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Original Article

Effects of a 15-week basketball training program following the club model in physical education courses for female students at Saigon University

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Abstract
Background. Increasing the quality of physical education (PE) courses by innovating training programs is essential to meet the training needs of students, improve their fitness, and innovate training approaches. The purpose of this study was to evaluate the effect of a new basketball program that follows a club model on female students at Saigon University after a 15-week experiment. *Materials and Methods*. A total of 64 healthy female students were chosen and randomly divided into two groups, i.e., an experimental group [which used the 15-week basketball program following the club model (BPCM)] and a control group (which used the program that is currently implemented in the PE course at Saigon University). In this study, five fitness tests were used such as a 30-s sit-up test (evaluates the core strength), 30-m sprint test (speed), 4 × 10-m shuttle run test (agility), standing long jump test (explosive power of the legs), and 5-min running field test [maximal aerobic speed (MAS)]. *Results*. The obtained results indicated that the application of 15-week BPCM training resulted in the higher scores for speed, agility, and maximum aerobic speed compared to those obtained by the current program, except for the scores for core strength and explosive power of the legs. In addition, the highest rate of increase in the control group was in agility (5.39%) and MAS (6.93%); while in the experimental group, the highest rate of increase was in MAS (16.09%) and speed (9.97%). *Conclusion*. BPCM can facilitate greater fitness enhancements, provide more benefits than the current program, create a healthy environment in studying PE, and satisfy the enhancing training needs of students at Saigon University. We recommend organizing more PE courses according to the new BPCM in the next academic year and classifying students in terms of training levels to achieve optimal results.
Keywords: 15-week BPCM, physical fitness, female students.

Introduction

University students are the future workforce. They are essential for innovation, industrialization, and modernization of the country. The development of their physical fitness is not only a matter of species preservation but also a matter of taking care of the essential workforce. Therefore currently, this is an important issue in the strategy of building and developing human resources in Vietnam to improve the quality of life (Gaetano, 2016). Herophilus, who is the father of scientific anatomy, in 300 B.C. stated "Without health and fitness, wealth is without value, knowledge is useless, art cannot become manifested, and music cannot be played" (Hornblower & Spawford, 1999). Thus, the aim of physical education is not only to help students have a good physical body but also to develop their body strength, endurance, and skills relative to their age, sex, as well as to establish relationships among students (Kostenko, 2018; Brynzak et al., 2021). This objective can be realized only through conscientious regulation of exercise, rest, diet, and periodic medical treatment. Physical education following the club model at schools promotes the creation of a healthy environment for training, improves physical fitness, and motivates students. Meanwhile, physical education (PE) courses are still heavily academic and have few course choices (Tuan, 2019). It is important to understand whether we should combine PE courses with a training program following the club model and whether this approach would change the sports practice habits of students? According to Tuan et al. (2016), many difficulties in building a training program following the club model are due to the lack of specific facilities for training, lack of attention from the board of directors, lack of student reviews about the studied sport, and lack of qualified coaches. However, if this program is applied, students will have more time for practicing their favorite sport, which will give them more opportunities to enhance their fitness, improve their performance during their regular studying time, and create a healthy environment for training with more choices.

Basketball is one of the most popular team sports that is played by both males and females of all ages and fitness levels, including our students at Saigon University. The physical capability and skill-related fitness of an individual in basketball are important characteristics that may contribute to competitive success. This is the reason why during training, coaches try to identify the best way for athletes to reach these necessary fitness components. It is necessary to develop a good training program to keep practitioners fit, motivated, and active. Therefore, the importance of developing good conditioning programs based on the specific physiological

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demands of each sport is considered a key factor to success (Taylor, 2003). Ziv and Lidor (2009) indicated that the use of a basketball program during training was limited owing to the lack of longitudinal studies, lack of examination tests under maximum exertion conditions (Reina et al., 2020), lack of examination about the position playing (Ronda, 2015) and lack of real-time movement studies. Research in exercise science has provided guidelines for the development of a safe and efficient program to improve personal fitness (Hoeger & Hoeger, 2002). However, most of our students had a full-time study plan in their major, and each person had different needs; thus, a single program for all was impossible. In reality, many students need higher exercise intensity when studying PE courses, i.e., the training plan should be as in the club model. This approach will require less time for the student to be ready for the competition. To meet this requirement, a new basketball training program was developed by following the club model in PE course for female students at Saigon University, which was our rationale in this study.

Materials and Methods

Participants

The participants of this study were 64 healthy female students, who attended a basketball course in the PE program at Saigon University. The participants did not have any physical problems, did not smoke, use alcohol, or were taking any medication. All of the participants joined the training for 15 weeks (equivalent to one semester). A total of 32 students (experimental group) were chosen to take part in a new basketball program following the club model; the remaining 32 students (control group) participated in the current basketball course in PE program at Saigon University. They were informed of the test procedures before providing written consent. This study was approved by the Saigon University board for the use of human beings (students). All participants were recommended to continue their daily dietary and physical activity training throughout the study.

Procedures

Two weeks before the training, each participant answered a brief baseline questionnaire about their personal information and sport-related injury history (the participants were excluded if there were any problems). One week after, all participants underwent examination of their fitness (1st testing) before the PE program began. Five fitness tests were used in this study, such as a 30-s sit-up test (evaluated the core strength), 30-m sprint test (speed), 4 × 10-m shuttle run test (agility), standing long jump test (explosive power of the legs), and 5-min running field test [maximal aerobic speed (MAS)], which are suitable for evaluating the fitness of amateur athletes similar to our students at Saigon University (Ministry of Education & Training, 2008) and also suited for evaluating the fitness in basketball course as PE program at Saigon University yearly (Tuan & Son, 2017) with high reliability.

Then, all participants in the two groups underwent 15-week training (described in Figure 1) under the same conditions such as the time of studying, facility use, weather, and climate. The time for training was 9.00 a.m. to 11.00 a.m. every Wednesday (once a week as in the PE program). At the end of the 15th week, two groups underwent the second examination of fitness (identical to the 1st testing).

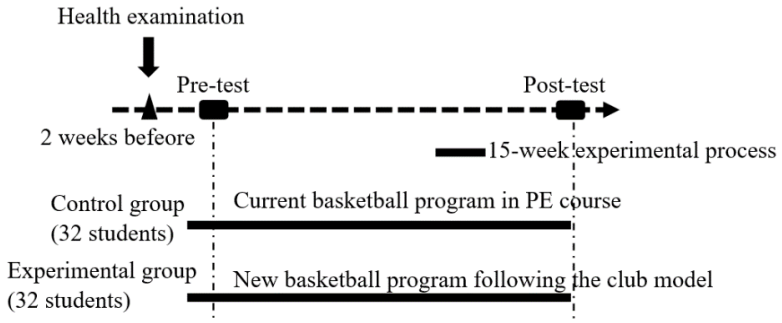


Figure 1. Research design of the study

Basketball program following the club model (BPCM) at Saigon University

A new 15-week BPCM was divided into four categories such as fitness, skills, tactics, and other training (described in Table 1).

Therefore, the training intensity regularly increased. During training, BPCM used tactics and skill-based exercises (e.g., tip-in, lay-up and block, rebound, and spin move), stealing techniques, and mixed training (e.g., man-to-man, triangle defense, and fast break). In addition, BPCM familiarized the participants with the rules and provided mental training for the competitions. In contrast, the currently used program (PE course) focused only on fitness training and two techniques (dribble and shot) to evaluate students' final grades.

Statistical analysis

All data are expressed as the mean and standard deviation values (mean ± SD). The obtained data were analyzed by Statistical Package for the Social Sciences (SPSS) for Windows version 20. Descriptive analysis was used to identify the subject characteristics. Independent sample t-test was used to evaluate differences in each test between the control and experimental groups. Paired sample t-test was used to identify differences between pre-test and post-test. The level of statistical significance was set at $p < 0.05$.

Table 1. 15-week BPCM training

Weeks	H	T	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	T
1. Fitness training																		
+ Speed			x	x	x	x												
+ Strength					x	x	x											
+ Endurance			x	x	x	x	x	x										
+ Cooperation								x	x	x	x	x	x	x	x	x		
+ Agility								x	x	x	x	x	x					
+ Flexibility							x	x	x									
+ Reaction time								x	x	x								
+ Mixed training											x	x	x	x	x	x	x	
2. Skills																		
+ Personalization			x	x	x	x	x	x	x	x	x	x	x	x				
+ Dribble-pass control			x	x	x	x	x	x	x	x								
+ Lay-up and block										x	x	x	x	x				
+ Jump-shot														x	x	x		
+ Mixed training													x	x	x	x	x	
3. Tactics																		
+ Individuals						x	x	x	x	x	x	x	x					
+ Defensive												x	x	x	x			
+ Offensive														x	x	x	x	
+ Mixed training															x	x	x	
4. Other training																		
+ Rules			x	x	x													
+ Mental training	x	x	x														x	x

Notes: x indicates that the participants are being trained; gray areas indicate that the participants are being tested. H: health examination day. T: testing day

Results

The average age, height, and weight of 64 healthy female students were 20.01 ± 0.59 years, 157.89 ± 4.64 cm, and 48.03 ± 6.86 kg, respectively. In the control group, the average age, height, and weight were 19.93 ± 0.56 years, 158.09 ± 4.42 cm, and 47.91 ± 4.69 kg, respectively; the experimental group, the values were 20.06 ± 0.62 years, 157.68 ± 4.92 cm, and 48.16 ± 8.59 kg, respectively (more details in Table 2). No students were eliminated during the experiment.

Table 2. Subjects' characteristics (n = 64)

Group	Age (years)	Height (cm)	Weight (kg)
Control (n = 32)	19.93 ± 0.56	158.09 ± 4.42	47.91 ± 4.69
Experimental (n = 32)	20.06 ± 0.62	157.68 ± 4.92	48.16 ± 8.59
All (n = 64)	20.01 ± 0.59	157.89 ± 4.64	48.03 ± 6.86

Note: The *values are the mean ± standard deviation.*

Table 3 shows the mean differences in students' fitness between the control and experimental groups before the application of the 15-week basketball training program at Saigon University. There were no significant differences in all fitness tests (such as 30-s sit-up test, 30-m sprint test, 4 × 10-m shuttle run test, standing long jump test, and 5-min running field test) between the control and experimental groups. This result suggests that the level of fitness in the two groups is similar. Therefore, it was possible to continue to implement the application of 15-week training programs in each specific group.

Table 4 shows the mean differences in students' fitness between pre-test and post-test (before and after the application of the 15-week training program) in both the control and experimental groups.

The results in Table 4 show that there are significant differences between pre-test and post-test in all fitness testing and both groups (control and experimental groups). This means that both programs were suitable for female students at Saigon University to enhance their fitness during the period of studying PE. In addition, the highest rate of increase in the control group was in agility (5.39%) and MAS (6.93%); while in the experimental group, the highest rate of increase was in MAS (16.09%) and speed (9.97%) (Figure 2 provides additional details).

Table 3. Mean differences between the control and experimental groups before the experiment

Test	Group	Mean ± SD	t	p
1	Control	15.78 ± 1.13	-0.129	.898
	Experimental	15.81 ± 0.78		
2	Control	5.95 ± 0.22	0.051	.959
	Experimental	5.94 ± 0.43		
3	Control	12.23 ± 0.16	0.267	.791
	Experimental	12.21 ± 0.44		
4	Control	169.75 ± 14.58	-0.06	.952
	Experimental	169.97 ± 14.38		
5	Control	772.66 ± 37.11	-0.041	.967
	Experimental	773.12 ± 52.08		

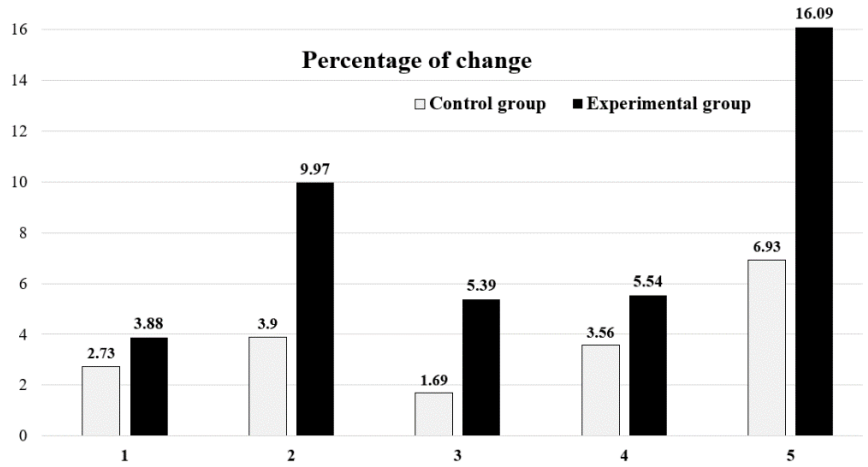
Notes: number the row in the table - 1: 30-s sit-up (times), 2: 30-m sprint (s), 3: 4 × 10 m shuttle run (s), 4: standing long jump (cm), 5: 5-min running (m). SD: Standard deviation

Our study showed an improvement in all basketball fitness tests for female students who participated in PE courses at Saigon University for both groups (experimental and control groups) between before and after the application of the two training programs. Many studies confirm this increase such as Mancha-Triguero et al. (2020); Aschendorf et al. (2019), Tamer et al. (2017), Zarić (2014), Scanlan et al. (2014), and Yilmaz et al. (2010).

Table 4. Mean differences between pre- and post-test in both groups

Group	Test	Time		t	p	Percentage of change
		Pre-test	Post-test			
Control	1	15.78 ± 1.13	16.22 ± 0.71	−2.946	.006	2.73
	2	5.95 ± 0.22	5.72 ± 0.19	15.102	.000	3.9
	3	12.23 ± 0.16	12.02 ± 0.13	6.326	.000	1.69
	4	169.75 ± 14.58	175.91 ± 9.65	−4.931	.000	3.56
	5	772.66 ± 37.11	828.12 ± 40.28	−21.557	.000	6.93
Experimental	1	15.81 ± 0.78	16.44 ± 0.84	−4.706	.000	3.88
	2	5.94 ± 0.43	5.54 ± 0.41	12.806	.000	9.97
	3	12.21 ± 0.44	11.74 ± 0.46	12.032	.000	5.39
	4	169.97 ± 14.38	179.66 ± 12.79	−11.728	.000	5.54
	5	773.12 ± 52.08	885.63 ± 46.76	−10.421	.000	16.09

Notes: 1: 30-s sit-up (times), 2: 30-m sprint (s), 3: 4 × 10 m shuttle run (s), 4: standing long jump (cm), 5: 5-min running (m). The values are expressed as the mean ± standard deviation.



Notes: 1: 30-s sit-up, 2: 30-m sprint, 3: 4 × 10 m shuttle run, 4: standing long jump, 5: 5-min running

Figure 2. Percentage of change after the experiment in both groups

Table 5 shows the differences in students' fitness between the control and experimental groups after the application of the 15-week training program at Saigon University. There were significant differences between the experimental and control groups in speed (30-m sprint test), agility (4 × 10-m shuttle run test), and MAS (5-min running field test); there were no significant differences in the core strength (30-s sit-up test) and explosive power of the legs (standing broad jump test).

Table 5. Mean differences between the control and experimental groups after the experiment

Test	Group	Mean ± SD	t	p
1	Control	16.22 ± 0.71	−1.127	.264
	Experimental	16.44 ± 0.84		
2	Control	5.72 ± 0.19	2.262	.029
	Experimental	5.54 ± 0.41		
3	Control	12.02 ± 0.13	3.451	.001
	Experimental	11.74 ± 0.46		
4	Control	175.91 ± 9.65	-1.324	.19
	Experimental	179.66 ± 12.79		
5	Control	828.12 ± 40.28	-5.27	.000
	Experimental	885.63 ± 46.76		

Notes: 1: 30-s sit-up (times), 2: 30-m sprint (s), 3: 4 × 10 m shuttle run (s), 4: standing long jump (cm), 5: 5-min running (m). SD: Standard deviation

The results in Table 5 show that after the application of BPCM, the experimental group had higher scores in speed, agility, and MAS than the control group. Basketball is one of the fastest-paced sports in the world. Therefore, speed and agility fitness are necessary for basketball players to improve footwork in competitions. It was also essential for decreasing the incidence of injuries in players (Mancha-Triguero et al., 2019; Olsen et al., 2005). In addition, the ability to rapid sprint, start running, and stop continuously while always keeping an eye on the opponent or the ball and the ability to rapidly change direction depending on the game situation are essential in basketball (Lockie et al., 2014; Spiteri et al., 2014). Therefore, any basketball training program needs to improve speed and agility (Aoki et al., 2017). Clearly, in this study, BPCM produced better results in speed and agility fitness than the current program and met the higher demand in training for female students at Saigon University. The participants in the experimental group were pushed harder to run and move under the application of the training program, which explains better results in speed, agility, and MAS indexes than those in the control group. These differences may be due to the fact that the new basketball program included conditioning training (campus and on-court running) in fitness training, special situation training in skills training, and position play in tactics training (Table 1 provides additional details).

Discussions

Dabonneville et al. (2003) indicated that the 5-min running field test can be used to evaluate an individual's training velocity on the actual training ground used for trained athletes. This test is reliable for testing the maximum velocity speed (MAS), especially in the heterogeneous group. In addition, MAS is directly related to the maximum oxygen uptake (Berthoin et al., 1996). Basketball players have to develop aerobic performance to allow better economy in sport-specific activities and faster recovery from anaerobic loads (Gocentas & Landor, 2006). Thus, aerobic index is important for basketball athletes. Specifically, when a higher demand is needed in running, the MAS must also increase (Baker & Heaney, 2015). In this study, the MAS index also increased owing to the demand during training in the BPCM.

Meszler et al. (2019) noted that the 7-week plyometric training program did not enhance the agility, balance, hamstring strength, except for the knee extensor strength. This may be due to the excessive fatigue, which did not restore in time between training sessions. Moreover, high-resistance circuit training may make athletes more susceptible to higher exhaustion, which leads them to perform less effectively (Freitas et al., 2016). However, if the intensity is low to moderate, it does not reduce mobility at all. In our study, this was the first time the BPCM was implemented for female basketball students, who felt strange to use the program but otherwise were motivated and sometimes became exhausted owing to the different way of training. However, the intensity of training was not too heavy during every training session, and training was only once per week as in the PE program. Thus, participants had enough time to recover and avoid the same intense training routines as in other training programs.

Core strength involves the strength of trunk muscles, which is necessary for playing basketball. Fort et al. (2012) showed the enhancement of the explosive strength after 15 weeks of vibration training. Kumar (2019) noted that core strength training can improve speed. Asadi (2013) showed an increase in both agility [Illinois Agility Test (IAT)] and power (standing long jump test) after using the 6-week in-season training for Division I basketball players. However, our results showed no significance in core strength and explosive power of the leg between the experimental and control groups. This can be explained by the low fitness level of participants (all of them were students at Saigon University). Lehnert et al. (2013) showed that the 6-week plyometric training program did not improve the explosive strength and agility in elite basketball athletes. According to Erculj et al. (2010), athletes with lower training status or lower training levels have lower results in acceleration, agility, explosive strength, and take-off power. Furthermore, the lack of change in core strength and explosive power of the legs may be due to the fact that strength training in the BPMC (which is focused on weight lifting and jumping on the court with weight) and the exercises in the current program of the PE course were similar.

It is difficult to directly compare the results of many previous studies because of the difference in gender, age, level of fitness (amateur, long-term training, semi-professional, or elite athletes), types of examination tests, number of training times per week, as well as political and cultural differences (Conte et al., 2015). Our study attempted to identify a better way to improve students' fitness during their full-time major studying. Thus, they required less time to join the basketball club next semester and were ready for training to prepare for the competition. Both training programs used in this study were beneficial for female students at Saigon University. However, the application of the BPCM met the increasing training needs of students in basketball at Saigon University. In other words, the application of the BPCM in the PE course at Saigon University provided more benefits than the current program. Tuan (2019) indicated that female students had low satisfaction with PE courses at Saigon University when participating in elective sports courses. According to Gibbons (2009), if females did not find value in PE courses (i.e., improved their fitness, got new friends, received more excitement in training), they would drop out when the opportunity came. However, if PE courses met the needs of female students and increased their physical activity, PE courses would become a regular part of their lives. Thus, we suggest organizing more PE courses according to the new BPCM in the next academic year and classifying students in terms of training levels to achieve optimal results.

Conclusions

Training female students in basketball was a very exciting and refreshing experience for the authors. Although female mobility had certain limitations, they showed maximum effort in most training sessions and had many positive results. According to our results, the effect of 15-week BPCM training at Saigon University positively improved speed, agility, and MAS of female students; however, the core strength and explosive power of the legs remained unchanged. It was difficult to identify reasons for the change or lack of change in female students' physical fitness owing to the differences in gender, region, training program, climate, and types of examination tests, etc. Simply evaluating the effectiveness of basketball training for healthy female students without any control after training (i.e., tips on nutrition, reasonable rest regime, limit heavy activities after the training session) was a limitation of our study. In conclusion, the new 15-week BPCM training produces improvements, provides more benefits than the current program, creates a healthy environment for studying PE, and meets the enhanced training needs of students at Saigon University. In addition, the participants of this study had a lot of time for fun, explored their abilities, and improved their physical fitness in basketball, which helped them to develop more social relationships for later professional work.

Author contributions

Tran Minh Tuan (corresponding author) drafted, wrote, and revised the article, while the coauthor Tran Ngoc Cuong revised and edited the article. Both authors approved the final version of the manuscript. Both authors agreed on the order of the presentation.

Ethical approval

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Conflict of interest

The authors declare that there is no conflict of interest that could be perceived as interfering with publication of this article.

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