



Health Promotion of Young University Students in Lebanon: Physical Activity Behavior and Cultural Barriers

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Authors' contributions

This work was carried out in collaboration between all authors. Author IS designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors HS and RK participated in the study designs, performed the data collection, and participated in the analyses of the study. Authors SS, ND and RL managed the analyses of the study, assisted with the writing and managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The aim of the present study was to assess the prevalence of physical activity (PA) and exercise behaviors in young students and to propose an evidence-based exercise practice program for undergraduates in a university setting in Lebanon.

Methods: From October 2014 to April 2015, a cross-sectional survey using mixed methods was conducted among 253 young university students. Information regarding the participants' sociodemographic and environmental characteristics, experience with leisure time, physical

exercise, and Stage of Exercise Behavioral Change (SEBC) were collected.

Results: The participants' mean age was 19.5 years (SD=1.21), and 86.6% were women. In total, 8.3 and 23.7% of the participants were in the inactive stages of exercise behavior change (pre-contemplation and contemplation, respectively). A third (33.2%) of the students were in the preparation stage, and another third felt that they were in either the action (12.6%) or the maintenance (22.1%) stages (i.e., had regularly engaged in PA for longer than six months). There was a higher percentage of men than women in the action (23.5 vs.11.0%) and maintenance (32.4 vs. 20.5%) stages ($P=0.002$). Academic discipline was associated with PA behavior. Of the students who exercised, 99.4% were engaged in aerobic exercise and 70.9% were engaged in walking. University students reported many barriers to PA, including lack of access to facilities and resources (33.3%), lack of time (35.7%), and cultural and social context barriers (19%).

Conclusion: The present study is one of the first to provide data on PA behavior among young Lebanese students. Despite the need for further research on this topic, universities should develop and implement effective interventions based on the transtheoretical model of change to promote sports among young students, increase PA, and thus improve their well-being.

Keywords: Physical activity; university students; Lebanon students; youth; health promotion.

1. INTRODUCTION

Physical activity (PA) is an important component of young people's health [1-3] and has been a major topic of public health discussion in recent years [3-11].

Population levels of PA have been affected by several behavioral and environmental factors and megatrends (major forces in societal development that affect people's lives), such as rapid urbanization, mechanization, new technologies (e.g., televisions, computers, electronic entertainment, the internet, and wireless communication devices), and increased use of motorized transport [5,12]. Leisure time activity, which applies to broader contexts than physical exercise, is defined as an intrinsically motivating and self-endorsed activity during freer periods in a person's life to pursue enjoyment, self-expression, and meaningful engagement [9].

Recent studies have shown that PA improves cardiovascular health[3,5,8,9,13,14,15,16,17, 18]. The primary goal of youth-focused cardiovascular health promotion is to provide age-appropriate information on the benefits of healthy behaviors including strategies to improve diet, eliminate tobacco exposure, and increase PA [18]. Lee et al. [15] found that runners have a consistently lower risk of all-cause and CVD mortality than non-runners; Running even at lower doses or slower speeds was associated with significant mortality benefits, and persistent running over time was more strongly associated with mortality reduction. Exercise training has also been shown to be associated with an overall 0.67% decline in glycosylated hemoglobin (HbA1c) levels and to reduce the incidence of

thrombosis-related cardiovascular events [3]. Regular exercise upregulates endogenous antioxidants not only in the muscles, where the effect can be evident after just five consecutive days of training, but also in the liver and other tissues (e.g., brain, heart, kidney, stomach, intestine, and vessels) [3]. PA is associated with a decreased risk of all causes of death in both middle-and high-income countries [11,19,20]. Sedentary behavior is known to be associated with atherosclerosis and metabolic syndrome [21-23]. PA plays an important role in preventing the development of overweight and obesity in young people and in suppressing its progression into young adulthood [24,25]. In addition, PA has positive effects on both depression and anxiety [26], contributes to attenuating aging autonomic dysfunction [3], and may delay the onset of Alzheimer's disease, Huntington's disease, and Parkinson's disease [26].

However, physical imbalance can elevate the risks of chronic diseases, such as diabetes [8, 9, 16,17], smoking [9], high cholesterol levels [9,14], osteoporosis, and certain cancers [16,27], additionally, it can increase the risks of disability pension and unemployment, loss of productivity at work, sickness absence, and reduced work ability [28].

The literature suggests that PA may enhance the academic performance and cognitive functioning of young students [8,9,26,29]. Unhealthy lifestyles among youth have been strongly linked to disabilities and health problems in adulthood [8,24,25,26,29]. Therefore, if these behaviors are detected and modified at an early stage, many of the effects of health-risk factors among adults could be avoided [8,26].

Several studies have shown that PA rates decline precipitously during the high school years and are consistently lower among girls than adolescent boys [6,7]. Health promotions at universities are not and should not be confined to improve only young people's health but should be aimed at building a just and healthy civil society [6]. Positive youth development first originated as a conceptual approach to develop assets within youth as opposed to removing risk factors via "deficit-focused strategies" [6,30]. Given the importance of the benefits of PA, health professionals face two major challenges: first, initiating sedentary people to practice PA and, second, helping physically active people maintain their PA [31]. Physical inactivity in youth remains a significant health issue that will likely be solved only through a multifaceted approach that includes education, PA campaigns [32], and structured interventions combined with the provision of enticing opportunities for voluntary daily PA [9,17].

Youth spend more time in schools than in any other setting with the exception of their homes. Accordingly, if young people are to engage in adequate amounts of PA, it is essential that schools systematically and effectively provide and promote participation in PA [33]. School-based health promotion programs are more likely to succeed when youth are involved in all stages including planning, implementation, and evaluation [18]. For several decades, professional organizations have indicated that the provision of "quality, daily physical education" should be a standard to which schools aspire [33]. Developing and testing interventions concerning youth fitness promotion can build youth's capacity, thus increasing the probability that youth will adopt a physically active lifestyle and maintain regular PA into adulthood [18].

However, the research on health promoting behaviors targeting PA among university students in Lebanon is rather sparse and has mainly focused on the prevalence of PA performance and its predictors [6,34,35,36]. The Lebanese program 'Health-E-PALS' is one of the first school-based interventions to promote healthy eating and an active lifestyle (and thus the prevention of obesity) with school children aged 9 to 11 in Lebanon [37]. Dobbins et al. [16] controversially reported that given that the primary focus of many studies was to promote PA, it was surprising that so few studies reported on either the leisure time PA rate or the duration of PA. A comprehensive approach that seeks to

empower, educate, and support youth is necessary [18].

To improve the maintenance of PA in youth, we have identified the importance of designing evidence-based targeted interventions that address the needs of young students, allow for greater efficiency and success in health behavioral change, and focus on individual health behavior theories and models such as the Transtheoretical Model (TTM). The TTM, developed by Prochaska and DiClemente, is an integrated theoretical model that aims to explain individual behavioral changes. It is one of the most popular models for describing the processes that individuals undergo as they move through different stages of readiness to change behaviors [7,31,38-41]. Often, individuals recycle through the stages or regress to earlier stages from later ones. The Stage of Exercise Behavioral Change (SEBC) scale is used to monitor PA levels and changes in these levels [41].

The current study aimed to assess the prevalence of PA and exercise behavior in young students using the SEBC scale and to propose an evidence-based exercise practice program for undergraduate university students in Lebanon.

2. MATERIALS AND METHODS

To assess the needs that should be addressed in health promotion efforts with Lebanese students, a cross-sectional survey was conducted from October 2014 to April 2015 among a population of young university students. The faculties of Economics and Management, and Public Health (Nursing, Midwifery, Physiotherapy, Medico-social Work, Radiology, and Laboratory Sciences departments) at a public university in south Lebanon were involved. This public university is the largest and most widespread institution of higher education in Lebanon [6]. The classes were chosen randomly. The students were approached after class and asked to participate in the study. The sample size assumed a two-sided significance of 5% with 80% power. The expected proportion (p) of PA was set to 0.50, and a 5% margin of error at a 95% confidence level led us to predict that 249 students would be necessary for the survey.

2.1 Data Collection

This study used mixed methods, integrating quantitative and qualitative data collection and

analysis [42]. After obtaining ethics approval from the Directors of the faculties, data were collected using self-administered questionnaires and focus group discussions. The students were informed about the purpose of the study and were assured that their participation would be voluntary and that the information collected would be anonymous.

2.2 Questionnaire

The study questionnaire had two sections. The first section contained questions on demographic characteristics of the study participants (gender, age, place of residence) that were developed by the authors of this study. Body mass index (BMI) was calculated from measured weight and height (kg/m^2) [6]. Health behaviors (smoking, alcohol consumption, and diet) and medical conditions were also self-reported by the students. Finally, the students' financial and health status and self-rated one-item measure of quality of life (QoL) were rated from 1 (very poor) to 6 (excellent) [6].

In the second section of the questionnaire, two types of data were collected: questions regarding the participants' experience with leisure time physical exercise and the assessment of the SEBC [7,31,40,41,43].

The prevalence of leisure-time activity was assessed by asking the participants whether they regularly practiced any type of PA. Those who answered yes were asked several additional questions about the type of exercise (walking, health clubs, dancing, and other types of sports performed on a regular basis). The students' favorite sport was also assessed.

The health-promoting behaviors of the university students towards PA, which are necessary to design interventions based on the TTM, were also assessed using the SEBC. The five stages of change describe and position the student's behaviors within the dynamic intentional processes of change [41]. In the first question, the participants were asked whether they believed that they practiced a sufficient amount of sports or PA (at least 60 minutes on most days of the week) and responded on a 2-point scale (yes/no). Those who answered "no" were asked to select one of the following options: 1) I'm not sufficiently physically active, and I have no intention to start in the next six months (pre-contemplation) or 2) I'm not sufficiently physically active, but I intend to start in the next 6 months (contemplation). Those who answered "yes"

were asked to select one of the following two options: 1) I'm currently exercising but not regularly (preparation) or 2) I'm currently exercising enough (action), and I have been for more than 6 months (maintenance) [41]. The SEBC questionnaire was translated into Arabic, and a pilot study was conducted to test the questionnaire with 5 students who were randomly selected. Revisions in wording and presentation were made based on the empirical findings and on recommendations from the pilot study participants.

2.3 Focus Group Discussions

The reasons why young students did not engage in organized physical activities in the university and in general settings were also collected. Ten focus group discussions were conducted; the participants were in the 1st and 4th year of university (aged between 18 and 23 years). The focus group discussions were limited to five to six students per group to construct homogenous groups of participants; This encouraged participants to feel comfortable sharing their thoughts on PA barriers and interventions to improve students' participation in PA. In each 40 minute focus group, participants were asked the following questions: "In general, what reasons can you see that may influence the engagement of young students in regular PA? How would you like to see it resolved? What interventions can you see that improve the student's participation in PA in the university and in general settings? The answers were written. In the next stage, the verbatim transcripts were analyzed thematically by creating coding nodes for common themes and subthemes. The weight of each theme was also calculated.

2.4 Statistical Analysis

Analyses were conducted using frequencies, means, and standard deviations (SDs) to describe the socio-demographic characteristics and stages of the SEBC. Chi-square statistics (χ^2) and independent sample t-test statistics were used for the categorical and continuous variables, respectively, to analyze the significance of associations and differences in the TTM stages. The youths' opinions were analyzed as qualitative data. Because the level of PA may have differed based on gender, we stratified the analyses for gender.

The SPSS 22.0 package (IBM SPSS Statistics, USA) was used for the analysis of the data. All

tests of significance were two-tailed. $P \leq .05$ was considered to be the critical level of significance.

3. RESULTS

A sample of 260 young university students was recruited. A total of 253 self-reported questionnaires were returned (a 97.3% response rate). The participants' mean age was 19.5 (SD=1.21) years, and the mean age did not statistically differ between men (19.4±0.65 years) and women (19.6±1.6 years) ($P=.43$). Female students composed 86.6% of the study sample, and 82.6% of the women studied in the department of Public Health (Table 1).

3.1 Participants' Stages of Exercise Behavior Change

Fig. 1. summarizes the percentage of participants in each stage of behavior change. Fig 1 demonstrates that 8.3 and 23.7% of the individuals were in stage one (pre-contemplation) and two (contemplation), respectively. This indicated that although the individuals in both stages did not perform the desired behavior, those in stage two intended to start in the next six months. A third (33.2%) of the participants were in the preparation stage and thus exercised irregularly. One-third of the students felt that they were in either the action (12.6%) or maintenance (22.1%) stages, indicating that individuals in both groups exercised regularly, but those in the maintenance stage had engaged in PA regularly for more than six months.

Table 1 presents the participants' SEBC based on their sociodemographic and environmental characteristics. There was a higher percentage of male students than female students in the action (23.5 vs. 11.0%) and maintenance (32.4 vs. 20.5%) stages, and this difference was statistically significant ($P=.002$).

There was an association between diet and PA behavior, in which 40.0% of the students who were on a diet were in the maintenance stage ($P=0.001$). Additionally, a statistically significant difference was found between the participants' SEBC and their perceptions of their financial status and QoL.

3.2 The Types of Exercise

The types of exercise that the students engaged in varied. The majority of the students (99.4%)

were engaged in aerobic exercise (endurance exercise), which included jogging, outdoor walking, biking, dancing, swimming, and Badminton; one participant reported performing anaerobic exercise (strength exercises), which involved pushups (0.6%). Regarding the intensity levels of PA, 25.1% of the participants engaged in vigorous activities such as football and basketball (8.4%), jogging (10.2%), swimming (5.8%), and pushups (0.6%). Many participants (70.9%) reported walking; therefore, we did not separate light intensity activities (such as walking slowly) from moderate activities (fast walking on a treadmill or outdoors). The majority (79%) of the students who engaged in walking were women (Table 2).

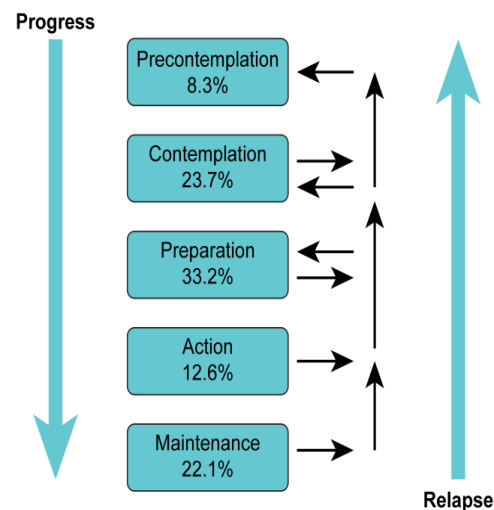


Fig. 1. Participants' stages of exercise behavior change (N=253)

Fig. 2. lists the favorite pastimes of the students, including dancing (16.5%); religious activities, such as praying in mosque or church or traveling to visit places of pilgrimage (61.3%); and listening to music (41.1%). The students' pastimes did not significantly differ between the men and women. Over a quarter (26.5%) of the men vs. only 10% of the women ($P=.007$) were members of a club (scout, Red Cross, fireman, and sports clubs). Other hobbies reported by the respondents were writing poems (n=1, 0.5%); Singing (n=2, 0.9%); social activities such as visiting relatives (n=5, 2.3% of women) and visiting vacation colonies (1.8% of women vs. 2.9% of men); and sportive activities such as bicycling (8.8% of men) and walking or jogging (2.3% of women).

Table 1. Participants' Stages of exercise behavior change based on their sociodemographic and environmental characteristics

	Total sample N=253	Participants' stages of exercise behavior change					P value
		Precont. n (%) N=21	Contempl. n (%) N=60	Preparation n (%) N=84	Action n (%) N=32	Maintenance n (%) N=56	
Specialization							
Health	209 (82.6)	11 (5.3)	52 (24.9)	74 (35.4)	27 (12.9)	45 (21.5)	.003
Business	44 (17.4)	10 (22.7)	8 (18.2)	10 (22.7)	5 (11.4)	11 (25.0)	
Residency area							
Urban	45 (17.8)	5 (11.1)	11 (24.4)	15 (33.3)	3 (6.7)	11 (24.4)	.69
Rural	208 (82.2)	16 (7.7)	49 (23.6)	69 (33.2)	29 (13.9)	45 (21.6)	
Gender							
Male	34 (13.4)	5 (14.7)	0 (0.0)	10(29.4)	8(23.5)	11(32.4)	.002
Female	219 (86.6)	16 (7.3)	60 (27.4)	74 (33.8)	24 (11.0)	45 (20.5)	
Marital status							
Single	221(87.4)	21(9.5)	41(18.6)	80 (36.2)	25(11.3)	54 (24.4)	<.0001
Engaged	32 (12.6)	0 (0.0)	19 (59.4)	4 (12.5)	7 (21.9)	2 (6.3)	
Location							
Nabatieh	109 (43.1)	10 (9.2)	26 (23.9)	44 (40.4)	8 (7.3)	21(19.3)	<.0001
South Lebanon	99 (39.1)	9 (9.1)	22 (22.2)	38 (38.4)	8 (8.1)	22 (22.2)	
Mount Lebanon	45 (17.8)	2 (4.4)	12 (26.7)	2 (4.4)	16 (35.6)	13 (28.9)	
Morbidity							
Yes	20 (7.9)	0 (0.0)	7(35.0)	6 (30.0)	3 (15.0)	4 (20.0)	.53
No	233(92.1)	21 (9.0)	53 (22.7)	78 (33.5)	29 (12.4)	52 (22.3)	
Smoking							
Yes	56 (22.1)	3 (5.4)	14 (25.0)	14 (25.0)	10 (17.9)	15 (26.8)	.34
No	197 (77.9)	18 (9.1)	46 (23.4)	70 (35.5)	22 (11.2)	41(20.8)	
Diet							
Yes	40 (15.8)	2 (5.0)	15(37.5)	05 (12.5)	02 (5.0)	16 (40.0)	.001
No	213 (84.2)	19 (8.9)	45 (21.1)	79 (37.1)	30 (14.1)	40 (18.8)	
BMI							
<18.5	45 (17.8)	2(4.4)	11(24.4)	15 (33.3)	3 (6.7)	14 (31.1)	.06
18.5-25	176 (69.6)	14 (8.0)	46 (26.1)	59 (33.5)	27 (15.3)	30 (17.0)	
25-30	26 (10.3)	5 (19.2)	3 (11.5)	8 (30.8)	1 (3.8)	9 (34.6)	
>=30	6 (2.4)	0 (0.0)	0 (0.0)	2 (33.3)	1 (16.7)	3 (50.0)	

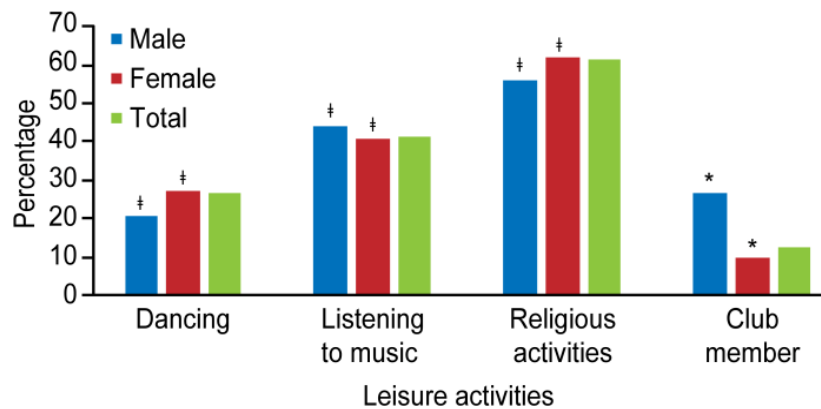
	Total sample N=253	Participants' stages of exercise behavior change					P value
		Precont. n (%) N=21	Contempl. n (%) N=60	Preparation n (%) N=84	Action n (%) N=32	Maintenance n (%) N=56	
QoL perception							
Poor and fair	40 (15.8)	1 (2.5)	8 (20.0)	11 (27.5)	11 (27.5)	9 (22.5)	.03
Good and above	213 (84.2)	20(9.4)	52 (24.4)	73 (34.3)	21 (9.9)	47 (22.1)	
Health perception							
Poor and fair	21 (8.3)	1 (4.8)	8 (38.1)	3 (14.3)	5 (23.8)	4 (19.0)	.13
Good and above	232 (91.7)	20 (8.6)	52 (22.4)	81 (34.9)	27 (11.6)	52 (22.4)	
Financial status perception							
Poor and fair	105 (41.5)	15 (14.3)	21 (20.0)	27 (25.7)	19 (18.1)	23 (21.9)	.003
Good and above	148 (58.5)	6 (4.1)	39 (26.4)	57 (38.5)	13 (8.8)	33 (22.3)	

Precont.: Pre-contemplation; Contempl.: Contemplation; BMI: Body mass index; Business: business and economics; QoL: Quality of life; Good and above: good, very good, and excellent. The p-value denotes statistical significance comparing the participants' Stages of Exercise Behavior Change according to their sociodemographic and environmental characteristics. P<.05 by Chi-square test (categorical variables)

Table 2. Types and intensity levels of students' favorite PA exercises based on gender (n=172)

Type of exercise		Total n (%) N=172	Female n (%) N=143	Male n % N=29	P value
Moderate physical activity		129 (75.0)	120 (83.9)	9 (31.0)	<.0001
Walking ^a	Aerobic exercise	122 (70.9)	113 (79)	9 (31)	
Dancing	Aerobic exercise	2 (1.2)	2 (1.4)	0 (0)	
Badminton	Aerobic exercise	4 (2.4)	4 (2.8)	0 (0)	
Bicycle	Aerobic exercise	1 (0.6)	1 (0.7)	0 (0)	
Vigorous activities		43 (25.0)	23 (16.1)	20 (69.0)	
Competitive sports ^b	Aerobic exercise	14 (8.2)	6 (4.2)	8 (27.6)	
Jogging	Aerobic exercise	18 (10.5)	8 (5.6)	10 (34.5)	
Swimming	Aerobic exercise	10 (5.8)	9 (6.3)	1 (3.4)	
Pushups	Anaerobic exercise	1 (0.6)	0 (0)	1 (3.4)	

^aModerate physical activity and light intensity activities. ^bCompetitive sports, football, and basketball

**Fig 2. Favorite participants' leisure activities**

3.3 Barriers that Prevented University Students from Active Lifestyles

A total of 56 individuals participated in the ten focus groups interviews. University students had to overcome many barriers to practice an active lifestyle, including a lack of access to facilities and resources (33.3%), a lack of time (35.7%), and cultural and social context barriers (19%) (Table 3). A summary of themes and subthemes that are proposed by participants to change and manage their behavior and improve the student's participation in PA is integrated in Table 4.

4. DISCUSSION

In this study, our aim was to describe the PA behavior of young Lebanese university students and to develop a program to enhance their physical fitness. Sedentary behavior was prevalent in the young university students in this study. The lack of time and resources in the

university setting and the cultural circumstances were the biggest barriers to being physically active.

In this study, the percentage of students in the pre-contemplation, contemplation, preparation, action, and maintenance stages were 8.3, 23.7, 33.2, 12.6, and 22.1%, respectively.

Our results were consistent with those reported in a Korean study, which found that the proportion of undergraduates who regularly exercised was 19.8% [44]. A survey in Iran that included 300 university students found that 86.3% of university students studying midwifery and nursing were in the contemplation and preparation stages [45]. This high prevalence was thought to be a result of insufficient exercise facilities and programs on campus [24,44], extensive theoretical and clinical schedules, fatigue after a day in the university [8,24,44], lack of sleep because of an excessive work

Table 3. Focus group themes: Barriers that prevent university students from active lifestyles (n=56)

Barriers	Details	Weight
Lack of access to facilities and resources	Lack of suitable places to be active.	33.3%
	Lack of recreation centers on campus.	
	Lack of access to community sport centers that require fees to practice sporting activities.	
	Living in a rural place.	
	Lack of walkways, running, and bicycle paths.	
	Lack of paths for pedestrians.	
	Lack of sport centers; sport centers not available in the neighborhood.	
Lack of time	Lack of equipment.	35.7%
	Doing homework or fulfilling responsibilities at home.	
	Having an extensive academic and clinical schedule.	
	Feeling too exhausted to practice activity exercises.	
General context: cultural and social context	No class suitable for PA.	19%
	The students' teachers do not encourage the participants to be active.	
	Teachers teach sports to only male students.	
	Cultural norms restrict women from being active.	
	Cultural norms: a low importance is placed on exercising over other activities such as doing homework or home responsibilities.	
Lack of awareness and motivation	Regular exercise habits are not integrated in the daily life of Lebanese people.	4.8%
	Social habits.	
	Exercise not an enjoyable activity.	
	Lack of motivation to perform PA.	
	Context not appropriate.	
Organization of PA and supportive environment	The university not a suitable setting to organize PA.	7.1%
	Sport to some extent is still perceived as a leisure activity (in summer).	
	Low importance placed on walking, group games, and dancing.	
	No regulation of team sports.	
	No recreation center on campus.	
	No PA program on campus (PA curriculum is a series of intentionally planned activities. Provides a list of activities that are developmentally appropriate).	
	No coach on campus.	

Load [24,44], economic status of the students [7,8], residence in small rural communities [7,24], cultural and social barriers (regular exercise was not integrated into people's daily lives and sport was still considered a leisure activity) [8], and the lesser importance placed on exercising over other activities such as doing homework or responsibilities at home [24]. Furthermore, class subjects such as art, music, and physical education, as well as recess, were viewed as "extras" that interfered with academic education, recreation, economics, and health promotion [46]. Additionally, accessing community centers that require fees to practice sports has been shown to be challenging [8].

Listening to music and participating in religious activities were prevalent in our population.

However, Kim and McKenzie [9] reported that physical exercise appeared to be more effective in reducing stress and enhancing wellbeing than passive forms of leisure such as social leisure, meeting with friends, watching TV [9], and listening to music. This suggests that social behaviors may tend to reduce PA.

As in other studies [7,45], our results showed that female students were not sufficiently active. A possible explanation for this is that young women are less likely to be physically active [6,7] and have different motivations for being physically active [6]. Girls' participation in PA is generally less frequent and of a lower intensity than that of boys [7], and girls generally prefer participating in home-based activities or unsupervised exercise such as walking [6]. Other

possible explanations are a high studying burden experienced by female students [8], cultural limitations [7], the need to wear a uniform or follow a dress code during physical education classes [24], and differences in health approaches [47]. Nowak et al. [47] showed that male students commonly chose physical fitness, good appetite, and inner calm as indicators of health, which are consistent with a holistic approach to health; female students, however, most often chose a good heart condition, normal laboratory tests, and an ideal healthy weight, which are more specifically associated with the traditional, biomedical health approach [47]. Furthermore, more than 70% of the students who were engaged in our study were in the pre-contemplation, contemplation, and preparation stages. All these students were women. Female students may also be overloaded by studying and other familial responsibilities; women are expected to assist in house duties and to care for siblings, with the ultimate purpose of preparing for her future role as a wife and mother. This, in turn, may cause female students to feel tired and stressed, potentially to the point that they do not have the time and energy to take care of their health and psychological well-being [8].

Half (45%) of the students who were on a diet were engaged in regular PA (action and maintenance), and no significant relationship was found between tobacco, alcohol use, and PA. Moreover, overweight and obese youth were regularly physically active. Our results contradicted those of Stankov et al. [24], who reported that overweight youth tend to perceive a greater number of barriers to sports participation, including feeling insecure about their appearance and peer stigmatization [24]. However, practicing a healthy lifestyle is very important to youth, and it is crucial to find factors that influence their decisions to be active. Data suggest that while school-based PA interventions are effective in reducing mean blood cholesterol and improving fitness levels by improving the VO_{2max} of children and adolescents, they are not effective in reducing mean systolic and diastolic blood pressure [16], pulse rate [16], body mass index (BMI) [16,33], or the prevalence of overweight [33]. In addition, there is some evidence that supports the effectiveness of providing specific courses such as health-related physical fitness in addition to the traditional courses to improve the stages of exercise behavior and perceived exercise benefit [45]. The implementation of a dance mat exergaming intervention was

associated with improvements in weight, BMI, percentage of body fat, and some dimensions of health-related QoL, i.e., psychological well-being, autonomy, and relationship with parents [48].

Academic discipline was found to be associated with PA behavior as a high rate of students studying health were in the inactive stage (contemplation and preparation stages of change). These findings are similar to those found among young Iranian students, in which 84% of university students studying nursing and midwifery were not active enough to gain health benefits [45]. Academic discipline was also shown to be associated with QoL, with students studying health reporting much lower SF-36 scores than their colleagues in business and economics [6]. Several factors may be responsible for this association, such as differences in staffing, in students' feeling of value in the two faculties [6], and their education in the health field [45]. Indeed, understanding and improving exercise among students studying health is very important because they pursue different courses in health sciences and have a key role in changing the behavior of people in society [45].

This study showed that 14.3% of the students who reported a low financial status were in the pre-contemplation stage and thus not engaged in PA. Similar findings have been reported in different countries, where students with a high economic status had better health-promoting behaviors than those with a low economic status [8].

Walking was selected significantly more often by participants as their favorite type of PA; fewer participants reported anaerobic exercise or health clubs. Similar results have been reported in previous studies [9,34]. However, the types of exercise that engaged a previous sample of similar Lebanese university students showed that only 58.4% of the students walked, jogged, or ran regularly, and 41.6% of the students reported participating in aerobic and anaerobic moderate-to-vigorous physical activity (MVPA) such as playing football or other sports, weightlifting, swimming, karate, horse riding, and dancing [6]. Kim and McKenzie [9] reported that few participants regularly used the recreation center on campus to engage in physical exercise for their leisure, and the lack of recreation centers in our faculties would further worsen the engagement of students in PA.

Table 4. Physical activity promotion program for young university students using strategies from the TTM of change [7,10,12,16,17,18,32,33,38,39,40,41,43,44,48,50,54,57]

Aim of the program: to change behaviors and increase PA among young university students

Process	Intervention objectives and their determinants ^a	Intervention development	Evaluation planning ^b
Stage 1. Pre-contemplation: Individual is unaware of the problem; no intention to change behavior in the foreseeable future [7,10,32,50,54].			
Consciousness raising	<p>“Understand the need for change” and “establish a sense of urgency”</p> <p>Become more aware of a problem and of potential solutions</p>	<p>Provide / propose:</p> <ol style="list-style-type: none"> Information on PA and good health. Information on walking or biking to school or the store instead of using the bus, taking the stairs instead of the elevator, and taking fitness breaks by walking or doing desk exercises instead of taking a sedentary coffee break[7]. Psychotherapy interventions: the psychotherapist expands information on oneself and the problem observations, confrontations, and interpretations and bibliotherapy (the use of books as therapy in the treatment of mental or psychological disorders) [58]. Workshop on PA to increase the students' understanding of the benefits of PA [18]. Use concrete examples that are age-appropriate; poster analysis; brainstorming about the benefits and obstacles of PA. Web-based health promotion project: students work in groups of five; the students are tasked with creating a fitness assessment, identifying barriers of PA, and developing a PA plan [18]. Awareness programs about the benefits of physical exercise 	<p>Were you informed about the importance of PA?</p> <p>Did you participate in the workshops on PA?</p> <p>Did you receive a brochure to promote PA behavior?</p> <p>Did you read the brochure?</p> <p>Were you informed about the importance of awareness programs?</p> <p>Did you access an Internet site to promote PA behavior?</p> <p>Do you know a mass media program that promotes PA?</p> <p>Did you participate in a role-playing intervention to promote positive PA behavior?</p> <p>Did you participate in community-based activities that promote movement? If yes, please specify the type of activity.</p>

Process	Intervention objectives and their determinants ^a	Intervention development	Evaluation planning ^b
		<p>are often referred to by concise abbreviations that can attract the attention of audiences and be used as tools of communication and collective mobilization, for example:</p> <ul style="list-style-type: none"> - "SWEAT" (for "sweat"): Senior Walking Environmental Audit Tool in the US [50]. - "SPACES" (for "spaces"): Systematic Pedestrian and Cycling Environmental Scan, which focuses on the spatial issues to consider in developing daily PA [50]. - "ParticipACTION" program, combining explicit words in both English and in French reflects close attention to information dissemination issues [50]. - "PLAY": Promoting Lifetime Activity in Youth, an intervention that included the introduction of 15-minute play breaks during class time among students[10]. - Change4Life: mass media campaigns that inform the general public about MVPA guidelines [32]. - The eHealth Behavior Management Model is built on providing better and more appropriate access to health information [38]. 	<p>Did you participate in the practice of video games during school breaks?</p> <p># of downloads of Google Fit in 6 months</p>
<p>Dramatic relief (Emotional arousal)</p>	<p>To experience and express feelings about one's problems and solutions</p>	<ul style="list-style-type: none"> a. Psychodrama: Using grieving or losses as emotions to provide a burst of energy that enables individuals to make changes. b. Role playing <p>"Develop a vision and common goals" serves the same purpose as dramatic relief; it arouses individuals' positive emotions by helping them visualize the change as bringing positive outcomes in the future, for example, fear of failure to change and inspiration for successful change[7].</p> 	

Process	Intervention objectives and their determinants ^a	Intervention development	Evaluation planning ^b
Environmental re-evaluation and control	<p>Assess how one's problem affects the physical environment</p> <p>Restructure the situation to elicit new behaviors and inhibit old habits</p>	<p>a. Increase participation in community-based activities that promote movement, e.g., dancing, sport, and “reinforce and refine the change” [50].</p> <ul style="list-style-type: none"> - Empathy training, documentaries “create short-term wins” [50]. - Voluntary action on the environment (messages, signage, recommendations, etc.) to optimize the incentive nature of the environment [50]. - Development of the living environment space (sidewalks, landscaping, walkways, bicycle paths, bicycle racks, and pedestrian paths, i.e., sidewalks reserved for walking or jogging) [50]. - Urban planning: e.g., the presence of public benches, places to rest, the readability of urban traffic [50]. 	<p>b. Use of mass media:</p> <ul style="list-style-type: none"> - TV programs to promote regular PA: daily television program that is broadcast twice, at 6:45 am and 9:08 am, and lasts 15 minutes each time. The exercise sequences are consistent with advice on health [50]. - Videogames: Video games that require PA beyond that of conventional hand-controlled games are referred to as active video games (AVGs) [17]. - Exergames in physical education classes and during school breaks [48]. - Computer-tailored intervention [59]. - Pedometer-based PA intervention [59]. - Google Fit, which actively contributes to the evolution of PA tracking with over five million downloads in 6 months since its release [60] <p>c. Enhance the adherence to sport clubs (create a sport club?).</p>

Process	Intervention objectives and their determinants ^a	Intervention development	Evaluation planning ^b
d. Encourage the provision of support by the family environment.			
Stage 2. Contemplation: Individual is aware of problem; serious consideration of change in behavior.			
Self-reevaluation	Appreciate that the change is important to one's identity, happiness, and success Assess how one feels and thinks about oneself with respect to a problem (sedentary behavior)	a. Elucidate / assess values, imagery, and corrective emotional experience [54]. - Discuss the benefits of and barriers to PA through brainstorming and focus groups [54]. - Develop campaign messages that may be more influential by targeting subjective norms instead of knowledge of guidelines. b. Raise awareness of personal MVPA behavior among inactive adults and increase motivation to engage in more MVPA [32].	Do you know the importance of moderate-to-vigorous physical activity (MVPA)?
Stage 3. Preparation: Individual is intending to take action.			
Social liberation; self-liberation	Be able to choose and have commitment to act or believe in one's ability to change Create more social alternatives for supporting new behaviors	a. Encourage people to join a guiding coalition to lead the change. ⁷ - Build social help groups. ⁷ - Plan PA to be easy, comfortable, and attainable by a large group [54]. - Choose exercise activities; create posters for the various activities, including the number of calories burned in 5 minutes of exercise [54]. b. Develop decision-making tools and techniques for increasing engagement.	Do you plan to participate in a PA program in the next six months?
Stage 4. Action: Individuals modify their behavior, experiences, and/or environment to overcome the problem.			
Countering	Be willing to act and believe in their own abilities to act	Enhance students' assertion and positive self-statements principle [58].	Did you have a coach in the university setting?
Counter conditioning	Substitute alternatives for problem behaviors to enable one's willingness to act and	Enhance relaxation and desensitization techniques among students.	Did you participate in a fitness class at the university? Is narghile prohibited in the university?

Process	Intervention objectives and their determinants^a	Intervention development	Evaluation planning^b
Commitment	strengthen belief in one's ability to change	<ul style="list-style-type: none"> a. Implement commitment-enhancing techniques. b. Propose fiscal interventions to reduce the price of equipment as podometric [51]. 	Are there places and equipment to practice PA on campus?
Countering	To substitute new behaviors for the old ones; "Empower others to act on the change"	<p>Ensure the presence of athletic facilities and kinesiology labs at the university [18].</p> <ul style="list-style-type: none"> - Have a coach at the university. - Implement interventions to increase the population's (particularly the students') levels of walking by at least 10 min consecutively on 5 or more days per week [12]. - Ensure the participation of the students in fitness classes at the university. - Develop structural campus interventions [51]. 	
Stimulus control	Avoid or counter stimuli that elicit problem behaviors Seek and use social support to facilitate change	<ul style="list-style-type: none"> a. Restructure one's environment (e.g., removing narghile from places of leisure). b. Encourage the inclusion of walking and biking (non-leisure-time walking and bicycling) for movement [33, 50]. 	
Helping relationships	Be open and trust one's problems with someone who cares	<p>Build therapeutic alliances, social support, and self-help groups: Engage parents in the intervention; use community-based strategies, mass media, and policy development [16].</p>	
Reinforcement and management Reward	Reward oneself, or be rewarded by others, for making change	<p>Implement evaluation and focus groups [54].</p> <ul style="list-style-type: none"> - Ensure the implementation of discussion sessions on the progress of and knowledge about physical exercise and about oneself as a leader [54]. - Promote the concept of 	

Process	Intervention objectives and their determinants ^a	Intervention development	Evaluation planning ^b
"health-related physical education" [33].			
Stage 5. Maintenance: Individual works to prevent relapse and consolidate gains.			
Social liberation	Increase alternatives for non-problem behaviors available in society Empower individuals by providing more choices and resources	a. Advocate for the rights of the repressed, empowering, and political interventions [33]. b. Expand after-school programs to promote PA and include competitive sports teams, clubs, classes or training, recreational and intramural sports, or nonathletic activities that involve physical activities (e.g., outdoor education, some community service programs) [33].	Are you a member of a sports club? Did you participate in a community-based PA in your neighborhood? In your region?
Termination: In the termination stage, people are no longer tempted by their old behaviors or problems. They have overcome their struggles and exited the cycle of change. Movement through the five stages of change is not linear as people may relapse to earlier stages several times before they reach the maintenance stage.			
Consolidation of changes	Consolidate gains and produce more changes Avoid relapse	Expand upon intervention programs in Lebanon: a. Association of young university students to encourage physical exercise: - In Arabic: "TaCHaJAa al Riayadah": Tajamooa el CHabab el JAmii li Riayadah. - In English: "The University Students Association to Encourage Sports". b. Implement a health promotion unit on campus [6]. c. Remote coaching supported by mobile technology and financial incentives are promising mechanisms for improving diet and activity [61].	

^a: Intervention objectives and their determinants/theory-based methods and practical strategies ^b: Quality of concept (yes=2 points, partly=1 point, no=0 points)

Walking is a common, accessible, and inexpensive form of PA, and it is an important component of total PA in adult populations. It is aerobic, necessitates the use of large skeletal muscles and confers the multiple health benefits of PA with few adverse effects [12,14,23]. Campaigns often specifically promote walking as a MVPA despite evidence suggesting that walking is often performed at an insufficient

intensity to meet MVPA guidelines [32]. Current guidelines recommend 60 minutes of MVPA daily, particularly for children and early adolescents [49]. To achieve this goal, time for PA should be built into program schedules [49], educational programs that enable students to overcome obstacles should be implemented [44], and measures to reduce barriers to PA should be presented to improve individuals' stage of

exercise practice and engagement in MVPA [32]. However, the organization of activities and inappropriate teaching practices have both been shown to act as barriers to engagement [24]. Therefore, evaluation is a priority, including the impact evaluation, process evaluation, and cost-benefit assessment [50]. Finally, access to equipment and facilities and providing a supportive environment were found to be effective intervention strategies with this population [7,8].

PA is a public health priority, and youth development programs are well positioned to improve PA. The programs must be carefully planned, implemented, monitored, and evaluated in response to local conditions. Health promotion is *“the science and art of helping people change their lifestyles to move toward a state of optimal health”*; thus “upstream” interventions such as policies have led to greater evidence than individually focused interventions [30]. Systematic reviews have confirmed the idea that “downstream” preventive interventions are more likely to increase health inequalities than “upstream” interventions. Additionally, some effective public health interventions may increase inequalities by disproportionately benefiting less disadvantaged groups (intervention-generated inequalities) [51].

Behavior, in terms of health promotion, is shaped by three main aspects: Knowledge, skills, and attitudes. Unfortunately, although knowledge and skills have received adequate attention, attitude has not [52]. Behavior change appears to be an idea that has developed over time [53]. It has developed because modern market economies have led to a range of health and social problems that have proved impervious to traditional approaches of legislation, education, and exhortation, such as the education systems that are failing, the parents who lack the basic skills to raise children, and the high rates of antisocial and lifestyle behaviors [53].

To direct students from inactive to active stages and to motivate them to follow the appropriate exercise behaviors, the following interventions are proposed for the implementation of sport promotion programs in young university students using strategies from the TTM of change (Table 4).The intervention is based on the stated barriers to PA and the recommendations proposed by young students to change and manage their behavior. In addition, a scoping review was conducted to identify and summarize

the relevant literature on exercise programs that influence youth acceptability of PA interventions that are designed to change their behavior [54-56].

The intervention is composed of the following steps:1) a needs assessment, 2) formulation of change objectives (intervention objectives and their determinants), 3) selection of theory-based methods and practical strategies, 4) intervention development, 5) development of adoption and implementation plan, and 6) evaluation planning (Table 4).

Successful behavior change requires passionate and committed public health experts to create access to appropriate solutions and choices through multiple channels and to empower vulnerable target groups to make informed decisions based on their own needs and wants [53]. Behavioral interventions are designed by psychologists, behavioral therapists, dietitians, exercise physiologists, or health educators [24,56]. They involve the participants' teachers and have the intention of changing cultural norms and providing vicarious learning for the students. Additionally, the development of a rigorous agenda for basic, translational, and applied research that will clarify how to better promote PA across the life course is recommended [7,26].

Current awareness programs about the benefits of physical exercise show that they are often referred to by concise abbreviations meant to pique the interest of audiences and are used as tools of communication and collective mobilization [50]. In general, such programs generate a collective membership: Effective participation, sympathy credit, and an understanding of underlying health issues [50].Internet-based approaches are able to reach large numbers of people at relatively low costs [38]. The eHealth Behavior Management Model is designed to provide better and more appropriate access to this information [38].

New generation active video games (AVGs) are an emerging technology that has recently become involved in the health care arena to address users' health. Preliminary evidence appears to support AVG play as an enjoyable medium for self-directed, light-to-moderate intensity PA [17]. The use of exergames in physical education classes and during school breaks could promote positive attitudes toward PA and improve self-efficacy for PA, cardio respiratory endurance, and academic

achievement [48]. Computer-tailored, pedometer-based PA interventions have been effective in increasing both pedometer-based and self-reported PA levels, mainly in the at-risk participants [59]. Google Fit has actively contributed to the evolution of PA tracking with over five million downloads in 6 months since its release [60]. In contrast, leisure time computer gaming, including computer gaming and emailing or chatting, has been reported as a prospective risk factor for overweight in women but not in men [62].

Physical education staff in particular would benefit from training that raises their awareness and competencies to address the environmental, interpersonal, and individual barriers that students encounter in relation to PA and other learning situations [24]. Based on our results, support and encouragement by family members and friends and interventions for active health behaviors such as sports are important [44]. Club activities are valuable when students intend to exercise even though participation is irregular; in contrast to the contemplation stage, students engaged in club activities have the intention or will to exercise within six months [44]. Finally, there has been substantial interest in offering additional after-school activities to serve the needs of more students, such as participation in community-based activities [33,50]. Additionally, the following interventions have shown some evidence of reducing health inequalities (structural workplace interventions, the provision of resources, and fiscal interventions [51]) and preventing exercise-induced cardiac fatigue [63].

Integrating PA into daily routines is a no-cost, sustainable method of health promotion that should be strongly considered by youth development practitioners [49]. Additionally, the available program times may not be conducive to including long blocks of PA. Instead, practitioners can employ shorter activity breaks by dividing their daily PA goals into three or more sessions [49]. Practitioners who are active with young people may enhance the engagement of participants by designing desired behavior sessions [49]. Although safety concerns among parents have helped increase the supervision of youth activities, evidence suggests that supervision may decrease overall activity levels [49].

This study has some potential limitations. It was conducted in only two faculties at a public

university, which limits the results to a certain social strata [6]. Additionally, this was a cross-sectional study; Thus, it cannot establish a temporal relationship between predictors and outcomes [6]. Women were more prevalent in our sample, particularly in the Public Health department, as is the case in higher education in Lebanon, most European countries [6], Jordan [8], and Iran [45]. It is possible that these results may also have been skewed by a recruitment bias, affected by reporting bias and the interactive nature of the focus group research method.

5. CONCLUSION

In conclusion, this study may motivate healthy but sedentary individuals to begin and continue exercising to achieve the substantial and attainable benefits of PA on mortality, morbidity, academic performance, and cognitive functioning of young students. It is necessary to not only identify the hidden barriers to PA but to also discover mechanisms that support a physically active lifestyle despite the potential cultural barriers. Accordingly, if young people are to engage in adequate amounts of PA, it is essential that universities systematically and effectively provide and promote students' participation in PA.

CONSENT

All authors declare that 'written informed consent was obtained from the participants for publication of this paper.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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