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## Effectiveness of a Combined Fitness and Basketball Drill Program for Male Students in Basketball Course 1 at Saigon University

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### Abstract

**Objective:** To evaluate a 12-week combined fitness and basketball drill program on health-related fitness and perceived exertion in male students.

**Methods:** 96 male students (19–21y) were randomized into EG (n=45, 22 exercises) and CG (n=51, standard curriculum). Fitness tests: grip, long jump, sit-ups, shuttle, 30m sprint, 5-min run. RPE: Borg 6–20. Welch's or independent t-test as appropriate.

**Results:** EG improved significantly more than CG in all fitness tests ( $p < 0.05$ ), especially 30m sprint, sit-ups, grip. Post-test RPE lower in EG (12.60 vs 13.96,  $p < 0.001$ ).

**Conclusion:** A 12-week supplementary program improves fitness and reduces RPE in male non-athlete students. Supports integration into elective sports curricula.

**Keyword:** Basketball, Combined Training, Physical Fitness, Perceived Exertion, University Students

### Introduction

Basketball is a high-intensity intermittent team sport that requires comprehensive development of motor qualities including speed, strength, endurance, agility, and coordination (Scanlan *et al.*, 2014; Delextrat & Martinez, 2014) <sup>[10]</sup>. While extensive research exists on elite and youth basketball players (Stojanović *et al.*, 2018; Svilar *et al.*, 2018) <sup>[11]</sup>, considerably less attention has been paid to non-specialized university students participating in elective basketball courses, particularly in Southeast Asian contexts.

At Saigon University (SGU), basketball is one of five elective sports in the Physical Education (PE) program. However, the current Basketball Course 1 curriculum is heavily focused on basic techniques—dribbling, passing,

shooting—and lacks systematic content for developing general physical fitness. Consequently, students often struggle to maintain technique and intensity during prolonged game activities (Huynh *et al.*, 2014) <sup>[6]</sup>.

Previous studies in Vietnam have demonstrated that supplementing with specialized exercise programs improves physical fitness and skill performance (Nguyen, 2021; Trinh, 2022; Ly, 2022) <sup>[9]</sup>. However, no controlled study has been conducted specifically for male non-specialized students at SGU. Furthermore, few intervention studies report perceived exertion (RPE) as an indicator of training acceptability alongside performance outcomes (Foster *et al.*, 2001) <sup>[5]</sup>, despite evidence that lower perceived effort is associated with better long-term adherence (Dishman *et al.*, 2015) <sup>[4]</sup>.

This study evaluates a 22-exercise battery on 6 fitness components and RPE in male students in Basketball Course 1.

### Literature Review

Basketball is a high-intensity intermittent team sport requiring comprehensive motor qualities (Scanlan *et al.*, 2014; Delextrat & Martinez, 2014) <sup>[10, 2]</sup>. While extensive research exists on elite players (Stojanović *et al.*, 2018; Svilar *et al.*, 2018) <sup>[11]</sup>, limited attention has been paid to non-specialized university students in Southeast Asian contexts. At Saigon University, the Basketball Course 1 curriculum focuses heavily on basic techniques without systematic fitness training (Huynh *et al.*, 2014) <sup>[6]</sup>. Previous Vietnamese studies have shown that supplementary exercise programs improve fitness and skill performance (Nguyen, 2021; Trinh, 2022; Ly, 2022) <sup>[9]</sup>. However, no controlled study has been

conducted specifically for male non-specialized students at SGU, and few interventions have reported perceived exertion alongside performance outcomes (Foster *et al.*, 2001; Dishman *et al.*, 2015) <sup>[5, 4]</sup>.

### Methodology

#### Participants

A total of 96 healthy male students (age 19–21 years) enrolled in Basketball Course 1 at SGU during the 2024–2025 academic year volunteered to participate. They were randomly assigned via a computer-generated random number sequence into an experimental group (EG, n=45) and a control group (CG, n=51). Exclusion criteria included any physical injury, chronic illness, medication use affecting physical performance, or absence from more than 20% of sessions.

**Table 1:** Characteristics of participants (n=96)

Variable	Experimental Group (n=45)	Control Group (n=51)	p
Age (years)	19.67 ± 0.67	19.92 ± 0.77	.090
Height (cm)	171.11 ± 3.65	170.88 ± 4.56	.788
Weight (kg)	60.87 ± 3.38	61.71 ± 3.85	.263

Note: Data presented as mean ± SD, no significant differences ( $p > 0.05$ )

Table 1 presents a comparison of baseline characteristics between the experimental group (n=45) and the control group (n=51). The results revealed no statistically significant differences between the two groups in mean age (19.67 ± 0.67 vs. 19.92 ± 0.77 years;  $p = 0.090$ ), height (171.11 ± 3.65 vs. 170.88 ± 4.56 cm;  $p = 0.788$ ), or weight (60.87 ± 3.38 vs. 61.71 ± 3.85 kg;  $p = 0.263$ ). All p-values exceeded the 0.05 threshold, indicating that the two groups were comparable in terms of age and anthropometric measures at baseline.

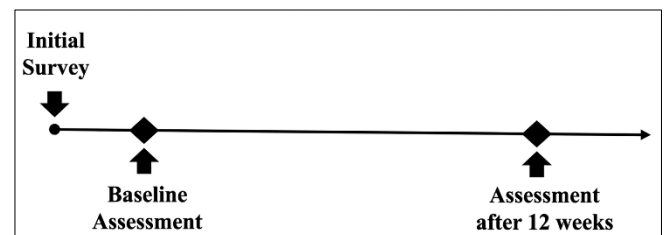
### Ethical Approval

Ethical clearance for the study was obtained from the Scientific and Ethical Review Committee of Saigon University (reference number: CSB2024-18). Written informed consent was secured from all participants after they had been given a clear explanation of the study's purpose, procedures, potential risks, and benefits.

### Research Design and Procedure

Ninety-six volunteer participants were enrolled based on predetermined inclusion criteria: healthy, no history of musculoskeletal injuries in the past six months, not using any performance-enhancing drugs or medications affecting physical function, and non-smokers. One week prior to the intervention, an initial survey was conducted to collect demographic and baseline health data. At the beginning of week 1, all participants underwent a pretest (physical fitness assessment) to evaluate their initial status. They were then randomly assigned to EG (n=45) or CG (n=51). The size difference was due to 7 participants withdrawing before the first session (4 EG, 3 CG) because of scheduling conflicts. No further dropouts occurred during the 12-week program. All participants trained twice per week, each session lasting 100 minutes (from 7:00 to 8:40 a.m.) on Tuesdays and Thursdays. A post-test was conducted immediately after the 12-week program. Perceived exertion was assessed immediately after each session using Borg's 6–20 RPE scale (Borg, 1977), with the average of weeks 11–12 used for analysis. The complete research procedure, including

participant allocation, intervention protocols, and testing timeline, is illustrated in Figure 1.



**Fig 1:** Research design of the study

### Intervention

The intervention lasted 12 weeks (2 sessions/week, 100 minutes/session). The experimental group (EG) performed 22 supplementary exercises in addition to the standard basketball curriculum, while the control group (CG) followed only the standard curriculum (basic dribbling, passing, shooting drills without systematic fitness training). The 22 exercises were selected through a two-step process. First, a pool of 50 potential exercises relevant to basketball was compiled. Second, a panel of 30 experienced coaches and physical education lecturers evaluated each exercise using a three-level scale ("Agree", "Rarely agree", "Disagree"). Only exercises achieving ≥80% consensus (≥24/30 experts choosing "Agree") were retained. The final 22 exercises comprised two categories: Category 1 – General physical fitness exercises (n=11, items 12-16, 18-22 in the list below) targeting strength, power, endurance, and flexibility; Category 2 – Basketball-specific drills (n=10, items 1-11 excluding item 17, plus item 17 as game-based activity). The first group was General Physical Fitness, consisting of 11 exercises: Exercise 12 – jump squat, Exercise 13 – bodyweight squat with pass, Exercise 14 – 5-minute endurance run, Exercise 15 – jump rope, Exercise 16 – box jump (30–50 cm), Exercise 18 – hamstring stretch, Exercise 19 – quadriceps stretch, Exercise 20 – calf stretch, Exercise 21 – groin stretch, and Exercise 22 – shoulder stretch. The second group was Basketball-specific Drills,

also consisting of 11 exercises: Exercise 1 – warm-up with two-hand pass, Exercise 2 – warm-up with ball around the body, Exercise 3 – figure-8 dribble around the legs, Exercise 4 – V-dribble on the spot, Exercise 5 – stationary one-hand overhead shot, Exercise 6 – two-step dribble and one-hand overhead shot, Exercise 7 – stationary below-knee bounce dribble, Exercise 8 – continuous alternating left-right dribble, Exercise 9 – speed dribble for 30 meters, Exercise 10 – two-hand chest pass, and Exercise 11 – combination pass-catch-two-step shot and Exercise 17 – 2v2 half-court game.

Exercise intensity for the general fitness component was prescribed at 60-70% of heart rate reserve (HRR) for endurance exercises, and 8-12 repetitions at 60% of estimated 1RM for strength exercises. Basketball-specific drills were performed at game-like intensity (RPE target: 13-15 on Borg 6-20 scale).

Table 2 details how these 22 exercises were integrated into the 100-minute session, with a total of 45 minutes allocated to the supplementary exercises across the warm-up, main fitness, and cool-down phases.

**Table 2:** Application of exercises within a 100-minute session

No.	Activity	Time	Exercise Application
1	Class announcement, attendance	5 min	
2	Warm-up (general and specialized)	15 min	X
3	Recovery and water break	5 min	
4	Main content training	30 min	
5	Mid-session break	5 min	
6	Physical fitness development	20 min	X
7	Recovery and water break	5 min	
8	Cool-down and stretching	10 min	X
9	Session evaluation and dismissal	5 min	
Summary		100 min	45 minutes

Note: The 45-minute supplementary block includes both general physical fitness exercises (20 minutes, during ‘Physical fitness development’ phase) and basketball-specific drills (25 minutes, integrated into Main content training and Warm-up phases)”.

**Statistical Analysis**

Data are presented as mean ± standard deviation (SD). Normality was checked using the Shapiro–Wilk test (p > 0.05 for all variables). Homogeneity of variances was assessed using Levene’s test. For between-group comparisons at pre-test, independent-samples Student’s t-test was used because Levene’s test was not significant for any variable. For post-test comparisons, when Levene’s test indicated unequal variances (p < 0.05), Welch’s t-test was used instead of Student’s t-test. Within-group pre-post changes were analyzed using paired-samples t-tests. Statistical significance was set at p < 0.05. All analyses were performed using SPSS version 20. To assess steady-state adaptation and minimise the influence of initial familiarisation effects, we calculated the mean RPE from the last two weeks (weeks 11 and 12) of the intervention.

**Results**

**Baseline Homogeneity (Independent Samples T-test)**

Table 3 shows the pre-intervention comparisons between the experimental group (EG, n=45) and control group (CG, n=51) revealed no statistically significant differences in any of the six physical fitness tests (p > 0.05 for all). Levene’s test confirmed homogeneity of variances across all tests (p > 0.05). Specifically: hand grip (EG: 40.98±2.77 kg, CG: 41.14±2.68 kg, t = -0.287, p = 0.775); standing long jump (208.18±2.14 cm vs. 207.67±1.83 cm, t = 1.263, p = 0.210); sit-ups (19.89±0.61 vs. 19.69±0.65 reps, t = 1.570, p = 0.120); 4x10m shuttle run (13.07±0.81 vs. 13.25±0.85 s, t = -1.111, p = 0.269); 30m sprint (5.98±0.15 vs. 5.96±0.19 s, t = 0.473, p = 0.637); 5-minute run (972.04±12.75 vs. 973±12.94 m, t = -0.505, p = 0.615).

**Table 3:** Pre-test physical fitness of EG and CG

Test	Time	Levene’s F	Sig.	EG (n=45)	CG (n=51)	t	df	p
1	Pre-test	0.587	0.45	40.98±2.77	41.14±2.68	-0.287	94	.775
2	Pre-test	2.208	0.141	208.18±2.14	207.67±1.83	1.263	94	.210
3	Pre-test	3.033	0.085	19.89±0.61	19.69±0.65	1.570	94	.120
4	Pre-test	1.253	0.266	13.07±0.81	13.25±0.85	-1.111	94	.269
5	Pre-test	0.906	0.344	5.98±0.15	5.96±0.19	0.473	94	.637
6	Pre-test	0.240	0.625	972.04±12.75	973.37±12.94	-0.505	94	.615

Note: (1) Hand grip (kg), (2) Standing long jump (cm), (3) Sit-ups (times), (4) 4x10m shuttle run, (5) 30m sprint (s), (6) 5-minute run (m), EG: Experimental group, CG: Control group. All Levene's tests for pre-test comparisons were non-significant (p > 0.05), indicating homogeneity of variances.

**Post-Intervention Comparison (Independent Samples T-test):**

After 12 weeks of intervention, independent samples t-tests revealed that the experimental group (EG) significantly outperformed the control group (CG) in all six physical fitness tests (p < 0.05). Specifically: hand grip (EG: 44.56±2.62 kg, CG: 42.45±2.22 kg, t(94) = 4.263, p = 0.000); standing long jump (219.02±6.31 vs. 214.92±2.84 cm, t(59.49) = 4.016, p = 0.000); sit-ups (22.58±1.32 vs. 21.29±0.78 reps, t(69.52) = 5.691, p = 0.000); 4x10m shuttle

run (11.93±0.62 vs. 12.51±0.64 s, t(93.33) = -4.472, p = 0.000); 30m sprint (5.04±0.21 vs. 5.39±0.49 s, t(69.08) = -4.592, p = 0.000); 5-minute run (1077.60±65.54 vs. 1044.04±34.67 m, t(64.93) = 3.076, p = 0.003). The largest between-group differences were observed in muscular endurance (sit-ups) and explosive speed (30m sprint and shuttle run), as indicated by the highest t-values and lowest p-values.

**Table 4:** Post-test physical fitness comparison

Test	Time	Levene's F	Sig.	EG (n=45)	CG (n=51)	t	df	p
1	Post-test	1.039	0.311	44.56±2.62	42.45±2.22	4.263	94	.000
2	Post-test	27.104	0.000	219.02±6.31	214.92±2.84	4.016	59.49	.000
3	Post-test	12.330	0.001	22.58±1.32	21.29±0.78	5.691	69.52	.000
4	Post-test	4.831	0.030	11.93±0.62	12.51±0.64	-4.472	93.33	.000
5	Post-test	160.29	0.000	5.04±0.21	5.39±0.49	-4.592	69.08	.000
6	Post-test	16.053	0.000	1077.60±65.54	1044.04±34.67	3.076	64.93	.003

Note: (1) Hand grip (kg), (2) Standing long jump (cm), (3) Sit-ups (times), (4) 4x10m shuttle run, (5) 30m sprint (s), (6) 5-minute run (m), EG: Experimental group, CG: Control group. For post-test comparisons, Levene's test indicated heterogeneity of variances for tests 2-6 ( $p < 0.05$ ), therefore Welch's t-test was used. Test 1 had equal variances ( $p > 0.05$ ), so Student's t-test was used.

**Pre-Post Improvements Within Groups (Paired Samples T-test)**

Both groups improved significantly ( $p < 0.05$  for all tests). However, the EG demonstrated significantly larger improvements across all tests, as indicated by the mean differences and t-values in Table 5. These results highlight the superior efficacy of the supplementary program in eliciting rapid physical adaptations.

**Table 5:** Pre- and post-test comparison within groups

Test	Time	Pre-test	Post-test	t	df	p
1	EG (n=45)	40.98±2.77	44.56±2.62	-9.935	44	.000
	CG (n=51)	41.14±2.67	42.45±2.22	-3.409	50	.001
2	EG (n=45)	208.18±2.14	219.02±6.31	-10.866	44	.000
	CG (n=51)	207.67±1.83	214.92±2.84	-14.701	50	.000
3	EG (n=45)	19.89±0.61	22.58±1.32	-14.444	44	.000
	CG (n=51)	19.69±0.65	21.29±0.78	-12.456	50	.000
4	EG (n=45)	13.07±0.81	11.93±0.62	7.356	44	.000
	CG (n=51)	13.25±0.85	12.51±0.64	5.236	50	.000
5	EG (n=45)	5.98±0.15	5.04±0.21	23.992	44	.000
	CG (n=51)	5.96±0.19	5.39±0.49	7.585	50	.000
6	EG (n=45)	972.04±12.75	1077.60±65.54	-10.962	44	.000
	CG (n=51)	973.37±12.94	1044.04±34.67	-14.161	50	.000

Note: (1) Hand grip (kg), (2) Standing long jump (cm), (3) Sit-ups (times), (4) 4x10m shuttle run, (5) 30m sprint (s), (6) 5-minute run (m), EG: Experimental group, CG: Control group. Within-group comparisons from pre-test to post-test for both groups. All improvements were statistically significant ( $p < 0.05$ ).

**Rating of Perceived Exertion (RPE)**

Table 6 presents changes in perceived exertion (RPE) before and after the intervention in both the experimental group (EG) and the control group (CG). In the EG ( $n = 45$ ), mean RPE decreased from  $14.27 \pm 0.44$  at Week 1 to  $12.60 \pm 0.65$  at Week 12, a statistically significant difference ( $t(44) = 14.544, p < 0.001$ ). In the CG ( $n = 51$ ), mean RPE also decreased slightly from  $14.29 \pm 0.46$  at Week 1 to  $13.96 \pm 0.87$  at Week 12, which was statistically significant as well ( $t(50) = 2.397, p = 0.020$ ). Thus, both groups showed improvements in RPE following the intervention; however, the reduction in the EG (a decrease of 1.67 points) was substantially greater than that in the CG (a decrease of 0.33 points), and the level of statistical significance was also higher in the EG. This finding is crucial: the EG reported significantly lower perceived exertion despite performing more demanding physical work, signaling superior training adaptation. At week 12, EG had significantly lower RPE than CG ( $12.60 \pm 0.65$  vs.  $13.96 \pm 0.87, t(94) = -8.34, p < 0.001$ ).

**Table 6:** Perceived exertion (RPE) pre- and post-intervention

Test	Time	Week 1	Week 12	t	df	p
RPE	EG (n=45)	14.27±0.44	12.60±0.65	14.544	44	.000
	CG (n=51)	14.29±0.46	13.96±0.87	2.397	50	.020

**Discussion**

The 12-week supplementary 22-exercise combined program (11 general fitness + 10 basketball-specific drills + 1 game-based activity) was effective, as evidenced by the significantly greater improvements in the experimental group compared to the control group. Compared to the control group (standard basketball curriculum only), the non-specialized male students in the experimental group showed significantly better improvements across all six fitness tests ( $p < 0.05$ ). Notably, after the intervention their perceived exertion (RPE) was also substantially lower ( $p < 0.001$ ). The improvement in the 30 m sprint for the EG was notably larger than that of the CG, as evidenced by the significant between-group difference ( $p < 0.001$ ). Similarly, the gain in sit-up endurance was substantially greater in the EG ( $p < 0.001$ ), which is comparable to improvements reported in resistance training studies for young adults (Suchomel *et al.*, 2016).

From a physiological perspective, the superior gains in the EG can be attributed to enhanced motor unit recruitment and intermuscular coordination. The repeated execution of sport-specific movements (e.g., zigzag dribbling, speed dribbling, jump squats) involves high-frequency activation of type II muscle fibers, leading to increased rate of force development (Suchomel *et al.*, 2016) [12]. The lower RPE in the EG despite higher physical output suggests two things: first, specificity of adaptation, where the EG's neuromuscular system adapted specifically to basketball-related movements; second, improved lactate clearance, potentially facilitated by the structured cool-down and stretching. Lower RPE is a strong predictor of better exercise adherence (Dishman *et al.*, 2015; Williams *et al.*, 2012) [14, 15], a key objective of university PE programs.

The larger post-test standard deviation for the 5-minute run in the experimental group (65.54 vs. 12.75 at pre-test) indicates substantial inter-individual variability in aerobic adaptation.

**Conclusion**

This randomized controlled trial demonstrates that a 12-week supplementary program combining general physical fitness exercises and basketball-specific drills significantly improves health-related fitness in male non-specialized university students enrolled in Basketball Course 1 at Saigon University. After 12 weeks, the experimental group showed superior improvements in all fitness tests ( $p < 0.05$ ) and significantly lower perceived exertion ( $p < 0.001$ ) compared to the control group.

**Recommendations**

- For the University:** Officially integrate these 22 exercises into the Basketball Course 1 curriculum, allocating 45 minutes per session as outlined in Table 2.

2. **For Instructors:** Organize training workshops on the correct implementation of this exercise system, emphasizing individual intensity adjustment using RPE.
3. **For Practice:** Monitor student RPE weekly to ensure appropriate training load and prevent overtraining, as demonstrated by the practical challenge encountered.
4. **For Further Research:** Conduct multi-center trials with female participants, longer follow-up periods (e.g., 6 months), and include direct basketball skill assessments.

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### 1. Competing Interest Statement

The authors declare no competing interests. The study received no external funding.

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