International Journal of Sport, Exercise and Health Research

Research Article

IJSEHR 2020; 4(1): 26-30

www.sportscienceresearch.com
Received: 06-04-2020
Accepted: 06-06-2020

Physical activity level and participation in strength training (ST) activities among undergraduate female students

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Abstract

Background: Insufficient physical activity has been identified as a leading risk factor for Non-Communicable Diseases and global mortality. Healthy adults should be involved in Strength Training (ST) activities to be in Health Enhancing Physical Activities (HEPA) level. Undergraduates are physically fit and in finest age to understand importance of physical activities. However, most of undergraduates in worldwide were found to be inactive and highest were women. Therefore, this study aimed to describe the physical activity level, participation in ST activities and perceived benefits and barriers for ST activities among female undergraduates. **Methodology:** Two hundred female undergraduates of Faculty of Science, University of Colombo were randomly selected to conduct this descriptive cross-sectional study. Interviewer administered questionnaire was used to collect the data. Physical activity level was assessed by the first part of the questionnaire. Section one of the second part of the questionnaire focused on individual perception of benefits and barriers to ST activities while section two was used to determine barrier scores. Data was analyzed using the Statistical Package for the Social Sciences (SPSS), version 21.0. **Results:** The mean age of the participants was 22.66. Majority (63.0%; n= 121) was physically inactive, 33.3% (n=64) were minimally active and only 3.6% (n=7) were in HEPA category. Fifty one participants (26.6%) showed zero MET min/week for walking, 64 participants (33.3%) for moderate activities and more than half (68.8%; n=132) for vigorous activities. Majority (89.1%; n= 171) were not ST participants and 87.5% (n= 168) perceived ST as an important activity. Health benefits were perceived as the most important benefit of ST by 44.8% (n=86). Lack of time was the mostly (30.7%; n=59) perceived restricting barrier for ST activities. Barrier scores were different in at least one physical activity level ($p< 0.01$). **Conclusion:** These undergraduates appeared to be having a sedentary life style. Improved awareness on importance of ST and HEPA and time management skills will increase participation in ST which results increase the physical level of undergraduates.

Keywords: physical activity, strength training, barriers to strength training, exercise.

1. INTRODUCTION

Insufficient physical activity has been identified as a leading risk factor for Non Communicable Diseases and global mortality [1]. World Health Organization (WHO) defined the physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure [1]. It was estimated in 2010, that more than 80% of the adolescents in world is insufficiently physically active [1]. By 2013, 80% of WHO member states developed policies and plans to address physical inactivity. However, these were operational in only 53% of members [1]. A Global Physical Activity Questionnaire (GPAQ) was developed by WHO to measure physical activity in adults [1]. According to GPAQ categorization, health enhancing physical activity (HEPA) category has two requirements. Either, an individual should engage in vigorous-intensity activities on at least 3 days achieving a minimum of at least 1500 metabolic equivalent of task (MET)-min/week or 7 days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-min/week.

1.1 Strength Training activities

As mentioned by Kinser & Colby (2007), strength training is any form of exercise where an external force is applied manually or mechanically against the contraction of the muscle which can be either dynamic or static [2]. Vigorous activities including strength training (ST) are the activities that elevate the heart rate to 60%- 80% of one's maximum heart rate. Furthermore, the WHO, American College of Sports Medicine and the American Heart Association have highlighted the importance of ST, along with aerobic and flexibility exercises, as key elements to a well-rounded training program for healthy adults aged 18–64 years [3, 4].

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1.2 Undergraduates

Commonly, undergraduates are considered to be physically and psychologically fit. Most Universities provide facilities for students to engage in physical activities within the university premises. In spite of this, a study reported that undergraduates worldwide were physically inactive [5]. Also, it is a known factor that women start to reduce the physical activity or sport practice from the age of 11 or 12 [6]. This results in less physical activity among women than men [7]. The gender gap is also common in undergraduates [8]. This point was proved in a Sri Lankan study which was conducted among overweight adult women [9]. Sedentary physical activity level was found in 91% of the participants while only 8% showed light physical activity level in that study. These findings emphasized the importance of encouraging people on physical activities from young age.

1.3 Perceptions

It is necessary to understand the perceptions and barriers to desired activities in a population prior to introducing those activities. Also, it has been recommended that detection of determinants of physical inactivity should be a public health priority [10]. Improvements in psychological and body image were found as greater benefits in physical activities for women [11, 12, 13, 14]. Female undergraduates in United Kingdom believed the physical performance as the greatest benefit. As their perception it would be resulted in better psychological outlook, less health problems, life enhancement and social exertion. Their perceived greatest barrier was physical exertion [15]. Students in a Mediterranean country also have agreed with them regarding the benefits of exercise [16]. Leisure-time physical inactivity was found in 70.9% among Brazilian undergraduates who had reported perceived barriers [10]. Further, a significant relationship was found between perceived benefits, barriers and current exercise habits among undergraduates [17]. Lovell *et al*., (2010) reported significantly higher perceived benefits than barriers [15]. Even though a study has predicted more benefits and low barriers among strength trainers and non-strength trainers, their findings disclosed no differences between two groups [11]. Moreover, it was found that individuals in the early stages of exercise adoption would perceive more barriers and fewer benefits to exercise while those in the later stages of exercises perceive more benefits and fewer barriers. This may be the main reason to lack of motivation to initiate and continue ST activities [11]. As indicated by Reichert (2005), perceived barriers and benefits to exercise and magnitude of their association with physical inactivity depends on the study population [18]. It is essential to screen the level of physical activity prior to decision making and developing policies to promote and facilitate physical activity in each setting.

1.4 Sri Lanka

Available literature regarding perceived benefits and barriers to strength training in Sri Lanka are scarce. Accordingly, previous studies have shown that 28% of men and 44% of women adults in Sri Lanka did not fulfill criteria recommended by WHO for satisfactory physical activity [4]. Present study was aimed to describe the physical activity level, participation in ST activities and perceived benefits and barriers to ST activities among female undergraduates of University of Colombo, Sri Lanka.

2. MATERIALS AND METHODS

2.1 Study population and sample

A descriptive cross sectional study was conducted among female undergraduates of Faculty of Science, University of Colombo during two months period. A study sample of 200 apparently healthy, female undergraduates attached to faculty of science who were in close proximity to indoor gymnasium, fitness training centre and outdoor playground were selected using simple random sampling. Undergraduates with diagnosed physical or mental disabilities with or without medications were excluded.

2.2 Data collection tool

A self-administered questionnaire was developed. Part one of the questionnaire consisted with GPAQ. This section included types of physical activities undertaken by participants and estimation of level of their physical activities. Frequency (days per week) and duration (time per day) of each physical activity (walking, moderate-intensity activity and vigorous-intensity activity) in relation to job, transportation, household and leisure activities were included.

2.2.1 Calculation of MET scores

Scores were calculated in MET-minutes separately for each physical activity as given below;

1. Walking MET-min/week = 3.3*walking minutes*walking days
2. Moderate MET-min/week = 4.0* moderate-intensity activity minutes * moderate days
3. Vigorous MET-min/week = 8.0 * vigorous-intensity activity minutes * vigorous-intensity days.

Combined total physical activity was computed as the sum of Walking + Moderate + Vigorous MET-min/week scores. Level of physical activity was evaluated as inactive, minimally active or HEPA category according to the guidelines of GPAQ. Two criteria were used to classify an activity under HEPA, i.e.; individual should involve in vigorous activities to achieve a minimum of at least 1500MET-min/week or involve in combination of walking, moderate and vigorous intensity activities to achieve a minimum of at least 3000MET-min/week. To be considered as minimally active, individual should engage in any of these four; vigorous activities of 480 MET-min/week, moderate activities of 600 MET-min/week, walking activities of 495 MET-min/week or any combination of those three activities to achieve at least of 600 MET-min/week. Individuals who could not be considered for other two categories were considered as the physically inactive group.

Part two of the questionnaire had two sub sections. In the section one, individual's perception regarding the most important benefit and barrier was noted. Section two contained modified version of exercise benefits / barriers scale (EBBS) [19].

2.2.2 Exercise Benefits/Barrier Scale (EBBS)

From the original version of EBBS which contains 29 items under the construct of benefits and 14 items under the construct of barriers, only the barrier part was considered for this study. Four subscales were under the barrier component; exercise milieu, time expenditure, physical exertion and family discouragement. Each question had to be marked in a four point likert scale; strongly disagree (1) to strongly agree (4). If more than five percent of the items were unanswered, the response was discarded. Mean barrier scores were calculated separately for each physical activity level.

3. DATA ANALYSIS

Statistical analysis was performed using SPSS 21.0 version (Statistical Package for Social Sciences). Student t- test, Chi-square test and Analysis of Variance (ANOVA) method were used for the analysis.

4. RESULTS

Response rate was 96% (n=192/200). Mean age of the sample was 22.66 years.

4.1 Physical activity level

Physical activity levels were calculated as described above. More than half of the participants (63.02%; n=121) were categorized as at inactive level, one third (33.33%; n=64) at minimally active level and only 3.65% (n=7) were categorized under HEPA level. However more than a half (56.85%; n=109) perceived that they were in inactive stage while all of them were actually at inactive level. Only three individuals (1.56%) perceived that they were in HEPA category while their actual level also was HEPA category. Eighty students (41.67%) thought they were at minimally physical active level while 16 of them were not actually in that level. Table 1 presented the number of students with their perceived physical activity levels and their actual physical activity level.

Table 1: Perception and actual levels of physical activity (n=192)

Physical activity level	Perception on physical activity level (no. Of students)	Actual physical activity level (no. Of students)
Inactive	109 (56.77%)	121 (63.02%)
Minimally active	80 (41.67%)	64 (33.33%)
HEPA category	3 (1.56%)	7 (3.65%)
Total	192	192

Out of the three physical activities, volume of walking ranged from 0 to 3102 MET min/week among the participants. Fifty one individuals (26.6%) reported zero MET min/week for walking. The volume of moderate activities in this sample ranged from 0- 4800 MET min/week and 33.3% (n=64) reported zero MET min/week. Range of scores for vigorous activities was found as 0-4200 MET min/week while zero scores of MET min/week was reported by 68.8% (n=132).

4.2 Participation in strength training (ST)

Majority (87.5%; n=168) of the sample perceived strength training as an important activity. However, ST activities were not practiced by 89.1% (n= 171). Most (85.9% (n=147) of the non-participants (n=171) in ST activities considered it as important. From the non-participants of ST, 70.7% (n=121/171) were in inactive category, while 1.7% were in HEPA category. However, their perceived level of physical activity was inactive in 63.7% (n=109/171) and minimally active in 62 (36.25%). Interestingly, seventeen of ST participants (n=21) were in minimally active group.

4.3 Perceived benefits and barriers for ST activities

Health benefits were perceived as the most important benefit of ST activities by 44.8% (n=86) of students. Improvement of body image was perceived by 25.5% (n=49) and reduction of stress was by 22.9% (n=44) as the most important benefit. Also 2.6% (n=5) perceived improvement of muscular strength as the most important benefit and 4.2% (n=8) perceived no benefits of strength training activities. Improving social interactions and any other benefits were not perceived by none of the individuals. Significant association (P-Value=0.003) was found between the perception on the importance of ST activities and perception on most important benefits of ST activities at 5% significant level.

Lack of time (30.7%; n=59), exertion 23.4% (n=45), and less important as compared to other priorities to be completed within the available time (time waste) 20.8% (n=40) were identified as restricting barriers for ST activities. Furthermore, a significant association (P-Value=0.000) was found between the perception on the importance of ST activities and perception on most restricted barriers to ST activities at 5% significant level. Figure 1 describes the barriers perceived by female undergraduates for ST activities. Table 2 describes the tabulation of perception on benefits and participation in ST activities.

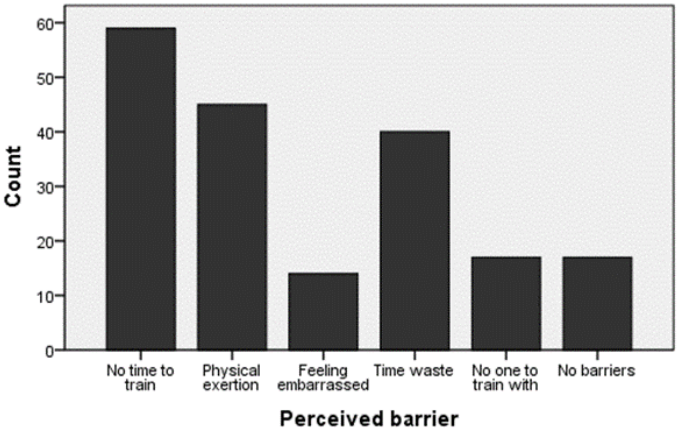

Figure 1: Perceived most restricting barrier to ST activities among female undergraduates

Table 2: Frequency of perception on benefits in participation in ST activities (n=192)

Perceived most important benefits	Participation in strength training activities	
	Yes	No
To improve health	11 (52.3%)	75(43.8%)
To improve body image	5(23.8%)	44(25.7%)
To reduce stress	2(9.52%)	42(24.5%)
To improve muscular strength	3(14.2%)	2(1.1%)
No benefits	0	8(4.6%)
To improve social interaction	0	0
Any other benefit	0	0
Total	**21**	**171**

Highest mean barrier score (32.19) was found for the group that had physical activity level at inactive category, while 30.29 and 28.15 were found in HEPA and minimally active groups respectively. At 5% significant level, mean barrier scores were different in at least one level of physical activity ($F = 12.892$, $p < 0.01$). Also, mean barrier scores were significantly different in ST activity participants and non-participants ($t = 2.44$, $p < 0.05$).

5. DISCUSSION

5.1 Physical activity level

Respondents were categorized into three groups; inactive (63%), minimally active (33.3%) and Health Enhancing Physical Activity (HEPA) (3.6%). Majority of participants belonged to the inactive group with regard to their physical activity status while only a significant minority belonged to HEPA group. These results seem to be slightly exaggerated when compared with the previous studies [20, 7, 21]. More than half of the sample (68.8%) reported 0 MET min/week for vigorous activities indicating that they did not engage in any vigorous activities during the academic, transportation, household chores or leisure time activities. Also, walking and moderate intensity activities were not as unpopular among them as only 33.3% presented 0 MET min/week for moderate activities and 26.6% for walking. Only a few students participated in ST activities. According to these results, participants were far behind the Global Physical Activity Questionnaire (GPAQ) standards. Many studies conducted among undergraduates have reported less than 50% of the population as inactive [20, 7, 21]. In the study done by Chan Sun and Azmutually (2013) in Mauritius, physical inactivity was relatively high among students in 18-25 years age group. One fifth of the students in

that study reported 0 MET min/week even for leisure-time physical activity [7].

5.2 Perception on ST activities

Perceived levels of physical activity were not significantly different from the actual levels identified in the study. Even though majority perceived ST as an important activity, participation in ST was only 10.9%. Even in United States, only 15% of female population over 18 years involved in ST activities [22].

5.3 Perception on benefits of ST activities

Most of the students perceived health profits as the most important benefit of ST activities while body image improvement and psychological benefits were also identified by a minority. These results were almost consistent with previous studies on perceived benefits of any physical activity [23, 14, 24]. Priority was given to psychological and body image benefits than for social benefits by participants in some other studies [11, 12, 13, 14]. In present study, all students who perceived that there are no benefits of ST and it is not important were non strength trainers. Since these participants are still in young age and physically fit, it seems that perception on benefits of ST activities is not enough to motivate them to engage in those activities. Furthermore, no significant relationship was found between the perceived benefits of ST and level of physical activity.

5.4 Perception on barriers for ST activities

Time and effort barriers were perceived by nearly 3/4th of individuals. Poor time management and insufficient knowledge regarding proper techniques could be underlying reasons as shown by other studies as well [6, 7, 8, 10, 14, 26]. An Iranian study found greater barriers among the students who had not engaged in regular physical activities [17]. Further, as found by Ranasinghe *et al*., (2016) lack of support and encouragement received during the childhood to engage in sports activities also could be a constrain [21]. Raising awareness on benefits of ST and providing facilities within easy access would increase the participation.

5.5 Reasons

Unawareness, poor time management or lack of sufficient time could be possible reasons which are worthwhile identifying. Non availability of infra-structure can also play a role. Access to exercise facilities also was identified as one of direct predictors of exercise [27]. Even though, academic commitments of the students could be the general constrain, there are many other domains such as household chores and transportation where walking, moderate and vigorous activities can easily be incorporated to improve physical activity level of undergraduates. Also it could be suggested that, perceived barriers had an effect on the participation in ST activities among these undergraduates. Similarly, the less physical activity among women than men was also a known factor as women started to reduce physical activities from the age of 11 or 12 years [7].

5.6 Significance

Overall findings suggested that these undergraduates appeared to be having a sedentary life style despite being in very close proximity to the playground and indoor gymnasium of a university in commercial capital of Sri Lanka. Guthold *et al.* (2008) found that, rural population was less physically inactive than urbanized groups [25]. Urbanization leads to an increase in sedentary life style. Further, findings of present study is very significant and highlight the need for urgent attention. Inactivity has been identified as the fourth leading risk factor for global mortality and for Non Communicable Diseases [1]. It is especially important to improve the physical fitness in young adult populations in order to prevent emergence of Non Communicable Diseases. Studies have shown that people who are in later stages of exercises experienced more benefits and fewer barriers where people who are at earlier stages of exercises experienced more barriers and fewer benefits [11].

Moreover, present study had several limitations. The effect of socio demographic characteristics such as religion and cultural beliefs and their residencies on physical activity level and participation in ST has not been evaluated. All these points focused the importance of further researches to identify the underlying factors including academic workload, exam time tables, time management skills, training schedules in gymnasium, awareness about the guidelines of ST and self-efficacy levels of undergraduates. Thereby, external and personal reasons for barriers of ST could be revealed. Also training programs have to be implemented to minimize barriers of ST activities thereby to increase the physical level of undergraduates.

6. CONCLUSIONS

Level of engagement in physical activities seems to be very unsatisfactory among the study population. Perceived and actual barriers need to be identified in detail. Improving awareness, facilities and supporting with other aspects such as provision of time management techniques, flexible curricula that allow time for physical activities will increase participation in health enhancing physical activities by undergraduates.

Funding: No funding source was used.

Conflict of interest: The authors report no conflict of interest.

Author contribution:

Study was designed by TT Ranaweera & YD Siriwardana. Data analysis part was carried out by TT Ranaweera, DR Fernando, and YD Siriwardana. Manuscript was written by DR Fernando, TT Ranaweera, and YD Siriwardana.

7. ACKNOWLEDGMENTS

Authors thank Physiotherapy research stream, Department of Allied Health Sciences, Faculty of Medicine, Colombo.

Ethical clearance

Ethical approval was obtained from the Ethics Review Committee (ERC) of the Faculty of Medicine, University of Colombo. Special approval was granted by the Dean of Faculty of Science, University of Colombo. Informed consent was taken from all study participants prior to the study.

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