

A Cross-Sectional Study to Investigate the Association between Physical Activity (PA) and Barriers among Tertiary Education Students in Hong Kong

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Introduction

Physical activity ties tight with our daily living. It defines as the bodily movement produced by skeletal muscles that involve energy expenditure [1]. According to WHO, it is recommended young adult should do at least 150-minute moderate to intensity PA or 75-minute aerobic vigorous to intensity PA throughout a week. The advantages of staying physically active have solid evidences supported. There, however, is a poor practice in PA in tertiary education students globally. It is stated that more than 80% of the adolescent population in the world is not enough physically active [1]. It is believed that students in Hong Kong are getting not enough physically active as well. Remediating this plight not only in the view of personal benefits but a global health issue. It, therefore, is a high time to investigate the relationship between perceived barriers and PA behavior among tertiary education students in Hong Kong.

Literature review

There is no doubt to say PA benefits to our health. Regular PA aids in the primary and secondary prevention of various diseases such as cardiovascular disease, diabetes, cancer, hypertension, obesity, depression and osteoporosis [2].

Regular PA has been proven to improve lipid profiles. In a study by a random sample of 1015 school children showed that PA beneficially related to lipid profile, and cardio-respiratory fitness (both $P < 0.01$) [3]. Recent research stated participants with high intense PA were associated with higher HDL-cholesterol significantly ($p < 0.05$); as well as positively-related to triglycerides, LDL, and total cholesterol ($p < 0.05$) [4]. PA also reduces the incidence rate of having diabetes and enhances the insulin sensitivity. In a randomized controlled trial post hoc analysis, it is suggested that individuals participate in more than 2.5 hour per week of walking as exercise were 63-69% lower risk of developing diabetes compared with those spend less than one hour [5]. Thus, a research revealed that, total activity is associated with insulin sensitivity in both sex ($P < 0.01$). This indicated accumulated routine PA is a key determinant of insulin sensitivity [6]. PA works to reduce the risk of hypertension. A study confirmed that walking 10,000 steps/ day could be useful in lowering both resting systolic and diastolic blood pressure. There was a notable linear decrease in systolic blood pressure and diastolic blood pressure, with an average decrease of 5.57 and 4.03 mmHg every three months respectively ($t = -5.69$, $P = 0.001$; $t = -5.53$, $P = 0.001$) [7].

Concerning the relationship between PA and coronary heart disease (CHD), a meta-analysis of 33 studies showed that individuals who participated in the equivalent of 150 minutes per week of moderate to intensity leisure-time physical activity (LTPA) lowers the risk of developing CHD by 14 % (relative risk, 0.86; 95% CI, 0.77-0.96) compared with those participated no LTPA [8]. It is suggested that a high level of LTPA reduces the overall risk of developing CHD and stroke among both sex by 20 to 30 percent [9]. Health is defined as a state of complete physical, social and mental well-being, according to the WHO.

PA not only benefits people physical health, but also the psychological aspect. Routine PA is also associated with a markedly decreased prevalence of current anxiety disorders and depression [10]. As it is the matter of fact that psychological well-being is crucial for adolescence because it has a huge impact to the development of personality, life goals as well as values in their futures. Despite this fact, the World Health Organization puts great emphasis on physical active in 2010 and identified physical inactivity as the fourth leading risk factor for global mortality [11].

Although there are numerous significant benefits in being physical active, tertiary education students seldom participate in PA among the world nowadays. There is more than a half of university students in the United States, China and Canada were classified as insufficiently active. While, 40% of students were insufficiently physically active in Australia, and 67% were inactive in Europe [12]. There is no recent research done in Hong Kong. A finding from decade ago, according to Department of Applied Social Sciences, there is only 24.6% of the young, and 21.6% of the adults could attain the standard of doing physical exercise three times or above per week with an average of 30 minutes or above in each occasion [13]. Physical exercise is not equivalent to physical activity. Physical exercises only count for exercises that are planned to do so as to maintain or improve one's physical fitness in purpose. It is a subset of physical activity [11]. As there is no data supporting tertiary education students' PA level, it is a must to obtain comprehensive up-to-date information in this area so as to protect the health of our tertiary education students in Hong Kong and remedy the situation as soon as possible.

The PA level of tertiary education students should not be overlooked. They experience the role changes and in the life stage of being

independent. It has been marked this period as a critical period for establishing and maintaining a physically active habit. It is more likely to develop a lifelong PA pattern in this stage and carry it throughout the adulthood [14]. There is no compulsory physical education lesson in tertiary education students in Hong Kong. Worse still, Downs and Ashton (2011) reported that college years are prone to experience the onset of physical and mental health problems. PA is certainly advantageous to their situation [15]. To help the youngsters engaging PA and enjoying the health benefits from it, it is of paramount importance to explore what are the barriers for them to participate in PA.

Barriers are defined as the obstacles individuals face in undertaking, maintaining, or increasing PA [16]. In the literature, demographics characteristics like age and gender, social factors like family and peers, psychological factors like enjoyment, as well as physical-environmental factors like living environment and accessibility to facilities were indicated to influence university students' PA behavior [12,17,18]. Discovering the barriers that hinder PA participation should be included various perspectives. Inadequate PA harms our health physically and mentally. Previous studies pointed that tertiary students rarely participate in PA around the world, while there exists no recent data about PA participation and its barriers in Hong Kong among tertiary students.

Knowledge gap

Tertiary students' physical activity and the barriers of physical activity participation have been neglected as a research topic. There is a lack of a multiple aspects approach (i.e. job, transportation, housework, sport and recreation related physical activity) to examine the physical activity behaviors and lack of a Dimensional view in exploring barriers to physical activity participation in tertiary education students.

Objectives

In the view of the above information, this study has two objectives:

- a) To identify the perceived barriers to physical activity among tertiary education students in Hong Kong;
- b) To evaluate the association between such perceived barriers and physical activity.

Research question

What are the associations between physical activity and the perceived barriers among tertiary education students in Hong Kong?

Significance of the study

The findings demonstrate the situation of the factors hindering physical activity participation in tertiary students for healthcare professionals and stakeholders. Useful clues and insights for government and tertiary institutions can be illustrated to motivate and promote tertiary education students in participating physical activities.

Methodology

Study Design and sampling

This cross-sectional study conducted in the 2016-2017, with a representative sample of the population of 128 tertiary education students in Hong Kong. Sample size is calculated for a chi-square test in G-POWER using an alpha of 0.05, power of 0.80, a medium effect size ($w = 0.3$) and 2 degrees of freedom [19]. Based on the aforementioned assumptions, the minimum sample size is 108. Subject recruitment and data collection took place at King's Park campus and Mongkok campus in Tung Wah College from 9am to

6pm in late January to late February 2017. Convenience sampling is used in data collection for the research.

Inclusion and Exclusion Criteria

The inclusion criteria are those who (i) aged 18-24, and (ii) who is a current tertiary education student in Hong Kong. The exclusion criteria are those who (i) has physical disability; or (ii) have contradiction to individual health issue (i.e. medical officers advised not to involve PA); or (iii) is a professional athlete.

Data Collection

Potential individuals who appeared to meet the inclusion criteria would be invited to participate by the researchers. Eligible participant is invited to complete the questionnaire including background demographic characteristics (i.e. age, sex, year of study, and discipline), International Physical Activity Questionnaires (IPAQ), and Barriers to Being Active Quiz (BBAQ) under the assistance of the researchers. Before administering the data collection process, alignments and integration were done among team researchers to maintain consistency and accuracy. To start the data collection, researchers explained the purpose and procedures of the study to participants. Information sheet is delivered and verbal consent is obtained as there is no personal identifier will be indicated in the questionnaires. The whole procedure took about 15-20 minutes.

Define variables

a) Dependent variables are the three categories of PA level based in IPAQ. According to the official protocol (International Physical Activity Questionnaire Research Committee [IPAQRC], the Metabolic Equivalent of Task (MET) level for walking is 3.3, cycling is 6.0, moderate yard work is 4.0, and vigorous intensity in leisure is 8.0. Calculating MET-min/ week by using MET level x minutes of activity/day x days per week [20].

- High level of PA level is obtained when participants took part in vigorous intensity activity on at least 3 days for ≥ 1500 MET-min/week OR 7 or more days of any combination in walking, moderate or vigorous intensity activities accumulating for ≥ 3000 MET-min/week.
- Moderate level of PA is obtained when the participants achieved 3 or more days in vigorous intensity activity for ≥ 20 minutes per day OR 5 or more days in moderate intensity activity and/or walking for ≥ 30 minutes per day OR 5 or more days of any combination of walking, moderate intensity or vigorous intensity activities for ≥ 600 MET-min/week.
- Low level of PA is categorized when no PA is reported OR the activities is not enough to meet the criteria in Moderate and High level.

b) Independent variables are the seven types of barriers under the BBAQ (Rubio et al, 2015). They are "lack of time", "social influence", "lack of energy", "lack of willpower", "fear of injury", "lack of skill", and "lack of resources". With a score ≥ 5 in each domain would be identified as an important barrier.

Outcome Measurements and Tools

The survey included demographic information, International Physical Activity Questionnaires (IPAQ) and Barriers to Being Physically Active Quiz (BBAQ).

- Demographic characteristics**
Self-reported demographic data on age, sex, year of study, and studying faculty were collected.
- International Physical Activity Questionnaires (IPAQ) IPAQ long version is a 27- item self-report questionnaire used to obtain data on PA in five parts regarding the frequency and duration in job, transportation, housework, sport and recreation related PA in the past seven days. According to the guideline, the PA level will be categorized into low, moderate and high (IPAQRC, 2005). IPAQ showed good reliability with intraclass correlations range from 0.46 to 0.96 and fair-to-moderate criterion validity with median ρ 0.30 [21].
- Barriers to Being Active Quiz (BBAQ) BBAQ is a 21-item self-report questionnaire that will be used as an instrument to evaluate the perceived internal and external barriers to being physical active Centers for Disease Control and Prevention [22]. The instrument evaluates seven domains. Each domain contains three items, rating on a four-point Likert scale with categories, varying from 0 means “very unlikely”, 1 means “somewhat unlikely”, 2 means “somewhat likely” and 3 means “very likely.” Five or above scoring in each domain would consider as an important barrier. It showed a good reliability of 0.83 Cronbach alpha, with intra-class correlation coefficient 0.46-0.87 as well as construct validity by confirmatory factor analysis indicated moderate factor loading [23].

Level of measurement

In demographic data such as gender is regarded as nominal data.

Results

Demographic data

The Participants' general characteristics

		Count	Column N%	Mean	Standard Deviation
Gender	Male	39	30.5%		
	Female	89	69.5%		
Age				22	2
Faculty	Medical Science	18	14.1%		
	Business	7	5.5%		
	Social Science	6	4.7%		
	Nursing	81	63.3%		
	Others	16	12.5%		
Year of Study	1	7	5.5%		
	2	11	8.6%		
	3	5	3.9%		
	4	22	17.2%		
	5	83	64.8%		

There are 128 participants recruited in this study and all of them completed the questionnaire correctly. Table 1 shows that, the number of females (n=89) participated in this study outweighed the males (n=39; mean age= 22 ± 2 years; age range = 18- 24). The majority of them are from the faculty of Nursing (n=81;63.3%), followed by 14.1% from Medical Science (n=18), 12.9% from Others (n=16), 5.5% from Business (n=7) as well as 4.7% from Social Science (n=6). In addition, over half of the participants are studying the fifth year in tertiary institutions (n=83; 64.8%).

MET-minutes/ week used ratio measure. As for categories of PA level, it is an ordinal data. Each barrier is regarded as nominal variable.

Data Analysis

PA data were cleaned and processed under the IPAQ protocol (IPAQRC, 2005). To clear extreme values, all activity variables exceeding 3 h/day were truncated to 3 h, and those lowering than 10 min/day were recoded to zero. For descriptive statistics, frequency, median and inter-quartile range were calculated according to its data nature in order to indicate the features of the survey outcome. For exploring the association between perceived barriers, gender, and PA level, Chisquare test is used. All the statistical analysis for outcome measures is achieved by using the Statistical package for the Social Sciences (SPSS) statistical software version 23. The level of significance was set at $P \leq 0.05$.

Ethical Consideration

The study is conducted after gaining the approval of Tung Wah College Ethics Committee. A detailed explanation of the study is given to the participants by an information sheet. Also indicated that participants could withdraw from the study under all circumstances. Verbal consent is obtained for participants who agree to join the study. All the obtained data stored in a locked storage cabinet and a PINprotected USB- device to ensure safety. All data can only be assessed by the investigators for research purposes and will be destroyed after the report has been published for 6 months.

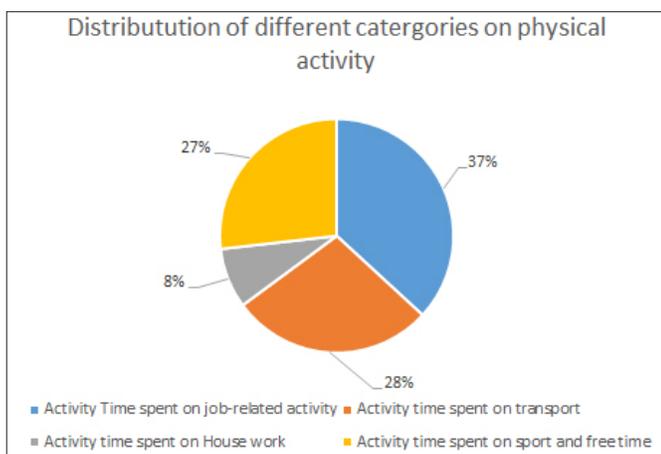


Figure: International Physical Activity Questionnaires (IPAQ-LF)

In generally, over one-third of the total physical activity time spent on job related activity (37%), followed by 28 percent is from transport related activity, which included walking and cycling. Time spent on sport and free time, as well as housework activity contributed 27 percent and 7 percent respectively in total physical activity.

	Median	Percentile 25	Percentile 75
Total Walking	990	594	1188
Total Moderate activity	420	0	795
Total Vigorous activity	0	0	1440
Total Physical activity	2030	1031	2961

All data expressed in MET-minutes/week

	Gender					
	Male			Female		
	Median	Percentile 25	Percentile 75	Median	Percentile 25	Percentile 75
Total physical activity met-minutes/week	2748	2034	4053	1470	765	2574

As the data received is not normally distribution, median is used to minimize the sensitivity from extreme values. Males (median=2748; IQR=2019) compared to females (median=1470; IQR=1809) declared more physical activity in METminutes/ week. The distribution of respondents' physical activity level: Low level of PA (n=18, 14.0%), Moderate level of PA (n=79, 61.7%), and High level of PA (n=31, 24.2%). Over sixty percent of respondents participated in moderate level of physical activity level.

The gender differences in physical activity levels

Category of PA	Gender					
	Male			Female		
	Count	Percentage	Count	Percentage	Count	Percentage
Low	3	7.7%	15	16.9%		
	20	51.3%	59	66.3%		
	16	41.0%	15	16.9%		

Pearson Chi-Square Tests

Category of PA	Gender	
	Chi-Square	9.150
	df	2
Sig.	.010*	

Results are based on nonempty rows and columns in each innermost subtable

*. The Chi-square statistic is significant at the .05 level.

In table above, PA level is statically associated with gender by Chi-square analysis (p<.05).

TABLE: Barriers to being Physically Active Quiz (BBAQ)

The Physical activity level differences in barriers

		Category of PA					
		Low		Moderate		High	
		Count	Percentage %	Count	Percentage %	Count	Percentage %
Lack of time	No	6	4.7%	30	23.4%	17	13.3%
	Yes	12	9.4%	49	38.3%	14	10.9%
Social influence	No	6	4.7%	46	35.9%	24	18.8%
	Yes	12	9.4%	33	25.8%	7	5.5%
Lack of energy	No	3	2.3%	18	14.1%	13	10.2%
	Yes	15	11.7%	61	47.7%	18	14.1%
Lack of willpower	No	3	2.3%	20	15.6%	12	9.4%
	Yes	15	11.7%	59	46.1%	19	14.8%
Fear of injury	No	15	11.7%	75	58.6%	29	22.7%
	Yes	3	2.3%	4	3.1%	2	1.6%
Lack of skill	No	16	12.5%	64	50.0%	31	24.2%
	Yes	2	1.6%	15	11.7%	0	0.0%
Lack of resources	No	11	8.6%	50	39.1%	23	18.0%
	Yes	7	5.5%	29	22.7%	8	6.3%

The major reason for neglecting physical activity of the tertiary education students surveyed was "lack of energy" (n=94; 73.5%), closely followed by "lack of willpower" (n=93; 72.6%), and then by "lack of time" (n=75; 58.6%). Other contributions to the inhibiting physical activity participation were "social influence" (n=52; 40.7%), "lack of resources" (n=44; 34.5%), "lack of skill" (n=17; 13.3%) and "fear of injury" (n=9; 7.0%).

The preceived barriers regarding different gender

		Gender			
		Male		Female	
		Count	Column N %	Count	Column N %
Lack of time	No	20	51.3%	33	37.1%
	Yes	19	48.7%	56	62.9%
Social influence	No	28	71.8%	48	53.9%
	Yes	11	28.2%	41	46.1%
Lack of energy	No	18	46.2%	16	18.0%
	Yes	21	53.8%	73	82.0%

Lack of willpower	No	18	46.2%	17	19.1%
	Yes	21	53.8%	72	80.9%
Fear of injury	No	33	84.6%	86	96.6%
	Yes	6	15.4%	3	3.4%
Lack of skill	No	35	89.7%	76	85.4%
	Yes	4	10.3%	13	14.6%
Lack of resources	No	28	71.8%	56	62.9%
	Yes	11	28.2%	33	37.1%

It also shows that “lack of energy” and “lack of willpower” were most frequently indicated barriers to physical activity in both males (n=21; 53.9% and n=21; 53.9% respectively) and females (n=73; 82.0% and n=72; 80.9% respectively). “Lack of skill” (n=4; 10.3%) and “fear of injury” (n=3; 3.4%) were the least common mentioned barrier for males and females respectively.

Category of PA		
Lack of time	Chi-square	3.172
	df	2
	Sig.	.205
Social influence	Chi-square	9.288
	df	2
	Sig.	.010*
Lack of energy	Chi-square	5.237
	df	2
	Sig.	.073
Lack of willpower	Chi-square	3.212
	df	2
	Sig.	.201
Fear of injury	Chi-square	3.040
	df	2
	Sig.	.219 ^b
Lack of skill	Chi-square	7.055
	df	2
	Sig.	.029* ^b
Lack of resources	Chi-square	1.362

Gender		
Lack of time	Chi-square	2.255
	df	1
	Sig.	.133
Social influence	Chi-square	3.587
	df	1
	Sig.	.058
Lack of energy	Chi-square	11.036
	df	1
	Sig.	.001*
Lack of willpower	Chi-square	9.989
	df	1

	Sig.	.002*
Fear of injury	Chi-square	5.987
	df	1
	Sig.	.014* ^b
Lack of skill	Chi-square	.446
	df	1
	Sig.	.504
Lack of resources	Chi-square	.947
	df	1
	Sig.	.331

“Social influence” is the only one associated with physical activity level ($p < .05$). The differences found between “lack of time”, “lack of energy”, “lack of willpower”, and “lack of resources” towards the three categories of physical activity level were not associated. Since there is more than 20% expected count less than 5, sample size requirement of independence is not satisfied for “fear of injury” and “lack of skill”. The association between PA level and these barriers by Chi-square analysis cannot be interpreted [24].

Regarding the association between barriers and gender, “lack of energy” and “lack of willpower” is associated with gender (both $p < .05$). Female are more likely to report “lack of injury” and “lack of willpower” are their barriers to PA.

Since there is more than 20% expected count less than 5, sample size requirement of independence is not satisfied for “fear of injury”. The association between genders and this barrier by Chi-square analysis cannot be interpreted [24].

Discussion

Physical activity level

The present study shows a higher prevalence of physically active among tertiary education student population in comparison with the general population in Hong Kong. Most tertiary education students (85.9%) being interviewed achieved a moderate to high level of physical activity. This finding conflicted with the result in Hong Kong decade ago. According to Department of Applied Social Sciences, there is only 24.6% of the young, and 21.6% of the adults could attain the standard of doing physical exercise three times or above per week with an average of 30 minutes or above in each occasion. It is of paramount importance to clarify the point that physical exercise is not equivalent to physical activity. It is a subcategory of physical activity. Present study could assess physical activity level rather than only the physical exercise level. As a consequence, physical activity level would be obviously higher than that of the physical exercise level. Besides, physical activity habit and participation inevitably changes over time. Time is a vital factor causing the differences between present study and the research done by Department of Applied Social Sciences in 2006.

According to Bauman et al. this review gathered data from 20 countries with a number of 52,746 participants aged from 18 to 65 [25]. It revealed that over a half of the males and females in 12 and 14 countries respectively did not meet the minimum criteria of high PA. Therefore, the findings from present research might achieve higher PA than that presented in other countries.

Sample characteristics may be a source for this inconsistency. It is reported that education level is highly positively related to physical activity participation [25,26]. Tertiary education students would have a higher PA level when compared to the general young and adult populations. Therefore, when the study only targeted on tertiary education students, the PA level should be elevated reasonably. Additionally, being studied in a higher year of study is linked with higher levels of PA supported by Pedišić, Rakovac, Bennie, Jurakić, and Bauman 2014. In the present study, near two-third of the respondents are from year five in their study. It may further explain the higher PA among tertiary education students than in the general population of young adult.

Furthermore, 4657 participants were categorized in Low PA (15.3%), in Moderate PA (50.6%), and in High PA group (34.1%) respectively among 4657 respondents in Hong Kong [27]. This pattern is consistent to what we found in current study. There are 14.1% tertiary education students categorized in low PA, 61.7% in moderate PA, and 24.2% in High PA. It is supported that the rates of PA among Hong Kong females increased in the older age group when compared to the younger age group [27]. This might be a cause of having a lower statistic in high PA group in present study.

Apart from that, there is no recent data in exploring PA among tertiary education students in Hong Kong. Nevertheless, respondents in our study had a general higher sufficient PA level than those students in different continentals. Most of the respondents in this study categorized as sufficient (moderate to high) level of PA (85.9%), while in Columbia (44%), in Korea (43.5%), in Turkey (69.8%), in Greek (54.7%), and in Saudi Arabia (42.0%) reported fewer students in statistics [28-32]. Some possible reasons for this inconsistency are the different measurement used to assess PA and different respondents' characteristics. These researches used the short version of IPAQ (IPAQ-SF) to assess physical activity, which is different from the form we used. IPAQ-SF does not examine domain specific physical activity and it is more likely to underestimate physical activity level compared to IPAQ-LF [33]. Therefore, the PA level of the above countries might be achieved higher if IPAQ-LF is used.

A survey used IPAQ-LF had a similar result with the current research. 11.3% of tertiary education students in Egypt were categorized in low PA, 52.0% in moderate PA and 36.7% in high PA group. More investigation should be done in exploring the pattern of PA among tertiary education students in the globe.

Physical activity patterns

Most activity time of the respondents spent on job-related activity in present study. The finding is not generally in accordance with previous study in Nepal and Spain. It is revealed that respondents in Nepalese and Spanish students highly contributed to domestic and transport-related activities physical activity [34,35]. It is not surprised that this situation occurred due to economic and cultural differences. A Foreign domestic helper can be found every seven domestic households in Hong Kong, not to mention local domestic helpers, they are paid to take all the responsibilities of housework [36]. Besides, a survey conducted by Department of applied social studies in City University, over 60 percent of parent replied that their children did not help with household chores. Parents explained that it is more important for children to spend time on academic performance [37]. This explained why domestic-related physical activity shared a low proportion in total physical activity in current research. As for the transportation, public

transport accounted for over eighty percent of all daily boarding [38]. Tertiary education institutions are closed to rail or numerous bus stops, students do not require to walk a lot to school. Moreover, cycling is not encouraged as a mode of transport by the government in the past. Cycle tracks, parking and other cycling infrastructures are not well developed Hong Kong. Hence, transport-related physical activity is uncommon among Hong Kong tertiary education students. Another study in Egypt suggested that work-related physical activity had the highest median score, while domestic and gardening related physical activities had the lowest median score among university students [39]. The current study agreed with these findings. Egypt is a less developed country, it is reasonable that tertiary education students primarily worked as physical labor that required high demand on physical energy. In Hong Kong, the majority (72.5%) of the part-time workers employed in services sectors (Census and Statistics Department [40]. Working in retail, accommodation or other service-related industry do need carrying loads and climb up and down. Thus, the PA required in job related domain among Hong Kong tertiary education students enhanced.

Main barriers to PA participation

As mentioned previously, "social influence" is significantly associated to PA level. Respondents who encountered the barrier of "social influence" would prone to participate less PA than those who do not have this problem. Corresponding to the results from the United States, Spain and Turkey, "social influence" is a critical barrier to students [41-43]. In Hong Kong, a materialistic society, having social activities that involving exercises with friends and family members is not a usual practice. Parents may not be suitable role models to practice with. Besides, lack of peers to exercises together is another concern. As a result, forming physical activity habit is not an easy task. Previous studies had demonstrated having a friend who is physically active or encouragement from peers to do PA is positively related to one's PA participation [45,46]. Interestingly, "social influence" can be a motivator. A research examined the association in indirect social influence by parents and friends towards one's PA level (Cheng, Mendonça, & Farias Júnior, 2014) [47]. This research further indicated that adolescents who observed that their parents and friends took part in PA more frequently had higher levels of PA. Peer influences were more important than parental influence in older adolescent [47]. Therefore, low PA group tertiary education students are encouraged to meet new friends who are physically active or develop social activities involving exercise with their friends so as to benefit from the social influence.

Apart from "social influence", lack of energy (73.4%), lack of willpower (72.7%) and lack of time (58.6%) are the three highlighted barriers the respondents faced. Although there is no significant association between barriers and physical activity level, over half of the respondents viewed these three barriers as critical obstacles than other barriers. Consistent with the study by Kulavic, Hultquist, and McLester, lack of energy, lack of willpower and lack of time were the major barriers keeping American students from participating PA [48]. Similar to other studies, lack of time was the top rated barrier in Saudi Arabia, Turkey and within European Union [19,33,44]. The "lack of time" is an external barrier that due to the time devoted into building up responsibilities in part-time work and study. This high rated barrier can be explained by three possible reasons. First and foremost, European Commission clarified that people aged 15-24 are the most likely to state that they are already doing sports regularly [19]. And it reflected the true situation in our study that nearly 60 percent of the

respondents are from high level of PA group. In addition, European Commission further pointed that people who stay in education for longer are more possible to mention “lack of time” when compared to who left education. Therefore, 58.6 percent of participants in present study expressed it as their barrier. Interesting to note that, BMI may be a factor yielded a high frequency in “lack of time”. A study revealed that respondents with normal weight are more likely to report lack of time” as their barrier to engage PA.

“Lack of energy” and “lack of willpower” are internal barriers that generally due to laziness, low motivation and unwillingness. These two barriers are the prime obstacles to participate PA in both genders. A research by Flintoff and Scraton (2001) stated that secondary school compulsory physical education do not provide a clear purpose of doing physical activity and lack of exploration to numerous kinds of physical activities [49]. Therefore, students do not understand the benefit of PA and loss of interest towards PA in the later life. This actually hinders students from learning new skills and practice in PA continuously. This situation is especially important in Hong Kong as not all tertiary education students have compulsory physical education lesson. Furthermore, a study gave a new insight in physical education program. It stated that self-determined motivation might be a critical factor in enhancing PA level of students. Free-choice condition is a method to motivate students to participate more PA than structured lesson [50]. Consequently, it is recommended that free choice condition strategies should be promoted in the physical education lesson so as to increase the interest and motivation towards PA.

The present findings is totally different from that presented in Columbia, “fear of injury” obtained the highest percentage of replies (89.5%). “Lack of willpower” (50.5%), “lack of energy” (40.2%) and “lack of time” (30.1%) were the least rated barriers to hinder PA. Parks, Housemann and Brownson pointed that lower income citizens were prone to report “fear of injury” as barriers to PA [51]. According to The World Bank (2017), Hong Kong achieved a higher GDP per capita than Columbia in the year of 2015 (US\$42,327,000; US\$ 6,056,000 respectively) [52]. Therefore, the income difference towards Hong Kong and Columbia might be a reason explaining a higher reported “fear of injury” as a barrier to ceasing to engage PA in Columbia. Cultural norms and social class as well as socioeconomic status are closely associated to physical activity participation Based on this analysis, the discrepancy between the present research and the existing study were not unexpected [44].

Gender difference

In current research, it implied that there is an association between genders and PA level. Studies among tertiary education students were inconsistency in this aspect, there is no difference between genders towards PA participation in Croatia [53]. On the other hand, more findings supported males being more active than females. Research done by Choi, Chang and Choi from Korea, there is significantly more male students engaged sufficient PA than their female counterparts. Additionally, this gender difference agreed with the studies in Somaliland, Poland and Malaysia, it illustrated that male students showed a higher level and intensity of physical activity than female students [54-57]. “Lack of energy” and “lack of willpower” are found significantly associated with genders in present study, a recent research in Columbia agreed with this findings [58]. Female-specific solutions should be made to enhance PA participation in this population. In order to promote physical activity, gender discrepancy is a prime issue should be

taken into consideration. Choi et al. found that the key motivations for performing PA are the demonstration of capability and pursuit of victory in male students. Improving their appearance and losing weight are motives for female students. Take the above into account, tailor-made approach towards females and males in physical activity promotion is encouraged.

Strengths and limitations

Due to a lack of recent study examining physical activity level and its corresponding barriers among tertiary education students, our study can inspire new interventions to promote PA in this population. Using IPAQ-LF not only can provide reliable and valid information, but also help in distinguish different types of PA. This current study can provide a multiple dimension of physical activity behaviors from several domains (work-related, transportation, domestic, recreational, sport and leisure time) and be comparable together related studies internationally. Moreover, all questionnaires were administered with the guidance of researchers, resulting a satisfactory response rate and an opportunity for students to clarify and question about the long questionnaires. Before that, alignments and integration were done among researchers to maintain consistency and accuracy. Still, there may be errors of recall for the physical activity involved in the last seven days by respondents.

Additionally, BBAQ is also a user-friendly tool assessing both internal and external barrier. Participants can understand their obstacles and thus cope with the problems they faced along the way to participate PA. Yet, it is a self-report questionnaire, it may lead to a potential problem that true barriers would hardly be differentiate from excuse to PA by respondents.

There are several limitations in this study. Firstly, some of the chi-square analyses cannot be interpreted due to the limited sample in particular categories. It is uncontrollable that the participants in low level of PA are extremely low in comparison to those in other levels. Larger sample is recommended for future study. Another limitation is generalization of our findings. In spite of the limitations in this study, most of our samples were from health-related faculty students. Health perception, health knowledge as well as other factors might slightly differ from the general population. Social, cultural and economical background of the respondents may also contribute to the difference. A joint tertiary education institution research that included all social, cultural and economical profile of participants is recommended to further investigate the PA habits and barriers.

Further study

Related research should emphasis on verifying whether the “fear of injury” and “lack of skill” are associated with PA level. There should be a further research concentrate on how to overcome the barriers of “lack of energy” and “lack of willpower” in female students population so as to enhance their PA level. Linked study should be focus on exploring how “social influence” affect PA participation among tertiary education students.

Conclusion

The results of the presented study demonstrate that “lack of energy” and “lack of willpower” had significantly association towards genders. A further contribution of the results is physical activity level is associated with genders. This study demonstrates a good foundation for continuous exploration towards this topic. This

research arouses the awareness of physical activity participation amongst tertiary education students.

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