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A comparative study of exergaming and traditional fitness circuits: Effects on MVPA, sedentary time, and enjoyment among college students

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Abstract
Exergaming has emerged as a novel tool in the field of physical education, integrating digital gaming elements with physical movement. While traditional fitness circuits remain a cornerstone of exercise in Physical Education (PE) curricula, their repetitive and often monotonous nature can reduce long-term student adherence. The present research compares the impact of exergaming and traditional fitness circuits on moderate-to-vigorous physical activity (MVPA), sedentary time, and enjoyment levels among college students. Fitness band accelerometers were employed to measure physical activity levels and sedentary time, while Physical Activity Enjoyment Scale (PACES) were used to assessed subjective enjoyment.
Results revealed that both groups achieved similar MVPA, though exergaming participants demonstrated significantly reduced sedentary time and higher enjoyment scores, suggesting that exergaming may complement or even substitute traditional circuits, especially for increasing engagement and motivation. By highlighting the potential of digital interactivity in structured exercise settings, this study contributes to evolving pedagogical approaches within higher education PE programs.

Keywords: MVPA, exergaming, fitness circuits, sedentary time, enjoyment

Introduction
The growing prevalence of sedentary behaviour among college students has raised concerns regarding their long-term health outcomes. College years mark a transitional stage when individuals shift from structured school routines to autonomous lifestyle choices. This shift often results in reduced levels of physical activity and declining participation in structured exercise programs (Keating *et al*. 136) [3]. As a result, colleges and universities face the pressing responsibility of promoting sustainable physical activity opportunities within their curricula.
Traditional fitness circuits rotational sets of bodyweight exercises, resistance drills, and aerobic conditioning are widely implemented in Physical Education classes at all ages. While effective in enhancing strength and endurance, such routines often lack novelty and may be perceived as monotonous (McKenzie and Smith 495) [4]. Consequently, motivation and adherence tend to decrease over time, especially among non-athlete student populations.
Exergaming introduces an alternative, blending physical exertion with digital game mechanics. Titles such as *Just Dance*, *Ring Fit Adventure*, and *Wii Sports* require continuous bodily engagement, transforming exercise into a playful and immersive experience (Gao *et al*. 108) [2]. Prior research indicates exergaming's capacity to increase physical activity and reduce sedentary behavior in children and adolescents. Yet, its applicability to older populations, particularly college students, remains understudied.

This study aims to fill that gap by comparing exergaming and traditional fitness circuits in terms of three critical variables:
- Moderate-to-vigorous physical activity (MVPA) during sessions
- Sedentary time during exercise
- Enjoyment levels reported by participants

By examining these variables in a controlled, college-level context, the research investigates whether exergaming can serve as an effective pedagogical tool for higher education PE programs.

Methodology

Participants

A total of 60 undergraduate students (30 male, 30 female) between the ages of 18 and 22 were recruited from elective PE courses. Participants had no pre-existing musculoskeletal injuries or chronic illnesses. They were randomly assigned to either the exergaming group (N=30) or the traditional fitness circuit group (N=30).

Measures

- **Moderate-to-Vigorous Physical Activity (MVPA):** Measured using ActiGraph GT3X accelerometers worn on the hip during sessions.
- **Sedentary Time:** Recorded simultaneously through accelerometry, defined as activity registering fewer than 100 counts per minute.
- **Enjoyment:** Assessed with the Physical Activity Enjoyment Scale (PACES), a validated 18-item questionnaire using a 5-point Likert scale. Higher scores indicated greater enjoyment.

Descriptive statistics (mean and standard deviation) were calculated for all variables. Independent samples t-tests compared MVPA, sedentary time, and enjoyment scores between groups. A significance threshold of $p<0.05$ was used.

Procedure

The study spanned six weeks. Each group met three times per week for 45-minute supervised sessions.

- **Exergaming group:** Participated in Kinect- and Wii-based games, alternating between rhythm (e.g., *Just Dance*), sports simulation (*Wii Sports*), and adventure (*Ring Fit Adventure*).
- **Traditional circuit group:** Performed structured bodyweight and aerobic exercises, including push-ups, squats, planks, jump rope, and shuttle runs.

Both interventions followed the same time structure: 10-minute warm-up, 30-minute main activity, and 5-minute cool-down. PACES surveys were administered weekly, while accelerometer data were recorded during every session.

Results

MVPA

Both groups achieved substantial MVPA. Mean weekly MVPA per session was slightly higher in the circuit group (M=22.6 minutes, SD=2.4) than the exergaming group (M=21.4 minutes, SD=2.8), though this difference was not statistically significant (P=0.34).

Sedentary Time

Exergaming participants recorded significantly lower sedentary time per session (M=5.1 minutes, SD=1.2) compared to the circuit group (M=8.7 minutes, SD=1.6; $p<0.01$).

Enjoyment

Enjoyment scores, measured on a 5-point scale, were consistently higher for exergaming (M=4.3, SD=0.4) than for circuits (M=3.6, SD=0.5; $p<0.001$).

Table 1: Comparative Outcomes

Variable	Exergaming (N=30)	Circuit Training (N=30)	P-Value
MVPA (min)	21.4±2.8	22.6±2.4	0.34
Sedentary Time (min)	5.1±1.2	8.7±1.6	<0.01
Enjoyment (PACES)	4.3±0.4	3.6±0.5	<0.001

Discussion

The present study demonstrates that exergaming is as effective as traditional fitness circuits in generating MVPA among college students. Importantly, exergaming significantly reduced sedentary time and improved enjoyment levels, highlighting its potential to address two critical barriers to physical activity in higher education: inactivity and motivation.

The comparable MVPA levels support earlier findings by Gao *et al*. (2017) [2], who reported that exergaming can meet physical activity thresholds comparable to moderate exercise. However, the higher enjoyment levels suggest that exergaming could play a pivotal role in fostering positive exercise habits among students who may otherwise disengage from repetitive circuit training.

Sedentary behavior reduction is particularly relevant in the college context, where prolonged sitting during lectures and study sessions dominates daily routines. By integrating active gaming into PE, institutions may provide both immediate physical benefits and long-term lifestyle advantages.

Conclusion

This research underscores the potential of exergaming as an effective pedagogical innovation within college physical education. While traditional circuits remain valuable for building muscular and cardiovascular endurance, exergaming enhances enjoyment and reduces sedentary time without compromising MVPA levels.

For educators, the findings support the integration of exergaming into PE curricula as a supplement to conventional exercise. For policymakers and institutions, it emphasizes the role of technology in addressing physical inactivity among young adults. Future research should extend these findings by testing hybrid approaches that blend exergaming with traditional training methods, ensuring both physiological benefits and long-term engagement.

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