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Original Article

Psychosocial determinants of physical activity at school among Lebanese children: an application of the planned behavior theory

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Abstract
Introduction: Based on an extended version the theory of planned behavior, this survey, aimed to identify the psychosocial determinants of children's physical activity at school and intention to engage in it. *Methods:* 276 fifth- and sixth-grade students from two schools in Lebanon completed a self-reported questionnaire assessing psychosocial and physical activity variables. Data were collected also on sociodemographic, anthropometric variables. *Results:* Determinants of physical activity at school were intention, perceived behavior control, self-identity, perceived barriers and gender. Children's beliefs associated with a positive intention were the following: to feel able to engage in physical activity at school when sport equipment is provided, despite an inclement weather, despite school restrictions on the use of physical activity facilities and equipment, and despite an inappropriate playground for some kinds of play. These should be targeted in physical activity interventions. *Conclusions:* These findings inform the design of culturally relevant school-based interventions in Arabic countries. Interventions should specifically support girls in recognition of the negative influence of gender on physical activity. They should also promote children's self-identification as a sporty child and enhance children's confidence in their capacity to engage in physical activity at school and to overcome barriers associated with it.
Keywords: - physical activity, school health services, children, health promotion, health behavior, correlation study

Introduction

Childhood obesity is a worldwide public health concern (World Health Organization, 2016). In Lebanon, as in most industrial and non-industrial countries, the prevalence of obesity among school-aged children tripled between 1997 and 2013, increasing from 4.8% to 14.2% (Ng et al., 2014). Childhood obesity is problematic as it tends to persist into adulthood (Institut National de la Santé et de la Recherche Médicale, 2000) and is associated with decreased health outcomes (Silva, Ribeiro, Carvalho, & Goncalves Oliveira, 2007) and reductions in quality of life (Tsiros et al., 2009). There is strong evidence for the preventive role of physical activity (PA) on obesity problems in school-aged children (Kelley, Kelley, & Pate, 2015). In particular, moderate-to-vigorous PA (MVPA) in school-aged children is positively associated with healthy weight, bone health, developing different motor skills (Mathisen, 2016), decreased cardio-metabolic disease risk factors (Janssen & LeBlanc, 2010) as well as psychological well-being (Dilsad, Yan, Kashef, Rudolph Leon, & Lee, 2016; Ekeland, Heian, Hagen, Abbott, & Nordheim, 2004) and academic performance (Ekeland et al., 2004). To this end, the Centers for Disease Control and Prevention recommends that elementary schoolchildren engage in at least 60 minutes of MVPA per day, 4 to 6 days per week, or 30 minutes of school MVPA per day (30 m. of school MVPA/d) (e.g., recess and classroom break activities, etc.) (Centers for Disease Control and Prevention, 2013).

In reality, few countries reporting data on children's PA achieve these recommendations (Jurakic & Pedisic, 2012; Sallis et al., 2016). For instance, in a systematic review performed among Asian countries, less than 50% of school-aged children were considered physically active, regardless of the recommendations used as a reference or the measurement methods (questionnaires, accelerometers or heart rate monitors) (Muller, Khoo, & Lambert, 2013). In Lebanon, 23.3% of school-aged children were reported to have at least 60 minutes of MVPA per day (World Health Organization, 2014). In addition, studies conducted in Lebanon (World Health Organization, 2014) and most industrial countries show a major decline in PA levels during puberty, around the age of 11 (Bacil, Mazzardo Junior, Rech, Legnani, & de Campos, 2015).

School-based PA programs have the potential to promote MVPA and to prevent this withdrawal from PA at puberty (World Health Organization, 2016). The first step for developing effective school-based programs is to acquire a deeper understanding of the determinants of MVPA, specifically in the school context (Rees et al., 2001). This can be obtained by means of qualitative or quantitative studies on the psychosocial or environmental

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determinants of school-based PA among children (Rees et al., 2001). A recent systematic review synthesized qualitative studies that children's experiences of PA at school (Martins, Marques, Sarmento, & Carreiro da Costa, 2015). Findings indicate that factors that facilitate MVPA include having a positive attitude toward PA, perceiving PA as fun, the perception of competence and a favorable influence of friends, family and physical education teachers. The barriers include the discomfort of being observed by others, the lack of opportunities and infrastructures for MVPA at school, being a girl, a lower socioeconomic background, and being in transition during puberty (Martins et al., 2015). Another review explored the correlation between environmental factors and children's PA at school (Ridgers, Salmon, Parrish, Stanley, & Okely, 2012). Higher levels of MVPA during recess appeared to be correlated to having access to facilities and unfixed equipment (i.e. balls, skipping ropes) and were also associated with gender (boys were consistently found to be more active than girls). Evidence was inconclusive for age, socio-economic status, adult supervision, recess duration, weather changes, fixed equipment (i.e. playground equipment) and markings in the schoolyard (i.e. hopscotch courts). A few longitudinal (Rhodes, Macdonald, & McKay, 2006) and cross-sectional (Martin, Oliver, & McCaughtry, 2007; Trost, Saunders, & Ward, 2002; Wang & Wang, 2015) quantitative studies based on psychosocial theories in children under 13 years of age identified that the main psychosocial determinants of MVPA were intention, attitude, perceived behavioral control (PBC) and, occasionally, subjective norms. None of these studies focused on the determinants of MVPA at school or were performed outside of North America or Europe.

The aim of the present study was to contribute to the understanding of the psychosocial determinants of children's MVPA during school days, in class and during recess, in an Arabic cultural context. More specifically, the objectives were the following: 1) to identify, based on the theory of planned behavior, the psychosocial determinants of children's intention to and practice of engaging in at least 30 m. of school MVPA/d; 2) to identify the beliefs associated with a positive intention, which should therefore be targeted in health promotion programs; and 3) to identify whether demographic variables act as determinants of intention and PA or as moderators of the intention-behavior relationship.

Theoretical framework

The theory of planned behavior (TPB) (Ajzen, 1991) was used as a theoretical framework for this study. In a meta-analytic review (Hagger, Chatzisarantis, & Biddle, 2002), TPB constructs appeared to be used successfully to identify psychosocial determinants of children's PA and explained 45% and 27% of the variance in children's intentions and behavior, respectively. According to the TPB, the determinants of behavior – the practice of at least 30 m. of school MVPA/d – were intention and PBC. The determinants of intention were attitude, subjective norms and PBC (Ajzen, 1991). Intention refers to the motivation to adopt a given behavior (Ajzen, 1991). Attitude refers to the perceived advantages of adopting the behavior (e.g., PA is fun and enjoyable) (Ajzen, 1991). Subjective norms refers to the perceived social pressures from relevant others to perform the behavior (e.g., my friends think that I should engage in PA) (Ajzen, 1991). PBC refers to the perceived control over performing the targeted behavior (e.g., PA may be easier to engage in if a child has the ability and the necessary skills) (Ajzen, 1991). Each determinant of intention (attitude, subjective norms and PBC) is also defined by sub-constructs called attitudinal beliefs (i.e., the perceived advantages and disadvantages of practicing at least 30 m. of school MVPA/d), normative beliefs (i.e., one's perceptions that parents, classmates or teachers want him or her to perform the behavior), and control beliefs, which are divided into perceived barriers and facilitating factors of engaging in the behavior (i.e., beliefs influencing perceived control over the behavior) (Ajzen, 1991). Identifying beliefs associated with the intention to perform the behavior allows critical targets of future interventions to be specified (Ajzen, 1991).

Finally, as recommended by the author of the TPB (Ajzen, 1991), additional variables were added to the model as potential determinants of intention, behavior and moderators of the intention-behavior relationship as it occurred in previous studies. Self-identity was added, as in an earlier meta-analysis (Rise, Sheeran, & Hukkelberg, 2010) it explained a further 6% and 2% of the variance in children's behavior and intention to engage in health-related behaviors including PA. Self-identity refers to the extent to which the person identifies the target behavior as part of his or her personality (e.g., to self-identify as a sporty girl or boy) (Tajfel & Turner, 1986). Demographic variables (e.g., age, gender), anthropometric variables (e.g., BMI, % body fat) and a measure of sedentary activities were also included as additional variables (Park & Kim, 2008).

Methods

Design & sampling

The study design was a correlational research study. Two secondary schools with similar socioeconomic characteristics were selected in an urbanized Arabic city of 250 000 inhabitants in the region of Sidon, Lebanon. All fifth- and sixth-grade students in these schools (n = 392) were invited to participate in the study, excepting those involved in the validation study (n = 84). A minimum of 89 respondents was required to detect a R^2 of 22% in intention prediction (Rise et al., 2010); alpha = 5%; power =95%; estimated response rate based on previous studies of 86% (Belanger-Gravel & Godin, 2010; Mummery, Spence, & Hudec, 2000).

Data Collection Procedure Data collection was carried out in June 2015 and included two measurement times at an interval of 7 days. Once both parent and child consent forms were obtained, demographic information was

provided by the schools' administrations, anthropometric measures were collected and the psychosocial questionnaire was administered. One week later, only the PA questionnaire was administered. For these two data collections, children were gathered for a maximum of 20 minutes in the school library during their compulsory physical education classes in the presence of a researcher and a teacher. Respondents were entered into a draw to win gift certificates. This study was approved by the Human Research Ethics Committees of the local University (2014-274, Phase III).

Measures

The psychosocial questionnaire measured intention, attitude, subjective norms, PBC, attitudinal beliefs, normative beliefs, perceived barriers, facilitating factors and self-identity. These variables were assessed by means of four-point Likert scales (not at all; not really; yes maybe; yes for sure) based on previous work carried out with young children (Belanger-Gravel & Godin, 2010)._ENREF_23 Cronbach's alpha (α) ranged from 0.72 to 0.92 (see Table I). The questions were developed following Ajzen's guidelines (2004) and referred to *doing PA at least 30 m. of school MVPA/d, in the classroom and during recess, over the next week*. Instructions indicated that PA referred to any activities or sports that get them to move, breathe hard, and increase their heart rate (Trost et al., 2000). An additional variable of sedentary behavior (Belanger-Gravel & Godin, 2010) – referring to time spent watching TV, playing on a computer or playing video games over the previous 24h was assessed by four items (α =0.79). Answers were (a) no, (b) yes, for no more than 1 hour, (c) yes, between 1-2 hours, (d) yes, for more than two hours and (e) yes, for more than three hours (American Academy of Pediatrics, 2013). The questionnaire measuring PA behavior was based on the validated self-administered Physical Activity Questionnaire for Older Children (PAQ-C) (α=0.79-.89; *r*=0.75-0.82) (Kowalski, Crocker, & Donen, 2004). After translating the PAQ-C into Arabic following the double-translation method (Perneger, Leplege, Etter, & Rougemont, 1995), the Arabic version demonstrated high internal consistency (α=0.89) and moderate reliability (*r*=.74). This 7-day recall instrument was developed to assess the general level of PA of children in grades 4 to 8. It includes 10 items, each scored on a 5-point scale. For instance, the first item provides a PA checklist including different kinds of activities and asks the students how many times they did each activity in the last seven days (none, 1-2 times, 3-4, 5-6, 7 times or more). To adapt it to the Lebanese context, some activities were removed from the list (e.g., cross-country skiing) and others added (e.g., handball). The subsequent questions required children to indicate their level of PA or how frequently they engage in PA in various contexts (e.g., physical education classes, recess). The average of the items is used to represent the child's general level of PA. Girls and boys with a mean score of at least 2.8 and 3.2, respectively, are considered to be physically active.

Demographic variables were provided by the schools' administrations, including the children's age, gender, grade, and parents education level (i.e. the highest level of education completed by either parents) (Park & Kim, 2008). Anthropometric variables, including waist circumference, height, weight, BMI category and percent body fat, were measured in the morning by six-trained undergraduate dieticians according to written standardized procedures (Cornier et al., 2011). BMI was calculated as weight in kilograms divided by height in meters squared and BMI classification was based on World Health Organization recommendations (de Onis et al., 2007). Percent body fat by age and gender were calculated using the bioelectrical impedance analysis (Inbody 720 composite machine).

Statistical analysis

Missing Data

Assumptions of ANOVA were checked for all variables before analysis (Tabachnick & Fidell, 2001). Normality and linearity were satisfied. Regarding parents' education, two cases of missing data were replaced by the mean substitution procedure (Tabachnick & Fidell, 2001). Two questionnaires were eliminated because of missing data on more than half of the theoretical constructs.

Analysis plan

First, descriptive statistics were computed for psychosocial, behavioral, demographic and anthropometric variables. Chi-square and t-tests were used to (a) verify the differences between the two school populations in terms of demographic and anthropomorphic variables among children between schools in terms of demographic and anthropometric variables (see Table II) and (b) to verify the differences between PA and intention (see Table III). Second, hierarchical multiple regression analysis was applied to identify determinants of MVPA measured using PAQ-C score. The following sequence was followed: (a) behavior was regressed on intention and PBC; (b) self-identity (Rise et al., 2010), perceived barriers and facilitating factors were added as they previously demonstrated their potential to improve behavioral prediction (Park & Kim, 2008); (c) sedentary behavior (Pearson, Braithwaite, Biddle, van Sluijs, & Atkin, 2014) and demographic and anthropometric characteristics (Park & Kim, 2008) were entered when correlated with behavior (p <0.20) on model. To remain in the model, each psychosocial variable had to reach statistical significance (p <0.05). Third, to identify the determinants of intention a similar sequence was followed: (a) attitude, subjective norms and PBC were entered; (b) self-identity was inserted; and (c) sedentary behavior and demographic and anthropometric characteristics were entered when associated with intention (p <0.20). Fourth, in order to identify potential targets for school-based interventions promoting MVPA, following Ajzen and Fishbein's recommendations (1980) intention was regressed on attitudinal beliefs, normative beliefs, and control beliefs (composed of perceived barriers and

facilitating factors) when their associated main construct (i.e., attitude, subjective norm and PBC) was found to be statistically significant in the previous analysis. Intention (dependent variable) was dichotomized at the median (Francis et al., 2004) (3.5) and a Poisson Log regression (Lumley, Kronmal, & Ma, 2006) was performed. Finally, a three-step hierarchical regression was performed to identify potential moderators of the intention-behavior relationship. At step 1, behavior (PAQ-C score) was regressed on intention. At step 2, each additional variable of the TPB model (demographic, anthropometric variables, and sedentary behavior) was entered one at a time. At step 3, the interaction term was introduced (intention X moderator). All statistical analyses were performed using SAS 9.2 software.

Table I. Descriptive statistics for the variables studied (n=276)

Variable	Number of items	Examples of items	Cronbach's alpha	% positive[a]	Means	SD	Median
Intention	4	Next week, will you do [BEHAVIOR][b] ?	0.76	90.94	3.44	0.57	3.50
Attitude	5	For you, is doing [BEHAVIOR] fun?	0.92	98.19	3.76	0.39	4.00
PBC	3	Do you feel able to do [BEHAVIOR]	0.72	26.81	3.64	0.62	3.66
Subjective norms	3	Do most people important to you approve that you do [BEHAVIOR]	0.90	89.86	3.47	0.81	3.83
Self-identity	3	Do you feel like you have the profile of someone who does a lot physical activity?	0.73	85.87	3.21	0.67	3.33
Behavioral beliefs	6	Do you think that [BEHAVIOR] help you to concentrate better in class	0.73	95.65	3.45	0.46	3.50
Normative beliefs	4	Do your parents encourage you to do [BEHAVIOR]	0.76	83.70	3.29	0.66	3.50
Perceived barriers	4	Do you think you can do [BEHAVIOR], even if it is not nice outside	0.77	52.17	2.75	0.92	2.75
Facilitating factors	4	Do you think it would be easier for you to do [BEHAVIOR], if the school gives you the equipment	0.66	14.49	3.38	0.62	3.50

Note. [a] Refers to the percentage of children having a score above 2.5 on a scale ranging from 1 to 4; [b] [BEHAVIOR] refers to do "at least 30 m. of school MVPA/d".

Results

Descriptive statistics

A total of 276 children answered both questionnaires and were included in the analysis for an overall response rate of 93.2%. The sample consisted of 108 girls and 168 boys (aged 10 to 12), 148 retrieved from the first school and 128 from the second school. Most parents had university education (68.5%). Overweight and obese children represented 34.4% and 19.6%, respectively, of the sample population. Half of the participants (49.6%) reported not being physically active based on the PAQ-C score (that means a score of less than 2.8 for girls and 3.2 for boys), and 89.2% reported having spent more than 2 hours in front of a screen the previous day. It is not recommended to exceed 1 or 2 hours of screen time per day (American Academy of Pediatrics, 2013).

Table II. Participant characteristics (n= 276)

Variables	School #1 (n= 148)	School #2 (n= 128)	*p*-value	Total (n=276)
Age in years, m*ean* ± *SD*	11.16 ±0.73	11.25±0.72	0.559[a]	11.20± 0.72
Gender, *n(%)*			0.98[b]	
Female	58(53.7)	50(46.3)		108(39.1)
Male	90(53.6)	78(46.4)		168(60.9)
Body mass index classification *n(%)*			0.009[b]	
Under/Normal weight	68(53.5)	51(46.5)		127(46.0)
Overweight	60(63.2)	35(36.8)		95(34.4)
Obese	20(37.0)	34(63.0)		54(19.6)
Student education level *n(%)*			0.305[b]	
Grade 5	75(55.6)	60(44.4)		135(48.9)
Grade 6	73(51.8)	68(48.2)		141(51.1)
Highest parental educational level *n(%)*			0.003[b]	
University	106(56.1)	83(43.9)		189(68.5)
High school	37(56.1)	29(43.9)		66(23.9)
Middle school	3(16.7)	16(83.3)		19(6.5)
Missing value	2(100.0)	0(0.0)		2(0.7)
Sedentary behaviors *n(%)*			0.009[b]	
< 2hrs/day	31(41.3)	44(58.7)		75(27.2)
≥ 2hrs/day	117(58.2)	84(41.8)		201(72.8)

Note. [a] T-test was used to compare school #1 and school #2; [b] Chi-square was used to compare school #1 and school #2. Data are presented as frequencies and percentages significantly different at $p < 0.05$.

Children in both schools displayed similar sociodemographic and anthropometric variables with the exception for parental educational level (X^2=16.29, p=0.003), BMI classification (X^2=9.45, p=0.009) and sedentary behavior (X^2=6.25, p=0.009) (see Table II). Significant differences in intention and PAQ-C were observed depending on gender and grade (see Table III). Girls reported to be significantly less motivated (X^2 =9.01, p=0.002) and less physically active than boys (PAQ-C scores for girls, mean=2.86, SD=0.74; for boys, mean=3.23, SD=0.73; X^2=7.01, p=0.008); children in grade 6 were significantly less motivated (X^2 =18.15, p<0.001) and less active than those in grade 5 (X^2=9.32, p=0.002). Finally, children whose parents reported the highest level of education were less active than those with parents who had attained a lower level of education (X^2=11.22, p=0.024).

Predictors and moderators of children's PA

Findings from hierarchical regression (see Table IV) indicated that the main predictors of children's levels of PA were intention (β=0.34, p<0.001) and PBC (β=0.23, p<0.02). They explained 36% of the variance in levels of PA. With the addition of self-identity (β=0.30, p<0.001), perceived barriers (β =0.11, p<0.001) and gender (β =- 0.18, p<0.001), the model explained 42.1% of the variance. The "goodness-of-fit" test (estimated by the scaled Pearson Chi-square divided by the number of degrees of freedom) demonstrated a good fit of the results of the final model (constant model: scaled deviance=1.02, scaled Pearson Chi-square=1.02). Gender also appeared to significantly moderate the intention-behavior relationship (β=- 0.20, p<0.001), indicating that the strength of the intention-behavior relationship was lower in girls as compared to boys. This moderating effect explained an additional 1.0% of the variance in level of PA.

Predictors of intention

Significant predictors of children's intention to practice at least 30 m. of school MVPA/d were, in order of importance, PBC (β =0.50, p<0.001), self-identity (β =0.31, p <0.001) and perceived barriers (β =0.09, p<0.001); these explained 66.0% of the variance in intention. The "goodness-of-fit" test demonstrated a good fit of the results of the final model (constant model: scaled deviance=1.01, scaled Pearson Chi-square=1.01). None of the demographic or anthropometric variables made a significant contribution (see Table V).

Table III. Differences in physical activity and intention based on sociodemographic and anthropometric characteristics (n = 276)

Variables	Physical activity N (%)[a]		p-value	Intention N (%)[b]		p-value [c]
	Low	High		Low	High	
Age (years)			0.085			0.093
10	16(32.0)	34(68.0)		14 (28.0)	36(72.0)	
11	55(45.8)	65(54.2)		38(31.7)	82(68.3)	
12	53(51.0)	51(49.0)		45(43.3)	59(56.7)	
Gender			0.008			0.002
Female	60(55.6)	48(44.4)		50(46.3)	58(53.7)	
Male	66(39.3)	102(60.7)		48(28.6)	120(71.4)	
Body mass index classification			0.663			0.943
Under/Normal weight	61(48.0)	66(52.0)		44(34.6)	83(65.4)	
Overweight	43(45.3)	52(54.7)		35(36.8)	60(63.2)	
Obese	22(40.7)	32(59.3)		19(35.2)	35(64.8)	
Student education level			0.002			<0.001
Grade 5	49(36.3)	86(63.7)		31(23.0)	104(77.0)	
Grade 6	77(54.6)	64(45.4)		67(47.5)	74(52.5)	
Highest parental educational level[d]			0.031			0.656
University	93(49.2)	96(50.8)		70(37.0)	119(63.0)	
High school	27(40.9)	39(59.1)		20(30.3)	46(69.7)	
Middle school	4(21.0)	15(79.0)		7(38.9)	11(61.1)	
Sedentary behaviors			0.229			0.403
< 2hrs/day	31(41.3)	44(58.7)		28(37.3)	47(62.7)	
≥ 2hrs/day	95(47.3)	106(52.7)		70(34.8)	131(65.2)	
Schools			0.411			0.401
School 1	69(46.6)	79(53.4)		60(40.5)	88(59.5)	
School 2	57(44.5)	71(55.5)		38(29.7)	90(70.3)	

Note. [a] Cut-off point at mean score as recommended by authors of PAQ-C (3.08); [b] Cut-off point at median score as recommended by authors of TPB (3.5); [c] Chi-square was used to performed analysis with statistical significance at p< 0.05; [d] Missing values = 2.

Table IV. Hierarchical regression analyses for the prediction of behavior (n = 276)

	Model 1	Model 2	Model 3	Model 4
	Standardized beta [*β*]			
Intention	0.57*	0.36*	0.30*	0.27*
Perceived behavioural control	0.32*	0.24*	0.25*	0.23*
Self-identity		0.29**	0.26**	0.26**
Perceived barriers			0.12*	0.11*
Gender [female]				- 0.18*
R^2 adjusted	0.36	0.39	0.41	0.42

Note. *p<0.05; **p<0.001.

Table V. Hierarchical regression analyses for the prediction of intention (n= 276)

Variables	Model 1	Model 2	Model 3
	Standardized beta [*β*]		
Attitude	0.13	____	____
Perceived behavioral control	0.71**	0.47**	0.50**
Subjective norms	0.08	____	____
Self-identity		0.34**	0.30**
Perceived barriers			0.09*
R^2 adjusted	0.54	0.64	0.66

Note. *p <0.05; **p <0.001.

Relevant beliefs for the development of school-based interventions

Four barriers and facilitating factors were significantly associated with children's intention in Poisson Regression (see Table VI). When the analysis was performed separately for boys, the same beliefs were associated with intention, while only two of these beliefs were significantly associated with intention for girls: I would practice at least 30 m. of school MVPA/d (a) even if the school playground isn't appropriate for some kinds of play (e.g., playground size and format); and (b) if school puts equipment at my disposal (e.g., ping pong tables, hula hoops, jumping rope).

Table VI. Final Poisson regression model of control beliefs associated with a strong intention to practice physical activity at school (n= 276)

Items	PR	95% CI	*p-value*
… even if it is not nice outside	1.33	1.08, 1.64	0.007
… even if school puts restrictions on the use of facilities and equipment used for physical activity	1.29	1.08, 1.53	0.003
… even if the school playground isn't appropriate for some kinds of play	1.17	1.01, 1.35	0.046
… if school puts equipment at my disposal	1.52	1.07, 2.15	0.019

Notes. PR = prevalence ratio; CI = confidence interval; significance level of p<0.05.

Discussion

This study aimed to identify the determinants of intention and the PA of children during the school day, using the established theoretical framework of the TPB (Ajzen, 1991). Children reported feeling very positive towards MVPA at school, although an important proportion of them were not physically active. Girls appeared significantly less physically active than boys and less motivated to engage in PA. Intention, PBC, perceived barriers, self-identity and gender were the main determinants of children's level of PA. The intention-behavior relationship was moderated by gender, indicating that intention was a stronger predictor of PA for boys than girls. Interestingly, time spent per day in front of a screen did not appear to be associated with children's PA, similarly to what was seen in the reviews of Van Der Horst et al. (2007) as well as Sallis, Prochaska, and Taylor (2000). This sets aside the hypothesis that screen time might replace time spent doing PA (Van Der Horst et al., 2007).

To the best of the authors' knowledge, the present study is among the few longitudinal (Rhodes et al., 2006) and cross-sectional (Martin et al., 2007; Trost et al., 2002; Wang & Wang, 2015) quantitative studies conducted among children under 13 years of age to identify the determinants of MVPA. Percentages of explained variance demonstrate the high performance of the study to predict children's PA (42.1%) and intention (66%), corresponding to a strong effect size according to Cohen's criteria(Cohen, 1992) (f^2 ≥0.35). For comparison, in earlier prediction studies of young populations, the percentage of explained variance ranged between 8% and 30% for PA (Foley et al., 2008; Godin, Anderson, Lambert, & Desharnais, 2005; Hagger et al., 2002; Martin & McCaughtry, 2008; Martin, Shapiro, & Prokesova, 2013; Wang & Zhang, 2016) and between 28.7% and 56% for intention (Foley et al., 2008; Godin & Shephard, 1986; Hagger et al., 2002; Martin et al., 2007; Mummery et al., 2000; Wang & Zhang, 2016). In addition, the present study is also the first to specifically explore the psychosocial determinants of children's PA in the school environment. Previous research was conducted on children's leisure-time PA (Martin et al., 2007; Mummery et al., 2000; Wang & Zhang, 2016) or based on the responses of parents and teachers (Martins et al., 2015; Rees et al., 2001). Moreover, these earlier

studies were all conducted in North American and European countries; the present study is the first to be performed in an Arabic country, providing a culturally relevant picture of the determinants of PA in this population.

Self-identity appeared as a determinant of PA and intention, contributing to an increased prediction of 3% and 10%, respectively. This indicates that children who more strongly see themselves as a sporty type are more likely to take opportunities to practice PA at school. A similar influence of self-identity was observed in a meta-analysis (Rise et al., 2010) in which this construct explained 6% and 2% of the variance in PA intention and behavior, in children and adolescents after controlling for the TPB components. This is also in line with the Health Survey for England, in which the statement "I am not a sporty type" was one of the main barriers to PA for children (Sports Council and Health Education Authority, 1992). Encouraging children to see themselves as sporty thus appears to be a promising strategy to promote PA at school among young children (Rise et al., 2010). According to the authors of social identity theory (Tajfel & Turner, 1979), self-identity consists in the identification of the self as adopting a role and in the incorporation of the meanings and expectations associated with this role (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). Social identity theory offers several recommendations for improving self-identity, such as the following: providing opportunities to adopt the role; rewarding proof of the adoption of this role (e.g., receiving an award); to be seen by important others in adopting this role and in obtaining rewarding proof for it; and finally, to act as a role model in persuading others of the importance of this role (e.g., giving a talk or running a peer-led PA session) (Tajfel & Turner, 1986). These techniques have been successfully used to improve self-identity in PA studies (Araujo-Soares, McIntyre, MacLennan, & Sniehotta, 2009; Michie, Abraham, Whittington, McAteer, & Gupta, 2009). They were more effective among children when the intervener was young (Bandura, 1977). _ENREF_54

Gender also appeared to influence PA in two ways: as a determinant of PA and as a moderator of the intention-behavior relationship. This result is consistent with a large body of earlier quantitative studies (Martin & McCaughtry, 2008; Martin et al., 2007; Park & Kim, 2008; Wang & Wang, 2015) that has demonstrated the influence of gender on children's leisure-time PA. For instance, in a systematic review (Park & Kim, 2008) of 35 cross-sectional and longitudinal studies on the determinants of PA in adolescents, female gender appeared to be negatively associated with PA in European, American and Asian youth populations. In these studies, the influence of gender appeared to be explained a complex interplay of developmental (e.g., pubertal phase), environmental (e.g equipment provided) and sociocultural (stereotypes) issues. Girls reported more body-related and sociocultural barriers to PA than did boys, who are more encouraged to engage in PA by their parents and teachers (Park & Kim, 2008). In the present study, gender also appeared to moderate the intention-behavior relationship, as in an earlier TBP-based study that explored the determinants of leisure-time PA in children (Wang & Wang, 2015). In order to take the influence of gender on PA into account, girls should be targeted as a priority population requiring interventions of higher intensity tailored to their own characteristics and designed to decrease gender inequalities in PA. A few previous interventions promoting school-based PA that explicitly described their interventions as gender-sensitive (Aznar-Laín & Webster) reported a significant decrease in gendered inequalities in levels of PA (Jurg, Kremers, Candel, Van der Wal, & De Meij, 2006; Pate et al., 2005). Practically, school-based interventions should increase opportunities for girls to engage in PA and invest in equipment appealing to a variety of genders and interests (Pardo et al., 2013), allowing girls to develop their abilities in individual and collective sports practiced in their community and improve their capacity to influence play (i.e. taking equal part in the decisions made while playing a game, whether that is baseball, jump rope, tag) (Pardo et al., 2013).

PBC and perceived barriers exerted a direct influence on intention and PA at school. Indeed, PBC is the third determinant in relative importance in this study's modeling of behavior, after intention and self-identity, and it is the main determinant of intention. In addition, perceived barriers seem to be a weak but significant determinant of both PA and intention. These results are in line with the findings of a previous systematic review (Park & Kim, 2008) and underline the importance of supporting children in developing their ability to easily engage in PA at school and overcome barriers associated with PA. According to the Kok et al. (2016) taxonomy the most effective techniques for improving PBC were the following: prompt modeling, guided practice, verbal persuasion, behavior self-monitoring and providing rewards (see the taxonomy for the definitions). These techniques should be used to target the specific barriers and facilitating factors that were significantly associated with a positive intention: perceiving that playing equipment (e.g. ping pong tables) would facilitate PA, perceiving inclement weather as a barrier to PA, school restrictions on the use of facilities and equipment and perceiving the school playground as inappropriate for some kinds of play. In an earlier systematic review (Ridgers et al., 2012) that examined factors influencing PA during recess among children under 12, equipment availability and access to facilities also appeared to be associated with positive intention, and inclement weather has been mentioned as a barrier to engaging in PA during the school day in some quantitative studies (Brodersen, Steptoe, Williamson, & Wardle, 2005; Chan & Ryan, 2009). Practically, interveners may choose to perform structural changes in the school environment (e.g., provide additional playing equipment, change rules for equipment use) to enhance children's ability to engage in PA either despite these specific barriers or in the absence of facilitating factors (e.g., in all weather conditions).

This study has also some strengths and limitations. The large sample ensured an appropriate statistical

power and was representative of the greater population of Lebanese children in terms of levels of PA and BMI classification. Psychosocial and behavioral measurement instruments were validated in the sample and demonstrated adequate psychometric properties. A robust theoretical model – the TPB – including evidence-based additional variables was used (Rise et al., 2010). However, considering the practical barriers associated with objectively measuring PA with accelerometers, children's levels of PA were measured through a self-report questionnaire. The prediction of behavior may have been reduced by the discrepancy in measuring the psychosocial items (Ajzen, 1991) of PA as per day (i.e. at least 30 m. of school MVPA/d) and in measuring PA behavior per week. Although confidentiality and anonymity were guaranteed and questions were strategically worded to avoid social desirability bias, children may have answered more favorably to psychosocial variables and overestimated their participation in PA (Klesges et al., 2004).

Conclusions

This study, based on an extended version of the TPB and conducted in an Arabic context, allowed for the identification of culturally relevant psychosocial variables that should be targeted in programs promoting PA in schools. Self-identity, PBC, perceived barriers and consideration of gendered characteristics appeared as priority targets for improving children's PA and their intention to engage in it. These findings shed light on the importance of enhancing children's abilities to play physically active games, to overcome the barriers they perceive be associated with it and to offer equal opportunities to girls and boys to engage in PA during the school day. School environments should also strengthen children's self-identification as sporty types by valuing the sporty type and emphasizing the match between children's behavior and the sporty type. Future research should explore to what extent these results may be generalized to Arabic countries and used to develop efficient school-based PA programs.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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