with academic performance [59]. In past research, favorable dietary intake characterized by consumption of fruits and vegetables, home-made meals, nuts, and adequate vitamin intake was found to predict greater academic performance [59–61], while a Western dietary pattern and consumption of nutrient-poor and refined food were predictive of poorer performance [62–65]. Our results are also in accordance with findings of previous studies that have explored adherence to the Mediterranean diet and academic achievement among Lebanese high school adolescents [43,66] and university students [67] showing that higher adherence was related to higher academic scores. The Mediterranean diet is considered one of the healthiest eating patterns and higher adherence has consistently been linked with better overall health and cognitive

functioning [68–71]. Adolescents with higher adherence and healthier eating habits are assumed to have parents with higher dietary knowledge [72]. Parents can influence their children's intake as they are considered the main meal providers and can control access to healthy food, they are also considered role models and can also influence their children's food attitudes and preferences [73,74]. Adolescents whose parents are involved in their diet are also more likely to be involved in their academic work, which is another factor affecting performance [75]. Moreover, healthy eating behaviors were found to be associated with conscientiousness, which can also lead to better achievement [76]. Conscientious individuals are more organized, efficient, dutiful, and show self-discipline, which positively influences academic performance [77]. Consequently, adolescents with higher adherence to the Mediterranean diet might be applying themselves better to their studies which consequently results in greater achievement. Our findings add to the evidence on the importance of adhering to the Mediterranean diet for achieving good academic performance. Future intervention studies are needed to test the causal effect of associations between the Mediterranean diet and academic achievement.

Even though in prior research, significant associations of smoking and drinking with academic achievement have been reported in cross-sectional and longitudinal studies [27,78,79], in this current study, change in smoking and alcohol status were not significantly related to change in academic achievement. The latter could be due to the time lapse between follow-ups; most longitudinal research reporting a significant influence of substance use on academic performance was conducted over three or more years [79,80] and thus, significant results might be observed over longer follow-up periods. An additional point to consider is that social desirability bias is common among adolescents when reporting on substance use [81], which might explain the null finding. Similarly, our study did not find a significant association between changes in BMI and physical activity and changes in academic achievement, which is in agreement with previous research [82–84]. Our results show that an increase in BMI was associated with a decrease in academic achievement, whereas an increase in physical activity was associated with an increase in achievement. However, those associations were not significant. Evidence regarding physical activity, BMI, and academic achievement remains inconsistent with some studies finding a positive association [85,86] and others null associations [82–84]. The non-significance could be explained by the insufficient length of the follow-up period to yield significant results and the level of adjustment for confounders. Previous studies that found a positive association between changes in weight status and academic performance were over a two-year period [86].

With respect to cognitive factors, only an increase in self-efficacy was found to be significant in its effect on academic achievement. A possible explanation for this finding is that the change in attitude and social norms was smaller compared to self-efficacy (Table 2), consequently, the amount of change might not have been sufficiently large to elicit a change in academic achievement. Attitude, social norms, and self-efficacy are constructs derived from social cognitive theories such as the I-Change Model and

The Theory of Planned Behavior [58,87] that are used to explain why people engage in certain behaviors. According to those theories, the relative importance of each of those constructs may vary across behaviors, populations, and situations [87]. Hence, in our sample self-efficacy could be a stronger predictor of academic achievement, attenuating the influence of attitude and social norms and might be more effective in causing change. Our findings show that a positive change in academic self-efficacy was positively related to higher academic achievement at both 6- and 12-months follow-up, but the effect was significant at 12 months only. Our results are in accordance with prior longitudinal studies that showed that higher efficacy beliefs positively predict academic achievement [88–90]. Efficacious adolescents are more likely to perform higher because their strong beliefs about their ability to perform push them to put more effort into their academic work, persevere longer in the face of failure, and ultimately achieve higher, whereas low beliefs lead to less engagement, less effort and perseverance and consequently lower success [34,91,92]. Moreover, our finding of a significant effect of self-efficacy change at only one-year follow-up suggests that the time-point of measurement influences the strength of the relationship between self-efficacy and performance. Self-efficacy change better correlates with achievement after a period of time, in our case one year, and may not strongly relate with achievement when measured at short time-points apart. A possible explanation to why increased self-efficacy has a stronger positive effect in the longer term may result from the potential bi-directional relation between self-efficacy and performance [93]. When adolescents see that hard work and persistence are paying off by them achieving progress in academic courses, this successful academic experience will, in turn, further foster their efficacy beliefs which will consecutively contribute to them achieving more. Thus, self-efficacy beliefs become stronger predictors of academic achievement as adolescents progress through the academic year.

Finally, change in intention was not significantly associated with a change in academic achievement. The latter could be due to habit moderating the intention-behavior relation [94]. The impact of intention on behavior might differ based on the extent to which the behavior is habitual [94]. In other words, adolescents might have certain study habits or patterns of studying that occur without conscious effort and which could also be affecting performance [95,96], and thus the impact of intention on academic achievement change is reduced. Research suggests that the intention-behavior relation is dependent on implementation intention and goal setting [97], forming if-then plans or implementation intentions could help overcome the control of habit [98].

5. Limitations

A few limitations should be considered in the interpretation of the findings. First, grades were self-reported and the possibility of respondent bias cannot be ruled out. However, previous research indicates that self-reported grades can be reliable and correlate strongly with accurate grades [99,100]. In addition, our sample was selected from only

two regions in Lebanon, consequently, generalization of the results should be carried out with caution. Furthermore, to increase the accuracy of predictions, self-efficacy at task-specific and context-specific levels should be considered in future research. Moreover, while standard measures to assess socio economic status are available [101], we opted to select those that were the easiest to answer. Yet, future studies may be needed to identify the most optimal way for assessing socio-economic status in study populations such as ours. Another limitation was the low Cronbach α for attitude, however, sensitivity analysis (excluding change in attitude from the model) gave similar results (data not shown). Finally, even though the study controlled for the influence of a variety of factors such as age, gender, school type, religion, parents' education, and parenting style, the unique role of other important variables related to cognitive ability and specific learning disorders may still need to be considered in future research. Despite the above caveats, this is the first study that we are aware of to analyze prospective associations between adolescents' dietary patterns and efficacy beliefs with academic achievement in Lebanon and the MENA region. This study expanded our understanding of how a change in lifestyle and motivational factors could affect academic achievement among high school adolescents. An additional strength of this study is the methodological approach used. Major advantages of using linear mixed model analyses are that it uses all available data (no list-wise deletion), accounts for the correlation between repeated measures, and assumes missing outcome data to be missing at random (missingness might depend on observed variables, which were therefore included in the model).

6. Conclusions

In conclusion, the findings of this study suggest that an improvement in adherence to the Mediterranean diet and an increase in self-efficacy beliefs were associated with an increase in academic achievement during a one-year period. This implies that education intervention programs should promote the adoption of a healthy dietary pattern and increase perceptions of self-efficacy in order to enhance adolescents' chances of achieving higher. Future research should be directed towards interventions that examine whether experimental manipulation of health behaviors and socio-cognitive factors results in a corresponding change in academic achievement.

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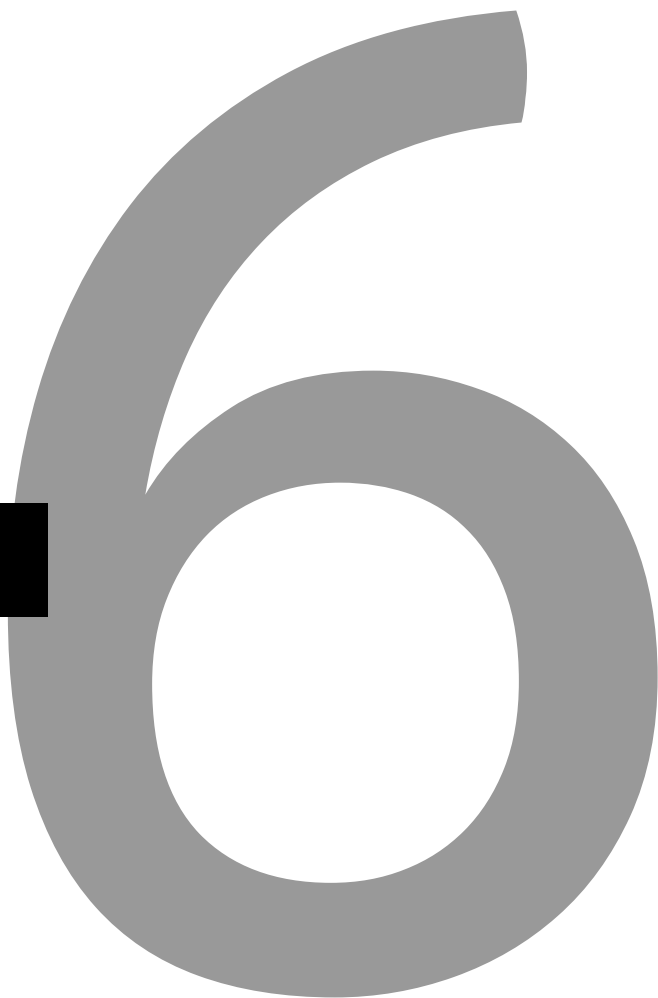
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CHAPTER 6



General discussion

Good academic achievement has been recognized as an essential prerequisite for individual and societal prosperity [1]. Although academic achievement and its determinants have been widely researched, prior studies often included a limited subset of factors with majorly cross-sectional designs. Additionally, in the Middle East and particularly Lebanon, limited data on academic achievement and the factors influencing it exists. Thus, the aim of this dissertation was to build on previous research and comprehensively examine the most important factors associated with academic achievement of adolescents in Lebanon and how changes in those factors influence change in academic achievement 6 and 12 months later to provide directions for the development of interventions to enhance academic achievement of youth.

This thesis also aimed to elucidate the socialization practices in the Lebanese context and how parenting style might affect academic achievement. Since parenting style has been found to influence academic achievement as well as predictors of achievement, we studied the influence of parenting style on determinants of academic achievement (health behaviors and social cognitions). In addition, we examined the integrated effect of parenting and socio-cognitive factors on academic achievement of Lebanese adolescents. This chapter provides a summary and a reflection of the main findings from the reported studies. It also discusses some methodological and theoretical limitations and recommendations for future research and practice and draws some general conclusions.

Summary of the main findings for each study

Chapter 2 describes a cross-sectional study examining the association between socio-demographics, health behaviors and socio-cognitive factors with academic achievement of adolescents aged 15 to 18 in Lebanon. The results confirm the positive association between a healthy diet and higher academic achievement and the negative association of smoking on academic performance. Our findings indicated that a higher adherence to the Mediterranean diet was associated with better academic achievement, while smoking was linked to lower achievement. Physical activity and alcohol consumption were not significantly related to academic achievement. In addition, we found that higher academic self-efficacy and stronger intention towards getting good grades were positively associated with higher academic achievement. Our findings highlight the link between health behaviors and academic achievement and suggest that support for developing and improving healthy behaviors, as well as efficacy beliefs may help improve academic achievement.

We also focused on the influence of parenting styles on both health behaviors, as well as academic achievement. First of all, *chapter 3* reports on a study investigating the prospective influence of parenting styles on health behaviors (diet, physical activity, smoking and alcohol) and BMI of Lebanese adolescents over a 6-month period and the moderating effect of adolescent characteristics, such as gender and age. The effect of

parenting style on health behaviors was not moderated by adolescents' age or gender. Of the four parenting styles studied (authoritative, authoritarian, permissive and neglectful), we found that authoritative parenting was the most reported parental style followed by the authoritarian style. The latter is a reflection of the blend of cultures in Lebanon and coexistence of traditional and modern societies. The authoritative parenting style was significantly associated with higher adherence to the Mediterranean diet and a lower level of alcohol consumption compared to the neglectful parenting style. We did not find any significant association of parenting style with smoking, BMI and physical activity. We concluded that authoritative parenting may be protective against alcohol consumption and unhealthy eating and that parents are still a major source of influence in the Lebanese context and should be included in interventions aimed at optimizing healthy behaviors.

In *Chapter 4*, the relation of parenting styles with socio-cognitive beliefs about getting good academic performances and academic achievement was studied in a longitudinal study with assessments at 6 months from baseline and 12 months from baseline. In addition, the study examined the mediating effect of these socio-cognitive factors in the relation of parenting to academic achievement. Potential moderation of adolescent and parental characteristics (adolescent's age, gender, school type, religion and parents' education) on the association of parenting style with academic achievement was also examined. First, no moderation effects were found for adolescent's age, gender, school type, religion and parents' education. Reporting of an authoritative parenting style was prospectively associated with higher academic self-efficacy and intention to get good grades and better academic achievement at 6 months follow-up. Additionally, we found that this association of parenting style to academic achievement was partly mediated by self-efficacy and intention. This study adds to the literature by examining the impact of socio-cognitive beliefs about achieving good academic performances in mediating the relation of parenting to academic achievement and revealing a new pathway to the association of parenting to academic achievement. Parenting style can influence academic achievement directly but also act as distal factor and influence achievement indirectly via proximal cognitions about academic achievement. This relation was found to be independent of gender, age, religion, school type and parent's education.

Chapter 5 assesses the factors that influence changes in academic achievement of adolescents over a 12 months period. We found that an increase in the adherence to the Mediterranean diet and efficacy beliefs was associated with an increase in adolescents' academic achievement. The improvement in adherence to the Mediterranean diet had the same effect on academic achievement 6 and 12 months from baseline, whereas increase in efficacy beliefs was only significantly associated with achievement at 12 months from baseline. We concluded that an improvement in diet quality and efficacy beliefs is linked to better achievement of adolescents and this association is independent of socio-demographics and parenting style. Interventions aimed at improving diet quality and efficacy beliefs will potentially also improve academic achievement.

Summary of the main findings per factor

Factors	Chapter 2	Chapter 3	Chapter 4	Chapter 5
Adherence to the Mediterranean diet	Higher adherence was significantly associated with higher academic achievement	Authoritative parenting was significantly prospectively associated with higher adherence to the Mediterranean diet at 6 months follow up		Improvements in adherence to the Mediterranean diet was associated with higher academic achievement over a one-year period
Physical activity	Physical activity was not significantly associated with better academic achievement	No significant association found between parental styles and physical activity at 6 months follow up		No significant association found between changes in physical activity and changes in academic achievement over a one-year period.
Smoking	Smoking was significantly associated with poor academic achievement.	No significant association found between parental styles and smoking at 6 months follow up.		Change in smoking status was not significantly associated with better academic achievement.
Alcohol	No significant association found between alcohol consumption and academic achievement.	Authoritative parenting was significantly prospectively associated with lower alcohol intake at 6 months follow up.		Change in drinking status was not significantly associated with better academic achievement over a one-year period.
Self-efficacy	Higher academic self-efficacy was significantly associated with better academic achievement.		Academic self-efficacy was associated with higher intention and higher academic achievement at 6-months follow up.	An increase in self-efficacy was significantly associated with better academic achievement over a 12-months period.
Intention	Higher intention to get good grades was significantly associated with better academic achievement.		Stronger intention was significantly associated with higher academic achievement at 6-months follow up.	No significant association found between changes in intention and changes in academic achievement over a one-year period.
Parenting Styles		Authoritative parenting was significantly associated with higher adherence to the Mediterranean diet and lower alcohol intake at 6-months follow up.	Authoritative parenting was significantly associated with a higher academic self-efficacy and intention to get good grades and with better academic achievement at 6 months follow up.	No significant association between parenting styles and change in academic achievement over a one-year period

Reflection on the findings

Mediterranean diet

One of the main objectives of this research was to assess the factors that influence academic achievement of Lebanese adolescents. With regards to health behaviors, we found that higher adherence to the Mediterranean diet was both cross-sectionally (*chapter 2*) and prospectively (*chapter 5*), associated with better academic achievement. This consistent finding confirms the influence of adherence to the Mediterranean diet on academic achievement. More specifically the longitudinal design in *chapter 5* examining how the change in adherence to the Mediterranean diet affects the change in academic achievement over a one-year period provides stronger evidence towards a causal association between this healthy dietary pattern and academic achievement.

Our results are in line with previous research demonstrating the positive influence of a healthy diet in general and the Mediterranean diet in particular on academic achievement of youth [2-6]. There are many potential explanations as to the positive effect of the Mediterranean diet on academic achievement. Firstly, from a nutritional point of view, this dietary pattern is rich in beneficial nutrients that exert a positive effect not only on physical health but also on cognitive health [7]. The Mediterranean diet is an important source of healthy lipids such as mono- and n-3 polyunsaturated fatty acids derived from fish, olive oil and nuts [8]. Polyunsaturated fatty acids are particularly important for brain health and were found to relate to better short-term memory, cognitive performance [9,10], better reasoning abilities [11] and improved reading abilities [12]. The Mediterranean diet is also rich in polyphenolic compounds and flavonoids from vegetables, fruits, cereals and legumes [13]. Polyphenols and flavonoids have been found to promote memory, learning and cognitive function through their antioxidant, anti-inflammatory and neuroprotective actions [14,15]. The Mediterranean diet is also low in harmful components such as saturated and trans-fat, sugar, sodium and processed food [7] all of which have been linked to oxidative stress and damaged blood-brain barrier negatively affecting cognitive performance [16-18]. Apart from the positive effects of single nutrients, the Mediterranean diet is an overall healthful dietary pattern, healthy quality diets have been found to be associated with improved mental health and reduced risk for depression and anxiety which in turn might contribute to better cognitive and academic performance [19-21]. Furthermore, the Mediterranean diet has been found to be associated with better enjoyment of school life and learning and better self-esteem which subsequently positively relate to academic achievement [22].

In addition to the benefits of this dietary pattern in terms of food components and nutritional adequacy, the Mediterranean diet is also characterized by food-related cultural aspects of family gatherings and conviviality [23,24]. Hence, adolescents with high adherence to the Mediterranean diet have probably regular meals with their families and have parents modeling healthy eating which has also been found to influence school performance [25]. Moreover, parents who are involved and monitor their children's dietary

intake are most likely also involved in their academic activities and school work which consequently positively influence their academic achievement [26].

It has also been suggested that following a healthy lifestyle is associated with conscientiousness, higher self-regulation and self-discipline [27,28] all of which might also lead to better academic performance [29]. Conscientious individuals are more likely to engage in goal-orientated activities that support better academic outcome and put more efforts towards achieving those goals [30,31]. Consequently, adolescents with higher adherence to the Mediterranean diet might be more organized, responsible and have higher willingness to perform, ultimately contributing to higher achievement.

Finally, the Mediterranean diet is an overall healthful way of eating and healthy dietary behaviors have been in general consistently linked with better academic achievement of youth. In a review by Burrows et al. [32], healthy eating habits such as breakfast consumption, low intake of energy-dense and processed food and consumption of higher quality diets as measured by diet indexes was significantly associated with better academic achievement.

Smoking

With regards to smoking, our results revealed that smoking was negatively associated with academic achievement (*chapter 2*); adolescents who smoked were 0.38 times more likely to have poor academic achievement. This finding is in line with earlier studies revealing this negative relationship, demonstrating that students who smoke had significantly higher risk of poor academic performance [33-35]. The odds of lower academic achievement for smokers in our study was comparable to the findings among Norwegian adolescents [36] but lower than that of studies among American and Korean adolescents in which the likelihood of poor performance was found to be twice higher than non-smokers [33-35]. In Jordan, it was found that academic achievement of smokers was lower by 4.3 relatively to children who did not smoke [37]. Some of the proposed explanations include the biological effect of smoking on adolescents' brain [38]. Nicotine exposure has been found to induce changes in the developing brain of adolescents and alter neuronal signaling negatively affecting cognitive functioning, attention and memory [38,39]. Furthermore, students who smoke are usually from families of low socio-economic status and a lower educational background [40] who tend to hold lower educational aspirations for their children [41,42] which in turn negatively influences their academic achievement [43]. Poor academic performance has been also suggested to precede smoking initiation [34,44]. Poor performing students are more likely to initiate smoking as a way to cope with anxiety and stress caused by underachievement [45,46] and because of feeling marginalized by teachers and higher achieving peers [47]. Moreover, adolescents with low academic achievement and who smoke have been found to cluster with peers who both perform poorly and smoke which puts them even more at risk of underachievement [47]. Affiliation with deviant peers has been shown to negatively affect school engagement and connectedness which in turn negatively impacts performance [48,49].

However, in *chapter 5*, a change in smoking status was not found to significantly affect academic achievement. The latter could be due to insufficient time between follow-ups; a change in smoking status might require longer follow-up periods to significantly affect academic achievement. Prior longitudinal research reporting a significant association of smoking with academic achievement was conducted over three or more years [50,51], hence a negative effect of smoking initiation or positive effect of smoking cessation might be seen over longer follow-up periods. Another possible reason might be the way smoking was operationalized, in *chapter 2* we examined three categories of smokers, whereas in *chapter 5* we only examined the change in the prevalence of smoking in the past 30 days which might explain the discrepancies in the results. In *chapter 2*, adolescents were categorized into never smokers, current smokers and past smoker based on two questions (having smoked ≥ 100 cigarettes in their life and number of days on which they had smoked in the past 30 days), while in *chapter 5* we only measured smoking prevalence by asking adolescents whether they have smoked in the past 30 days. Hence, the latter definition of smoking is more prone to information bias and may not be as reliable which might have impacted the results [52] since we did not take into consideration the lifetime consumption of a 100 cigarettes and we did not inquire about the number of cigarettes smoked, whether it was a few puffs or a whole cigarette or whether it was a one-time experiment. When investigating smoking behavior, it is recommended to assess it using several questions (e.g. number of cigarettes per day, duration of smoking, age at initiation ...) for more accurate results [53]. Another probable explanation to the null associations between change in smoking and change in academic achievement might be the phenomenon of regression to the mean. This usually occurs with repeated measurements in the same subject when high or low values are followed by measures that are closer to the subject's true mean. The percentage of adolescents smokers increased from 9.2% at time 1 to 10.8% at time 2 to 12.8% at time 3, thus we hypothesize that this might not be a real change but rather we might have a certain regression towards the mean since the percentage is also getting closer to results found in the latest Lebanon GSHS (11.2%) [54]. Hence, there might not have been a real change and the smoking prevalence of our respondents has probably remained constant [55].

Alcohol

In our studies, we found no significant association between alcohol consumption and academic achievement neither cross-sectionally (*chapter 2*) nor longitudinally (*chapter 5*). In contrast to our findings, evidence from prior literature point to a negative effect of alcohol consumption on academic achievement of youth [56]. Additionally, previous studies indicate that a higher alcohol consumption was associated with academic difficulties, lower grades and decreased likelihood of school completion [57-60].

A possible explanation to our null finding is that in our research we measured the prevalence of alcohol consumption in the past 30 days but did not assess the quantity of alcohol consumed or binge drinking. Therefore, adolescents who reported to have drank in the previous month and who were categorized as drinkers might have just had a few

sips/taste compared to heavy drinking. We now believe that it might have been better to assess the quantity of alcohol consumed and differentiating drinking alcohol from binge drinking and drinking to get drunk [56]. Furthermore, in their review, Busch et al [61] suggested that alcohol might not have a direct effect on grade but is rather a proxy for underlying social problems that may lead to poor academic performance. Adolescent who engage in alcohol drinking associated with peer who drank and with problematic behavior. Hence alcohol might be leading to poor grades as a result of a weakened interest in academic performance in exchange for a gain in social status [61,62].

Physical activity

In *chapter 2*, we found that the odds of having high academic achievement were significantly higher (OR:2.73) for adolescents with medium levels of physical activity compared to the low-level group. However, this association was no longer significant after adjusting for social cognitive factors in the last model, such as self-efficacy and intention. This suggests that physical activity in our sample might have had a weaker influence on academic achievement compared to social cognitive factors. In *chapter 5*, we also did not find a significant effect of change in physical activity on change in academic achievement. This is in accordance with prior research that found that compared to self-reports, objectively measured physical activity (such as accelerometers or pedometers) does not affect grades and academic achievement [63,64]. Furthermore, other studies have found that physical activity was not associated with academic achievement of children and adolescents, but on the other hand cardiorespiratory fitness did predict better academic achievement [63,65]. Hence physical activity might be more specifically associated with cardiorespiratory fitness which in turn positively impact academic achievement. Future studies investigating physical activity and academic achievement should use objective measurement methods to be able to distinguish general physical fitness from cardiorespiratory fitness. Better insights may also be gained by conducting randomized control trials examining the impact of physical activity interventions on academic achievement [66].

Moreover, the influence of physical activity on academic achievement has been suggested to be attributed to social contextual factors [61]. For instance, Crosnoe et al. [67] found that participation in team and school sports strengthen bond with school personnel, raises social status, provides entry into elite group and raises aspiration for college entry whereas participation into individual sports was negatively associated with academic performance. Team sports participation was suggested to increase self-esteem, psychological well-being and teach greater time management and self-discipline enabling students to achieve higher [68]. Hence future studies should also inquire about types of activities (individual or group sports) and examine the related socialization component of sports participation.

Self-efficacy

Similarly to the adherence to the Mediterranean diet, academic self-efficacy was found to be cross-sectionally (*chapter 2*) and longitudinally (*chapter 4 & 5*) related with better academic achievement strengthening the evidence of this association. Our results are in concordance with prior cross-sectional, prospective and experimental studies demonstrating the positive effect of efficacy beliefs in predicting subsequent academic achievement [69-74].

Academic self-efficacy relates to and influences performance through cognitive and motivational mechanisms [75]. Efficacy beliefs govern a person's efforts, goals, motivation, action, and perseverance which affects likelihood of success in academic activities [76,77]. Self-efficacy influences how adolescents approach academic tasks, how much effort they put in achieving those tasks and their persistence in face of obstacles [78]. Adolescents with higher academic self-efficacy undertake challenging tasks, motivate themselves during those tasks, experience less stress and anxiety and persist longer when they encounter challenges compared to their peers who doubt their abilities [79]. They approach difficult tasks as challenges to be mastered rather than threats to shy away from [80]. Self-efficacy affects academic achievement beyond actual abilities [81]. Adolescents can have the knowledge and skills to perform but have low efficacy beliefs and doubt their abilities which results in weaker effort put in the task or academic activity and subsequently poorer performance [75]. Furthermore, additional ways in which academic self-efficacy was suggested to influence academic achievement is by promoting high academic aspirations, prosocial peer relations and lowered vulnerability to depression [82]. Highly efficacious students have higher academic aspirations and set higher personal goals and are more committed to fulfilling them which positively influences scholastic achievement [83].

Additionally, high perceived academic self-efficacy has been found to promote supportive social relationships and building peer acceptance which positively influences academic achievement, whereas students with low academic self-efficacy tend to gravitate towards peers with low academic values and behavioral problem which leads to disengagement from academic activities and negatively impacts academic achievement [82,84]. Finally, low sense of academic efficacy beliefs increases vulnerability to depression which compromises academic achievement [82].

Intention

As regards intention to get good grades, it was found to be significantly associated with academic achievement cross-sectionally (*chapter 2*) and at 6-month follow-up (*chapter 4*), but no effect of change in intention on academic achievement was observed in *chapter 5*. A possible explanation for this is that the change in intention was small and not significant after 6 and 12 months from baseline and hence the amount of change was not large and significant enough to cause change in academic achievement. Another explanation could be that a change in intention might be attenuated by habit. If behaviors such as

study patterns are done repeatedly under circumstances conducive to habit formation then intention has less impact on behavior [85]. Moreover, research suggest that the intention-behavior relation is dependent on implementation intention and goal setting [86]. Meaning that a weak intention-behavior relation could be the result of individuals having strong intentions but failing to act on them by developing specific action plans to realize intentions towards getting good academic performances.

Behavioral intention is determined by attitude, perceived social norms and self-efficacy beliefs [87,88]. In our research, academic self-efficacy was significantly associated with intention to get good grades (*chapter 4*), but attitudes and social norms were not. According to social cognitive theories such as the Theory of Planned behavior and the I-change model [88,89], attitude, social norms and efficacy beliefs are used to explain why people engage in certain behaviors and the relative importance of each of those constructs may vary across behaviors, populations, and situations [89]. Hence, in our sample self-efficacy could be a stronger predictor of intention and consequently be more effective in influencing academic achievement, attenuating the influence of attitude and social norms. One strategy that may be is focusing on also reinforcing attitudes towards getting good grades and strengthening social norms and support towards achieving good academic performances so they can become progressively more important determinants of intention. Strengthening those cognitions combined with self-efficacy might eventually have a greater impact on the predictive strength of intention ultimately leading to better academic achievement.

Parenting style

We examined parenting styles in relation to health behaviors, social cognitive factors and academic achievement. Our findings indicate that out of the four studied parenting styles (authoritative, authoritarian, permissive and neglectful) an authoritative parental style is prospectively associated with higher adherence to the Mediterranean diet, lower alcohol consumption (*chapter 3*) higher academic efficacy beliefs, stronger intention to get good grades and higher academic achievement (*chapter 4*).

With regards to health behaviors, our findings of a positive effect of authoritative parenting on adherence to the Mediterranean diet and a lower alcohol intake are in line with prior studies showing that children raised with an authoritative style had generally healthier eating habits [90,91] such as higher fruit intake [92,93], and regular breakfast consumption [94] and were less engaged in risky behaviors [95,96]. The positive effect of authoritative parenting on eating and drinking behavior can be explained by the favorable characteristics of this style. Authoritative parents are firm but also kind and understanding, they set clear rational rules and boundaries and use communication and reasoning when discussing those rules which legitimize their authority [97,98]. Authoritative parenting has been also found to foster self-regulation and competence which has been associated with lower problematic behavior and drinking [99] and healthier eating behaviors [100]. Additionally, authoritative parenting might influence adolescents eating behaviors

through its influence on specific parenting practices. Food-related parenting practices such as modeling of healthy eating, mealtime structural practices and food rules are better accepted by adolescents when exercised in authoritative context [101,102] which might be another factor indirectly influencing adherence to a healthy diet. Hence, promoting an authoritative parental style produces favorable health outcomes for adolescents which will probably positively impact their academic outcomes.

Our results also complement previous findings with further evidence on the positive effect of authoritative parenting on psychosocial development and academic performance [103-105]. Firstly, and consistent with results of previous reviews [106,107], we found a direct positive association between authoritative parenting and academic achievement. A possible explanation to the positive influence of authoritative parenting on academic achievement pertains to the favorable characteristics of this style. Authoritative parents support autonomous behavior and individuality which promotes independent problem solving, critical thinking and self-reliance [108,109]. Authoritative parents provide positive encouragement, instruction and support which fosters adolescents' abilities and control beliefs in turn promoting academic performance [109]. Secondly, and further to the direct effect our findings revealed the indirect mediated influence of parenting on academic achievement via the mediator effect of self-efficacy and intention. These results are in line with prior research that indicate that authoritative parenting can help foster the development of healthy psychosocial competencies such as efficacy beliefs which in turn affect academic achievement [103,105,110]. Additionally, our findings bring new insight into the indirect link between parenting style and academic achievement by suggesting the sequential pathway of self-efficacy and intention which has not been studied before. Parents are thus important influencers who can shape their children's beliefs which in turn will affect their achievement.

It is important to note that parenting has been found to differ across cultures and the positive effect of authoritative style compared to the other styles has been majorly seen in studies from Western countries and to a lesser extent among other ethnicities [111]. Evidence from prior research suggest that white adolescents are more likely to benefit from authoritative parenting than African-American and Asian adolescents [112,113]. Similarly, among Spanish adolescents it was found that permissive parenting was associated with better psychosocial adjustment and academic success compared to authoritative parenting [114]. Furthermore, while authoritarian parenting style was in general associated with negative outcomes compared to the authoritative style in the West, among African and Arab adolescents this style seems to be tolerable and accepted in this cultural context [115]. Studies on parenting among this group is rarely consistent, some studies indicate no negative associations with the authoritarian style [116] while others confirm the detrimental outcomes linked to authoritarian style found in Western studies [117]. In a study by Alt [117] examining parenting style and college life adjustment among Female Palestinian-Arab, it was found that authoritative parenting was positively associated with increased adjustment whereas authoritarian was associated

with academic maladjustment. In contrast, Dwairy [118] indicate no negative impact of authoritarianism on psychological well-being of Palestinian-Arab adolescents. Another study among Emirati adolescents found that maternal demandingness was positively related to GPA scores whereas responsiveness was not [119].

In the current research, our findings were comparable to studies from Western countries demonstrating the positive influence of authoritative parenting on healthy eating, drinking behaviors, motivational factors and academic achievement, this can be explained by Lebanon being a more liberal country and exposed to Western influence compared to other Arab countries. We can conclude that general parenting positively influences adolescents' eating behaviors and alcohol consumption and that a significant association probably exists between parenting and academic achievement and this association is partially mediated by self-efficacy and intention. However, we were not able to assess the impact of a change in parenting style over academic achievement. On another note, evidence from previous research indicate that parental behavior that are specifically directed at promoting academic achievement have larger effects on achievement than general parenting behaviors and that parenting style act as moderator for those specific school-related parenting practices. It was found that parental educational involvement such as helping with homework, participating in parent-teacher meetings and monitoring of school progress enhances adolescents' academic achievement [120] and this positive influence was much more likely to happen when it occurred in the context of authoritative parenting [112]. Hence with regards to future research investigating the influence of parenting on adolescents' academic outcomes, it is recommended to incorporate school-specific parenting practices in addition to parental styles.

Limitations

Practical limitations

As with any study, some limitations need to be acknowledged when interpreting the results of our studies. With regards to the tools used, the majority of data used was obtained through self-administered questionnaires, except for the anthropometric measurements which were physically measured by trained dietitians. Previous research has shown that respondents tend to give less socially desirable answers in self-administered surveys than in interviews on health behaviors and lifestyle factors [121]. It was reported that there is a lower chance of biased response, higher motivation to tell the truth and higher assurance of confidentiality with self-administered questionnaires [122]. Our outcome measure, academic achievement was assessed by adolescents reporting their grades and there is a possibility of student overestimating their performance. While actual grades obtained from school records might be more objective, the majority of research examining academic outcomes rely on self-reported grades because of the difficulty and legality of obtaining school data and self-reports are considerably more accessible and efficient [123]. Additionally, previous research comparing actual grades to self-reported grades

indicate that self-reported grades are a reliable measure of academic achievement and were found to strongly correlate with actual grades [123-125].

Reports about parenting styles were also limited to reports by adolescents. Although the preferred method to measure parental style is by observational assessment and use of multi-informant data [126] this is not always feasible. Additionally, adolescent reports were suggested to be more reliable than parent self-report [127] and there are indications that it is how parenting style is perceived and experienced by the adolescent that is more important and has more influence [128]. Moreover, in our study parenting style was based on Maccoby and Martin's typological approach and we examined the four prototypes of parenting [129] as a function of two dimensions of parental behavior: responsiveness/warmth and demandingness/control. While this configuration is widely used other studies have also used the dimensional approach when examining the influence of parents on child's outcomes mainly examining parental support and parental control [130,131]. Research using the dimensional approach have found that parental support and appropriate behavioral control and monitoring was positively associated with better academic achievement whereas intrusive psychological control was negatively related to developmental outcome among which academic achievement [106,130]. This is comparable to our results of a better academic achievement associated with authoritative parenting which is characterized by a balance between affection and support and appropriate amount of parental control.

Regarding physical activity, the IPAQ short form was used and the possibility of adolescents overestimating their physical activity should also be considered. However, we had a high percentage of adolescents with low physical activity (32.8%) which is comparable to previous studies among Lebanese children and adolescents (32.6%) [132]. Although accelerometers and pedometers are more reliable objective measures of physical activity, the IPAQ has been shown to be a reliable and valid tool to obtain estimates of physical activity [133,134].

As with all dietary assessment methods data accuracy may be limited by measurement errors and memory bias. However, FFQ remains one of the most widely tools used in epidemiological studies as it provides information of food intake over an extended period of time while having a lower respondent burden and being cost effective. Previous studies assessing the association between nutrition and academic achievement have varied in their use of dietary assessment methods. Some studies used recognized assessment tools such as 24-hr recall [135,136], food diary [137] or FFQ [138-141]. Other studies just assessed certain aspects of diet such as breakfast consumption, regular meal intake and frequency of fruits and vegetable or junk food [35,36,142]. Compared to other dietary assessment tools, FFQs have been found to be the most practical and economical method to collect comprehensive dietary data with minimal burden on participants and researchers [143-145].

Moreover, while self-administered questions tend to minimize socially desirable answers, many respondents still tend to misreport when answering sensitive questions such as substance use [122]. However, in our study, questions on smoking and alcohol consumption were based on the validated survey items of the Global School-Based Health Survey [146].

Furthermore, the questions measuring social cognitive variables were developed based on the I-change model [88]. Exploratory and confirmatory factor analysis show low to moderate loadings of items for attitude and social norms and high to moderate loadings of items for self-efficacy. We therefore acknowledge the need to further validate this scale in future research. It is important to mention that all scales were translated in Arabic by a translator and then back translated to English by a native English translator.

Our sample was recruited from only two geographical areas: Mount Lebanon and Beirut the capital and largest city in Lebanon, but not at the national level. Consequently, the results may not be fully generalizable to the adolescent Lebanese population. Nonetheless, these two areas have the highest concentration of people (hosting nearly half the population) and are representative of the various religious and socio-demographic societies in Lebanon compared to the other Lebanese regions where one major religion predominates. Additionally, the distribution of the study sample by sex and school sector was similar to that of the Lebanese secondary student population [147]. The majority of our sample comes from private schools and are males which is comparable to statistics showing that private schools in Lebanon account for the majority of enrolment and that the percentage of males is higher than females [147].

We had a drop-out rate of 38% mainly due to absenteeism and loss to follow up. However, variables related to missingness (gender, school type, and religion) were adjusted for in the linear mixed model which ensures missingness at random and those variables were not significantly related to the outcome (academic achievement). We were not able to measure parenting style at time 1, it was only measured at time 2 and time 3, however, parenting did not differ between t2 and t3 and there are indications that parenting style is generally stable and constant over time and may only slightly adapt during developmental phase as children mature (e.g. between infancy and childhood or childhood or adolescence) [148,149].

One additional possible limitation might be the use of change scores in *Chapter 5* to examine factors that influenced change in academic achievement over the one-year period. Very few studies have used a similar analysis or the use of change scores [150] and mostly studies rely on studying how factors at baseline might affect academic achievement years later [2,61,151,152], and thus this might have affected our results. However, we opted for the use of change scores to answer the objective of the study in *Chapter 5* which was to examine if and how change in our independent variables affect change in our outcome variable: academic achievement.

Theoretical limitations

When examining parental influences on academic achievement of adolescents, this thesis focused on the concept of general parenting and raising styles. However, other parenting behaviors such as parenting practices have been found particularly important to adolescents' academic performance. Parental support and school-specific involvement such as helping with homework, communication about school problems, positive reinforcement and attending school events have been positively associated with achievement [106,112,153]. Parenting style is thought of as the emotional context for specific parenting behaviors and is assumed to moderate the association between education-specific parenting practices and adolescents' academic achievement [154]. Parenting style is a more global way in which parents interact with their children, focusing less on what parents do and more on how they do it [155]. While parenting practices are more explicit caretaking practices directed at specific behaviors and are assumed to have a more direct influence on children's developmental outcomes [154]. School-related parenting practices should thus be included in future research as it will offer a more detailed understanding on the effect of parents on academic achievement. Furthermore, parents are not the only influence in adolescents' lives. In addition to examining the home environment, the school environment is also a part of the micro-environment of adolescents and may influence their academic achievement [156]. Hence the importance of studying specific features of the school environment and the influence of teachers and peers on adolescents' academic achievement for a more complete model [49,157].

Moreover, when assessing socio-cognitive determinants of academic achievement we included attitudes, social norms, self-efficacy beliefs and intentional behavior. However, there are other motivational variables that we failed to account for such as intrinsic and extrinsic motivation, task value, expectancy for success and attributions that have been found to significantly influence academic achievement [158]. Those motivational beliefs have been also found to mediate the relation between self-efficacy and school performance [159] and should be considered in future research of academic achievement.

Additionally, prior research suggests that having strong goal intentions might not always be enough for the goal to be enacted and that forming implementation intentions specifying when, where and how to act helps translate the goal into behavior [86]. Hence studying implementation intentions and goal planning would help bridge the intention-behavior gap in predicting academic achievement. Duckworth et al. [160] have shown that students who were taught to think about a desired school-related goal and plan for it using implementation intentions (if-then plans) specifying when and where to overcome potential obstacles that stand in the way of achieving their goal had improved academic performance compared to children who were just taught to think positive about academic wishes. Furthermore, when assessing academic self-efficacy, we measured adolescents' beliefs of being successful in achieving good grades and hence measured a more global aspect of academic self-efficacy. A self-efficacy scale tailored to specific activity domains such as specific academic subjects and the different levels of tasks demands within that

domain is preferred to allow greater prediction and more accurate explanation of academic achievement [161]. For instance, Pajares & Miller [162] examined mathematic self-efficacy assessing student's perceived capabilities to solve math related tasks and to succeed in math courses and found that math self-efficacy was predictive of math problem solving. Other research has investigated writing self-efficacy in predicting writing achievement among adolescents [163]. Thus, to increase accuracy of predictions, task-specific and context-specific self-efficacy should be considered in future research. The same applies to attitude and social norms; measuring more specifically social norms and attitudes such as attitudes towards learning scientific subjects or perceived social pressure of passing the academic year or a particular school course from important others [164] may be more predictive of academic achievement and should be considered in future studies. Moreover, in our research, adolescents' attitudes towards achieving good academic grades was assessed by four items asking about their perception of two cons and two pros which also included rational and affective components. Attitude is determined by the perception of various consequences and beliefs [165], prior research measuring attitudes varied in the number of items used ranging from 16 [166] to 28 questions [167], hence measuring attitude with only four questions might have affected the predictive value of the construct. Social norms were assessed by asking adolescents about their perception of their parents and teacher with regards to achieving good academic performances, however there might be other important people that we have missed such as siblings, classmates and friends. In addition, it might be recommended to also measure how much support adolescents receive from significant others for getting good grades in future research [168].

Lastly, although we aimed to have a comprehensive and manageable design with several relevant confounders as possible, there are other factors that have been found to be relevant to understand academic performance that were not included in our model. For instance, among environmental factors and aside from the influence of parents, studies have shown peers group and teachers-student relationship to also impact academic achievement [169]. Similarly, among behavioral determinants, perceived stress, sleep deprivation and learning disorders were also found important for their effect on academic achievement [170-172]. Hence future studies examining determinants of academic achievement should account for those variables so as to better predict academic achievement.

Implications for practice

The current dissertation focuses on comprehensive formative work examining determinants of academic achievement to better inform intervention strategies. The findings of this dissertation should be viewed as groundwork for future interventions and have practical contributions for policy makers, educators, parents and adolescents.

Mediterranean Diet or a Healthy Diet to improve academic performances.

Firstly, our findings indicate that promoting adherence to the Mediterranean diet among youth will most likely lead to better cognitive functioning and academic outcomes. This is of particular importance to Lebanese adolescents who are moving away from this traditional healthy diet as reflected by sub-optimal levels of adherence to the Mediterranean diet. This nutrition transition towards energy-dense processed food is comparable to other countries of the Mediterranean coast [173-174]. The latter further highlights the need for raising awareness on the benefits of the Mediterranean diet and foster its adoption as a means for a healthy life and chances at a successful future. In non-Mediterranean settings, this could be translated into the promotion of overall healthy diets that could incorporate key principles of the Mediterranean diet. In this research we concentrate on the Mediterranean diet as this is the traditional cuisine in the Lebanese context of the study. However, it is important to note that the Mediterranean diet is one model of healthy eating and one region's diet cannot be promoted to be universally ideal. The beneficial effects of the Mediterranean diet stems from healthy components and their synergistic effects [7], which could be attained from different cultural cuisine by following practical recommendations including increased fruit and vegetable consumption, eating more plant-based such as legumes and whole grains, substituting foods high in saturated fats with mono- and polyunsaturated fats and lowering the consumption of meat, full-fat dairies and processed foods. Therefore, any general dietary pattern comprising of minimally processed food and a combination of food that form a healthy diet such as those mentioned above may be considered beneficial and will also likely have a similar positive effect on academic achievement [139,140,175].

Facilitating healthy eating habits, among adolescents can start at the school level. One way of doing this is by integrating nutrition education into the school curricula. Educating adolescents on nutrition and healthy eating will provide them with the knowledge and skills to make informed food choices. For example, adolescents can be taught how to prepare healthy snacks at home and adapt the healthy food choices to their situation. Previous school-based nutrition interventions studies among Lebanese school students have shown that incorporating nutrition education into the curriculum can help in the prevention of pediatric obesity and adoption of a healthier lifestyle [176] and can result in improved dietary behaviors and attendance [177,178].

Nutrition education is an influential factor in the adoption of healthier dietary behaviors, however, nutrition knowledge alone is not sufficient [179]. Schools need to implement strategies that make healthy food choices the easiest choice for students [180]. This could be done by providing a physical environment conducive to healthy eating; schools need to ban the sale of junk food and unhealthy snacks and beverages at canteens, school shops and vending machines while increasing the availability of healthy alternatives such as fruits and vegetables. In Lebanon there are no policies or law that regulates the sale of food and drinks in schools, there is a Ministerial decision that bans some junk foods and soft drinks, however it is not properly applied in all schools especially private schools

who are managed by private organizations and do not abide by the Ministry's decisions if extra-curricular. Hence there is a need for a national decree that regulates the sales of food items in all schools with close monitoring on its implementation. Furthermore, in order to allow equal chances to all students with regards to access to healthy food, school meal programs offering healthy free meals to students are of particular importance especially in public schools as they include students from disadvantaged background and food-insecure household. In Lebanon, there is no federal school meal program implemented by the local government, but rather a project led by the World Food Program distributing healthy snacks such as fruits and vegetables in some but not all public schools [181]. Thus, efforts are needed to expand such a program on a national level and offer free or reduced-price full nutritious meals for the most vulnerable students so as to improve their health and learning outcomes. Farm to school program is another interesting approach for facilitating healthy food choices. Farm to school programs or school gardens combine both nutrition education and accessibility to healthy local food. Such programs have been shown effective in positively influencing students eating habits [182] while providing experiential learning about food. Lastly, at a macro level, government policies aiming at regulating the marketing of food and beverages to youth are needed as they are exposed to commercial messages promoting unhealthy foods.

Motivational factors/efficacy beliefs

The findings of our studies also suggest the need to foster higher efficacy beliefs in adolescents as a way to enhance academic achievement. Our results confirm that academic self-efficacy is among the strongest motivational constructs predicting academic achievement and should be targeted when trying to improve academic outcomes. Strategies to promote adolescents' efficacy beliefs are important and possible by targeting the four sources of self-efficacy: the student's own previous performance or mastery experience, observing the experience of others or vicarious experiences, verbal persuasion that one possesses the needed abilities and physiological and affective states [183]. Education policy makers should integrate instructional practices aiming at fostering student's efficacy beliefs within the regular school curriculum [71,184]. By doing so, schools will not be only helping students with the acquisition of knowledge and skills but also fostering the confidence in their abilities to use them well. Schools should train their teachers on employing instructional techniques that enhance students' efficacy beliefs. Those techniques include helping students set specific short-term achievable goals and track progress towards those goals. Teachers can review students' accomplishments and provide individual feedback and praise on specific skills they developed. Teachers can also organize group work in which students can observe peer models successfully implement learning tasks which will encourage them to try and do the same [71,184,185]. Adopting this instructional style has been shown to support knowledge acquisition and reinforce students' skills development and their beliefs in their capabilities to apply them to various academic situations [71]. Self-efficacy training is thus a recommended strategy to integrate within the overall school curriculum as a means to enhance adolescents' efficacy beliefs which will in turn enhance academic achievement.

Environmental factors/parents

Interventions aiming at improving adolescent's academic achievement should go beyond the school setting and include the family environment. Our results indicate that parents are still very much influential on adolescents' lives. They significantly influenced adolescents' academic achievement, adherence to the Mediterranean diet, alcohol consumption, efficacy beliefs and intentions to get good grades. Hence fostering a positive parenting style, namely authoritative parenting, will result in positive outcomes for adolescents' academic achievement. Moreover, encouraging the use of an authoritative style in rearing practices will also result in positive outcomes for health behaviors and social cognitions which will indirectly influence academic achievement.

Promoting authoritative parenting could be done by the development of a multilevel parenting intervention program. Many programs already exist such as the Triple P-Positive Parenting Program and Parent Management Training [186,187] and can be taken as examples. Parents could be targeted with key messages and group sessions on effective parenting through different channels (such as mass media and peer groups), in different settings (such as schools, health facilities, online) and involving different stakeholders (such as school educators, social workers, physicians etc) for a wider reach. Such parenting support interventions have the potential to foster competent parenting and strengthen parent-child relation consequently improving youth outcomes among which academic outcomes.

In addition to empowering parents to adopt a positive parental style, involving parents in intervention activities such as the educational sessions on healthy eating and strategies to foster efficacy beliefs, is fundamental for the success of the interventions. Parents have been found to still have influence on adolescent's food choices, act as role models for their children, and control availability and accessibility of healthy food in the home [188]. Therefore, involving them in awareness raising on healthy eating and healthy behaviors in general will complement efforts done at the school level and help sustain healthful habits at home. Similarly, parents are important intervention components for enhancing adolescent efficacy beliefs. Parents can nurture adolescent's efficacy beliefs by being involved in academic activities and praising their children's effort and persistence and challenge them to do better [189].

Implication for theory and further research

The findings of this present study allowed for a better understanding of the main determinants of academic achievement of secondary school students and filled a gap as to the evidence from Arab countries. Specifically, the findings confirmed that the socialization theories and social cognitive theories are also applicable in Middle Eastern countries and beyond Western settings.

Future studies prioritizing experimental designs and for longer periods of time to confirm and extend the current findings would be valuable.

In addition, further research should focus on longitudinal cross-lagged associations to examine the way in which health behaviors, social cognitions, parenting and academic achievement influence each other over time. Future studies should also investigate determinants of health behaviors and socio-cognitive factors and potential barriers that contribute to poor adherence to the Mediterranean diet and low efficacy beliefs. The latter will guide the development of interventions for improving health behaviors and cognitions and subsequently academic achievement.

One important variable that was not studied in the current dissertation is parenting practices. Parenting practices are more proximal content-specific acts of parenting, that are thought to mediate the effect of the more distal general parenting. Darling & Steinberg [154] conceptual model of parenting suggests parenting style as a context within which parenting practices occur. Positive parenting practices used towards specific socialization goals are better accepted when exercised under a positive rearing style. For instance, in the context of eating behaviors, food parenting practices such as encouragement of healthy eating and restriction of unhealthy food were found to be better accepted by the children under a positive parenting context and were associated with healthier eating behaviors [190]. Similarly, in the academic achievement domain, school-related parenting practices such as involvement in school work was more effective in facilitating better adolescent academic achievement in an authoritative rearing context [154]. We therefore suggest a framework for future studies examining parenting style (taken at time 1), health behaviors, cognitions (taken at time 2), and academic achievement (measured at time 3) and including parenting practices as a potential mediator (Figure 1). Another important consideration for future studies is to differentiate between maternal and paternal styles and examine their separate influence as parenting style and their perception may vary depending on caregiver gender.

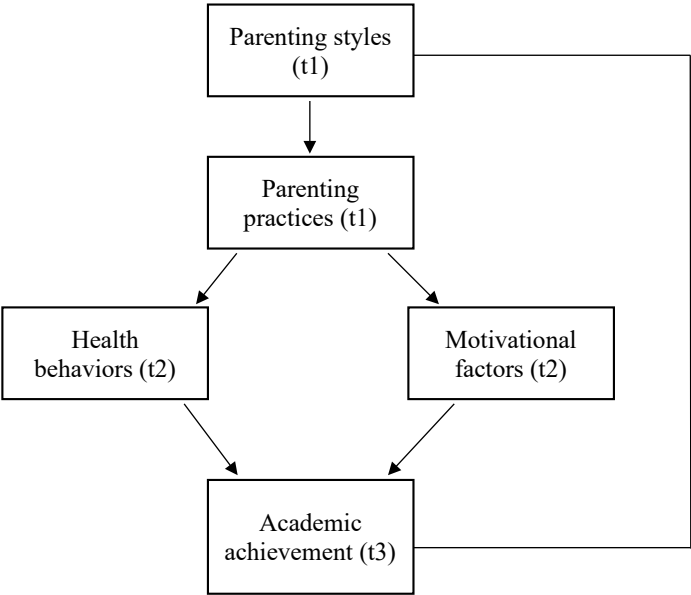


Figure 1. Proposed model for studying parental influences, health behaviors and motivational factors with academic achievement.

General conclusion

The current dissertation examined the influence of socio-demographics, health behaviors, social cognitive factors and parental styles on academic achievement of Lebanese adolescents. Our results indicate that academic achievement of adolescents improved with increased adherence to the Mediterranean diet and higher efficacy beliefs. Adherence to a healthy dietary pattern and high efficacy beliefs are important factors influencing academic achievement of adolescents and should be tackled in interventions aiming at improving academic outcomes of youth. In addition, our studies reveal that authoritative parenting is the most commonly adopted parental style in Lebanon and positively predicts higher adherence to the Mediterranean diet, lower alcohol consumption, higher efficacy beliefs, intention to get good grades and better academic achievement. Parents are important part of the microenvironment of adolescents and a major source of influence and should therefore be targets for interventions aimed at improving youth outcomes in particular health behaviors, social cognitions and academic achievement.

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Impact paragraph

Academic achievement of adolescents has a far-reaching impact on adolescents' life prospects and on society at large [1]. Research indicate that school failure, grade repetition and drop-outs are common problems faced by most countries and inflicts high cost on society [2,3]. Results from international tests show that students from Arab countries are performing poorly and below the basic proficiency levels compared to other countries [4]. In Lebanon data shows that student's performance has been significantly lower than the international average and that Lebanese students are lagging behind peers from other countries [5]. Studies during the past decades have researched factors affecting academic achievement of youth such as demographics, health behaviors, motivational factors and environmental factors. However, most of the research examines one or two of those factors and rarely include multiple factors simultaneous. In addition, evidence of these factors is limited for Arab countries in general and for Lebanon in particular. In this thesis we were able to study the longitudinal influence of socio-demographics, health behaviors, social cognitive factors and parenting style on academic achievement of Lebanese adolescents. Our main findings indicate that:

1. Among the factors studied, a higher adherence to the Mediterranean diet and higher academic efficacy beliefs were prospectively associated with an improved academic achievement.
2. Authoritative parenting was the most reported parental style and was associated with higher adherence to the Mediterranean diet, lower alcohol consumption, higher academic efficacy beliefs, and stronger intentions to get good grades.
3. Authoritative parenting was also directly and indirectly associated with academic achievement. The indirect association was partly mediated by academic self-efficacy and intention to get good grades.

Scientific relevance

Our findings add to the limited body of longitudinal evidence on the association of multiple factors with academic achievement of adolescents particularly in the Middle Eastern region where this kind of scientific research is sparse. To our best knowledge, there are no longitudinal studies comprehensively examining the association of multiple factors (socio-demographics, health behaviors, motivational factors and parental styles) with academic achievement among Arab youth. The available evidence from Arab countries and in Lebanon specifically, focuses on a few subsets of factors and follow cross-sectional designs. We believe our findings have a potential impact on the current scientific knowledge about determinants of academic achievement in the MENA

region and the development of strategies, policies and culture-specific interventions to improve achievement of youth. This dissertation offered insight on the most important factors influencing academic achievement of Lebanese adolescents. It emphasized the role of healthy eating habits, in particular the Mediterranean diet, and efficacy beliefs in contributing to academic success and avoiding school failure. Additionally, the findings of this thesis contributed to expanding the knowledge on socialization practices in the Lebanese context. Our results replicated previous findings on the protective effect of authoritative parenting on adolescent's eating and drinking behaviors and revealed a new sequential pathway of academic efficacy beliefs and intention in explaining the relation between parenting and achievement. For the purpose of disseminating our research findings widely we submitted our work in international peer-reviewed Open Access Journals. Researchers can use the findings of our research to plan evidence-base interventions to improving academic achievement of adolescents. Furthermore, research gaps were identified and recommendations for future research were provided: 1) Including more proximal variables such as education-specific parenting practices that are embedded into the broader concept of general parenting and examine its mediation effect in the relation of parenting style to academic achievement. 2) Conducting cross-lagged analyses to gain insight into the way health behaviors, social cognitions, parenting and academic achievement influence each other over time. 3) Conducting experimental studies testing the impact of changing health behaviors and socio-cognitive factors on subsequent change in academic achievement.

Practical and societal relevance

Considering that school failure has detrimental effects on adolescent life-course and the growth of a country as whole, planning interventions that address factors for improving academic performance of adolescents is crucial. Our results shed the light on important factors that can be targeted in evidence-based interventions to improve academic achievement. The results of this dissertation are of interest to policy makers in the Lebanese government and can be circulated to relevant stakeholders and decision-makers for planning interventions and drafting favorable policies that will have a growing impact in the future for individuals and the country as a whole.

Policy level

Our finding of a significant positive association between a healthy eating pattern and better academic achievement is of value to the Ministry of Education in order to improve nutrition knowledge of adolescents by updating the school curriculum to address healthy eating and nutrition education with a particular focus on the benefits of the Mediterranean diet and its positive influence on both cognitive and physical health. Nutrition could be taught as a separate subject such as a stand-alone health education class or integrated into existing lessons or activities [6]. Integrative nutrition education curricula might be regarded as a more feasible option for school administrators and teachers and will also

help students view nutrition knowledge in real life context. Nutrition education can be integrated into various school subjects, for instance, students can learn about food growth, food groups and the relation between diet and chronic diseases in Science class [7]. Teachers can also use experiential and hands-on activities to apply nutrition principles such as recipe preparation and cooking activities [8]. Nutrition education can be also integrated in math class where students can learn about portion sizes and compare nutrient content while using principles of additions, subtractions and fraction concepts [9]. Students exposed to nutrition information will be more empowered to make informed decisions for a healthier lifestyle [8]. Our results can also be disseminated to UN agencies and non-governmental organizations who are already implementing health and educational interventions targeting Lebanese youth and can thus help by providing necessary resources in the development of a nutrition curriculum, train teachers and health educators and monitor the intervention. Nutritional education should be accompanied by supporting activities and a supportive school environment, thus the results of this dissertation may also be of value to policy makers in the Ministry of Public Health so they can work together with the Ministry of Education to develop and implement new laws and guidelines regulating the sale of foods and drinks inside the school. Our findings can also be circulated to the Ministry of agriculture, as they can coordinate the implementation of farm-to school activities which have been found to improve students' dietary behaviors, nutrition knowledge and academic outcomes.

School level

The findings of this dissertation may also be disseminated to school boards, directors and school health care providers by making results available online on the website of the Ministry of Education. In turn, schools can share those findings with parents and students via the school site or magazine. School directors are considered pillars in the implementation of school health promotion interventions and have significant influence in making schools healthy environments and ensuring the success of any intervention. School principals and teachers should also become aware of the role and impact of academic efficacy beliefs in influencing subsequent academic achievement of adolescents and the importance of adopting instructional practices that can help foster adolescent's academic self-efficacy.

Parents and adolescents

Our findings are also relevant to parents, engaging them in interventions will yield more successful and maintainable outcomes and will ensure the effectiveness of the recommended policies [10,11]. Targeting parents with nutrition education will complement efforts done at the school level. For instance, school administrators and parent school councils can collaborate and organize educational awareness sessions for parents on healthy eating behaviors and also communicate to parents the health key messages taught to adolescents to ensure consistency and continuity. Parental engagement is important as parents can make healthy food accessible in the home, serve as models of healthy eating and help maintain healthy habits in the home environment.

Additionally, awareness raising of parents on the impact of their raising style on their children's health behaviors and academic achievement may encourage them to want to improve their parental style and take part of interventions supporting positive parenting. Finally, the results of this thesis can also be disseminated to our target population; Lebanese adolescents so they can be motivated to partake in health initiatives in which they will be enabled to make good health decisions.

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Summary

The aim of this dissertation was to identify the most important factors affecting academic achievement of Lebanese adolescents (*chapter 2*) and how changes in those factors influence change in academic achievement 6 and 12 months later (*chapter 5*). Additionally, and since parenting styles have been found to influence academic achievement as well as factors affecting achievement, this thesis aimed to examine the socialization practices in the Lebanese cultural context and how parenting affect health behaviors (*chapter 3*), motivational factors and academic achievement (*chapter 4*) of Lebanese adolescents. The results of this thesis will help uncover important factors for promoting strong academic achievement among Lebanese adolescents and to target in future evidence-based intervention studies.

Determinants of academic achievement have been extensively studied in developed countries [1-3] and more recently in developing ones [4-7] to inform effective educational strategies to improve academic outcome. Academic achievement in developing countries is especially important as it determines the prospects of future generations and is considered a main driver for economic growth and social development of a country [8]. Benefits of academic achievement can be seen at the micro and macro level. At the micro level, good academic achievement is associated with better health [9,10], civic engagement [11] and better economic and work opportunities for the individual [12]. At the macro level, academic achievement is related to human capital development which is key to enhancing a country's labor productivity, prosperity and economic growth rate [13].

Despite the many studies on academic achievement, empirical evidence is still scarce in the MENA region with studies limited to the exploration of one or two factors influencing academic performance such as psychological factors [14], nutrition [15] and socio-demographics [16]. In Lebanon specifically, the evidence is almost nonexistent while the need for such studies is high. Lebanese students have ranked among the lowest on international assessment [17,18]. According to the Program for International Student Assessment [17], the difference between Lebanese students and other students is a gap equivalent to around three to four years of schooling. Results show that more than two-third of Lebanese students did not meet basic proficiency in science, reading and mathematics [17]. In addition, schools in Lebanon were recently closed for almost the majority of the school year-2020 due to the COVID pandemic which will likely lead to a further decline in learning outcomes [19]. Hence the need to examine the most important factors associated with academic achievement and a future academic divide.

In **Chapter 1** we provide a general introduction to the studies presented in the dissertation. The background, framework, the gap in the current literature with regards to academic achievement and the research questions are outlined.

Chapter 2 describes a cross-sectional study investigating the relationship between academic achievement of Lebanese adolescents aged 15 to 18 ($n=563$) with health behaviors, socio-demographics and social cognitive factors and anthropometric measures using logistic regression models. The findings indicated that higher adherence to the Mediterranean diet, and higher efficacy beliefs and intention towards getting good grades were positively associated with academic achievement, whereas smoking was associated with lower achievement. No association of physical activity, alcohol consumption, breakfast intake and snacking with academic achievement were found. Based on the results of this study, we recommended integrating health and nutrition education in the regular school curriculum with a focus on raising awareness about the Mediterranean diet and the negative effect of tobacco use. We also highlighted the need to promote adolescent's academic efficacy beliefs by involving important contextual agents such as teachers and parents.

Chapter 3 describes the influence of parenting style on health behaviors (diet, physical activity, smoking and alcohol) and BMI of Lebanese adolescents while checking for moderation effect of adolescent characteristics (age and gender). We used longitudinal data from two measurements 6-months apart ($n=341$), parenting style was taken at time 2 (6 months from baseline) and health behaviors and BMI were taken at time 3 (12 months from baseline). The effect of parenting on health behaviors and BMI was not moderated by adolescents' age and gender. Authoritative parenting was found to be associated with higher adherence to the Mediterranean diet and lower alcohol consumption compared to the neglectful parenting style. No association between physical activity, smoking and BMI with parental styles were found. We concluded that parenting style is a significant predictor of dietary behaviors and alcohol intake among Lebanese adolescents and should be accounted for in interventions aiming at improving health behaviors of adolescents.

In **chapter 4**, the longitudinal effect of parenting style (at time 2) on social cognitive factors (at time 3) of Lebanese adolescents aged 15 to 18 ($n=345$) was examined and whether adolescent and parental characteristics (adolescent's age, gender, school type, religion and parents' education) moderated these effects. We also tested for the mediating role of social cognitive factors in the relationship between parenting style and academic achievement. Adolescent and parental characteristics did not moderate the effect of parenting on academic achievement. The results indicated that authoritative parenting had a direct and indirect influence on academic achievement of Lebanese adolescents. Authoritative parenting was prospectively associated with better academic achievement and higher self-efficacy and intention towards getting good grades at 6 months follow-up. In addition, academic self-efficacy and intention towards getting good grades were found to partially mediate the relationship of parenting style to academic achievement.

Adolescents who perceive their parents as authoritative were more likely to develop high academic self-efficacy and higher intention to get good grades and subsequently were more likely to achieve better compared to peers of neglectful parents.

Chapter 6 describes a longitudinal study examining the factors that influenced changes in academic achievement of Lebanese adolescents (n=563) over a one-year period. A linear mixed model was used to investigate the effect of change in health behaviors and social cognitive factors on change in academic achievement adjusting for socio-demographics and parenting style. The findings indicated that an improved adherence to the Mediterranean diet and an increase in academic self-efficacy is associated with an improved academic achievement after 12 months. Changes in smoking and alcohol consumption, PA, BMI and intention to get good grades did not significantly impact change in academic achievement. The results of this study provide further strong evidence on the association between a healthy diet, namely the Mediterranean diet and academic efficacy beliefs with higher academic achievement among Lebanese adolescents.

In **Chapter 7** we provide an overview of the presented studies and discuss the most important findings while relating them to previously published studies. We also present main limitations encountered and implications for future research and practice. In conclusion, the studies showed that adherence to a Mediterranean dietary pattern and high academic efficacy beliefs are important factors influencing better academic achievement of Lebanese adolescents and should be considered in interventions aiming at improving academic outcomes. In addition, our studies revealed that authoritative parenting is the most common style of child rearing adopted in Lebanon. This parental style was found to significantly influence higher adherence to the Mediterranean diet, lower alcohol intake, higher academic efficacy beliefs, intention to get good grades and higher academic achievement. Parents are thus identified as important actors to target in future interventions for improving health behaviors, motivational factors and academic achievement of Lebanese adolescents. Future research on a bigger more representative sample and including specific school-related parenting practices is recommended. Additionally, a cross-lagged model looking into the bi-directional association of health behaviors, social cognitions, parenting styles and academic achievement is needed to help draw causal conclusions.

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Joyce

Curriculum Vitae

Joyce El Hayek was born on September 19, 1989 in Lebanon. After graduating secondary school at Sainte Famille Francaise Fanar, she started pursuing a bachelor degree in Biochemistry at the Lebanese university (2007-2010). After her graduation she started the Master Nutrition, Dietetics and Food Management at the Lebanese University and graduated with high distinction in 2012. Consecutively, as a licensed dietitian, Joyce started her own private practice, counseling and providing treatment plans to clients. She also worked at hospitals and diet centers. In 2014, Joyce started working in the humanitarian field implementing community nutrition activities. Joyce is currently holding the position of Health Area Coordinator at an international ngo (IOCC) planning and managing health and nutrition projects in coordination with different UN agencies. Joyce has been also teaching Nutrition masters students at the Lebanese University since the academic year 2014-2015 to the present time. November 2016, Joyce started working on her PhD project, which is presented in this dissertation, at the Department of Health Promotion at Maastricht University.

List of publications for the thesis

Hayek J, Schneider F, Tueni M, de Vries H. Is Academic Achievement Related to Mediterranean Diet, Substance Use and Social-Cognitive Factors: Findings from Lebanese Adolescents. *Nutrients*. 2020 May;12(5):1535.

Hayek J, de Vries H, Tueni M, Lahoud N, Winkens B, Schneider F. Increased Adherence to the Mediterranean Diet and Higher Efficacy Beliefs Are Associated with Better Academic Achievement: A Longitudinal Study of High School Adolescents in Lebanon. *International Journal of Environmental Research and Public Health*. 2021 Jan;18(13):6928.

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Hayek J, Schneider F, Lahoud N, Tueni M, de Vries H. Authoritative parenting stimulates academic achievement, also partly via self-efficacy and intention towards getting good grades. *Manuscript under review at PLOS ONE*.

