

Effectiveness of gamification on enjoyment and satisfaction in older adults: systematic review and meta-analysis.

Javier Bravo-Aparicio, Iria Trillo-Charlín, Juan Avendaño-Coy, Hector Beltran-Alacreu

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Effectiveness of gamification on enjoyment and satisfaction in older adults: systematic review and meta-analysis.

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Abstract

Background: Sedentary behavior is highly prevalent among older adults, with adherence to exercise being a major challenge. Exercise offers significant physical, psychological, and social benefits, but enjoyment is a key factor influencing adherence. Technology-based interventions, have shown promise in enhancing motivation and participation, demonstrating higher adherence rates compared to conventional treatments, though challenges like motivation loss and technological barriers persist. This review evaluates active videogames interventions' effectiveness in enjoyment and satisfaction.

Objective: This systematic review and meta-analysis aimed to determine whether active video games are superior to other interventions in generating greater enjoyment or satisfaction.

Methods: Pubmed, Cochrane, PEDro, SportDiscus, CINHALL, Web of Science and Scopus databases were searched from inception to October 2024 to identify randomized clinical trials (RCT) or crossover studies. The primary outcome was enjoyment or satisfaction, assessed using various scales, including the Physical Activity Enjoyment Scale (PACES), Intrinsic Motivation Inventory (IMI), User Satisfaction Questionnaire, and Likert-type scoring scales. Secondary outcomes included adherence rates and adverse effects. Cochrane tool (v2.0) was used to evaluate risk of bias.

Results: Five studies were included in the quantitative analysis. The results indicated a significant improvement in enjoyment/satisfaction compared to control groups (SMD: 0.34; 95% CI (0.05 to 0.64); p=0.02; I²=24%), although the size effect was small. Secondary outcomes could not be analyzed due to insufficient data in the selected studies.

Conclusions: Active video game interventions may improve enjoyment and satisfaction in older adults, but the evidence remains of low certainty.

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Original Manuscript

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Keywords: Gamification, exergaming, enjoyment, satisfaction, older adults, elderly.

INTRODUCTION

The global population of older adults is projected to surpass 994 million by

2030., and this trend is expected to continue in the following years [1]. A major concern in aging is the reduced expectancy of healthy life years. The three aspects of healthy or successful aging have been defined: cognitive/mental, social well-being and physical, highlighting the importance of exercise within the physical part [2]. However, older adults are among the most sedentary population groups, as sedentary behavior seems to increase with age with older adults spending between 62 and 86% of the day in a sedentary behavior [3-5]. In 2018, the World Health Organization (WHO) launched an intervention plan aimed at reducing physical inactivity among adults and adolescents by 15% by 2030 [6]. This initiative enhances individual and community health by creating active societies, environments, people and systems. It emphasizes the importance of exercise or physical activity as a primary treatment approach given its numerous benefits and low risk of side effects. Regular physical activity improves mortality rates, life expectancy, and physical and functional health outcomes [7-12].

There are discrepancies in the literature regarding the risks and benefits of sedentary behavior and physical activity on physical, psychological, and social outcomes [13,14]. Consequently, sedentary lifestyles remain prevalent among this population, as barriers or facilitators to physical activity adherence arise from intrapersonal factors (physical and mental health, and individual preferences), interpersonal influences, as well as physical, structural and organizational environments [15]. Numerous barriers and facilitators impact older adults' engagement and adherence to exercise, shaped by individual experiences and preferences. Previous researchers have suggested that fun should be incorporated into the FITT (Frequency, Intensity, Time, Type) prescription model [16], as enjoyment may be a critical factor in exercise adherence. Studies have shown that patients perceive exercise differently, some view it as a pleasant activity, while others regard it as an obligation, like taking medicine [15,17]. Addressing this barrier through an immediate reward system, like enhancing enjoyment, could positively transform patients' exercise experiences and potentially improve adherence to physical activity interventions [18,19]. This can be explained through various theoretical frameworks, such as operant conditioning theory, self-determination theory, or models like

Ekkekakis's, which link enjoyment to perceived exertion [20,21]. Technology-based interventions, particularly those that integrate engaging and interactive elements, offer a promising solution to enhance motivation, make exercise more enjoyable, and encourage sustained participation among older adults [19].

Gamification, which applies video game design elements like points, badges, leaderboards, and avatars in non-game contexts, has become an increasingly popular tool in recent years for enhancing adherence to various interventions. Gamification might positively influence user behavior and experience, though its effectiveness may vary depending on the intervention, as inconsistent results have been reported across different age groups [22,23]. Video games or technology-based interventions have demonstrated adherence rates as high as 91%, and in some cases, rates up to 1.38 times higher than conventional exercise treatments or no intervention, which could suggest that greater adherence to physical activity might lead to enhanced health benefits [19,24,25]. Adherence rates in exercise programs for older adults range from 65 to 86% but tend to decline in unsupervised training programs or when the duration exceeded 12 weeks, suggesting that factors such as supervision, program length, and the engaging nature of the intervention play a crucial role in maintaining adherence [19,24,26]. Despite these benefits, such interventions also present challenges, including loss of motivation or interest, space limitations, technological barriers, and feelings of embarrassment when using video games [24,27].

This systematic review aims to evaluate the satisfaction and enjoyment generated through active video games. The secondary objective is to determine adherence to treatment and possible side effects of the intervention. These metrics are essential for understanding intervention efficacy and long-term adherence

METHODS

The protocol for this systematic review and meta-analysis was registered in International Prospective Register of Systematic Reviews (PROSPERO) CRD42024593212. It was conducted following the recommendations of the Cochrane Collaboration and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Search strategy

A bibliographic search was completed between September 21st and 30th, 2024, in the following health and sports science databases: PubMed, Cochrane, Web of Science, CINAHL, SPORTdiscus, PEDro, and Scopus. The search strategies used are available in Annex 1.

Inclusion and exclusion criteria:

Inclusion criteria for the present review were: (1) randomized clinical or controlled trials and cross-over studies, (2) patients older than 60 years, (3) exercise or physical activity intervention using gamification, including commercial apps, exergames or serious games, (4) the comparison group had to perform some form of active exercise, follow their usual treatment or do nothing, (5) use of enjoyment or satisfaction scales.

Studies that met any of the following criteria were excluded: (1) case series, observational studies and conference proceedings, (2) use of enjoyment or satisfaction scales in only of the groups.

No language exclusion criteria were applied.

Study selection:

Studies were selected based on a predefined PICOS framework established at the outset of the review. The population included older adults, the intervention involved exercise delivered through video games, and the outcome focused on assessing levels of enjoyment or satisfaction. After defining the search strategy, studies were entered into Rayyan software to exclude duplicate articles.

Two researchers selected studies according to the inclusion and exclusion criteria set out, in case of disagreement a third researcher reviewed the study until a consensus was reached.

Data extraction:

First, two reviewers extracted informative data from the studies independently, in case of discrepancies, a third reviewer resolved this. The data to be extracted were: first author and year, number of participants, design, groups, type of intervention in both groups, outcomes, number of sessions, session time, perceived effort, hardware and software used and follow-up.

The second part consisted of extracting data values for the different outcomes, both primary and secondary. For the primary outcome of exercise enjoyment or

satisfaction, as for the secondary outcomes of adherence and adverse effects, mean and standard deviation values were extracted. When values were reported as change or as final values, the extraction of final values for analysis was determined as the preferred option.

If data were only available in graphs, the graph digitization software Graph Grabber 2.0.2 (<https://www.quintessa.org/software/>) was used for extraction.

Risk of bias

The methodological quality of the included studies was assessed by two independent reviewers (J.B.A and I.T.C) using the Cochrane 'Risk of Bias 2.0' tool, which evaluates the possible risk of bias in randomized trials for both parallel and crossover design studies [28], in case of disagreement a third reviewer broke the tie (H.B.A). This scale assesses bias based on 5 domains: 'process randomization', 'missing data on outcomes', 'outcome measurement', 'selection of reported outcomes' and 'deviations from intended interventions'.

The Grades of Recommendation Assessment Development and Evaluation (GRADE) rating system was used to assess the quality of evidence. Publication bias was also assessed by funnel plot and Egger's test for publication asymmetry.

Main outcomes:

The primary outcome variable for this review was exercise enjoyment/satisfaction, which was assessed using the scales reported in the included articles. These scales were not predetermined but were identified during the review process based on the methodologies of the selected articles. Each scale was included because it was used by the respective studies to measure enjoyment or satisfaction, ensuring consistency with their reported outcomes. The following tools were identified:

-Physical Activity Enjoyment Scale (PACES): The PACES is a validated and reliable tool used to assess the level of enjoyment individuals experience during physical activity. The studies reviewed utilized a modified 5-item version of the scale, with responses recorded on a Likert scale ranging from 1 to 7 [29].

-Intrinsic Motivation Inventory: The IMI is a multidimensional scale designed to assess intrinsic motivation, with various subscales including interest/enjoyment [30]. Only the interest/enjoyment subscale was used as an outcome measure in

the study reviewed.

-User Satisfaction Questionnaire: It is a 15-item questionnaire divided into two parts: the benefits and pitfalls of the intervention and self-perceived improvements in physical and cognitive outcomes.

Two studies did not use specific enjoyment or satisfaction scales. Instead, they directly asked participants about their levels of enjoyment or satisfaction and measured their responses using Likert-type scales.

Statistical analysis:

The overall effect of exercise through video games on enjoyment or satisfaction was assessed. As secondary outcomes, the effects of gamification compared to other interventions on adherence and adverse effects were analyzed. Subgroup analyses of the primary outcome (exercise enjoyment/satisfaction) were conducted to explore key variables potentially influencing variations in enjoyment. These included session time (<10 minutes vs. >10 minutes), target population (older adults without reported health conditions vs. older adults with reported health conditions), immersion type (virtual reality vs. augmented reality), type of control group (active vs. passive), and the number of sessions (1 session vs >10 sessions).

The inverse variance method analyzed the primary variable (exercise enjoyment or satisfaction). Statistical heterogeneity was assessed using the Chi-square test and the I² value was calculated. A low level of heterogeneity was established for I² =25%, moderate I² =50% and high I² =75%. The random effects analysis model was used for a heterogeneity I² ≥ 50% and the fixed effects analysis model when the heterogeneity was I² <50%.

The standardized mean difference (SMD) was used for the overall effect over enjoyment or satisfaction, as different scales were implemented in the included studies. For all enjoyment or satisfaction scales higher scores implied a better result on this outcome.

A 95% confidence interval (95% CI) and a statistical significance level of $p < 0.05$ was established for all variables. The effect size was determined as low SMD=0.2, moderate SMD=0.5 and high SMD=0.8 according to Cohen. Sensitivity analysis was performed individually per study to analyze their influence on the overall results and changes in heterogeneity according to study

weight. RevMan 5.4.1 software was used for quantitative analysis.

Deviations from protocol:

Some analysis foreseen in the protocol registered in PROSPERO could not be performed in this review. Secondary outcomes were foreseen to meta-analyze the adherence of exercise through videogames and the adverse effects these interventions could have, however, this could not be done as adherence and appearance of adverse effects were measured in one and two studies, respectively.

RESULTS:

Study selection:

A total of 850 studies were retrieved from the search strategy, after the elimination of 290 duplicated articles, 590 articles were screened, of which 570 studies were excluded after reading Title and Abstract. 20 remaining articles were included for full-text reading, of which only 6 were included in this systematic review, as represented in Figure 1. In the quantitative analysis, five studies encompassing a total of 419 participants were included with a mean age of 74,72, 263 of which performed an active videogame, while 253 carried out other interventions. Author Takei was contacted to obtain unavailable data in the published article, but no response was received. This selection process underscores the robustness of the study inclusion.

(Figure 1)

Characteristics of Included Studies:

The systematic review included a total of six studies: two randomized controlled trials and four crossover studies, involving 420 participants [31–36]. Among these, three studies focused on older adults without reported health conditions [31,32,34], two on older adults undergoing rehabilitation [35,36], and one specifically on older adults with Parkinson's disease and mild cognitive impairment [33].

Most studies implemented active video game interventions that incorporated full-body movements, combining various therapeutic approaches such as strength training, balance exercises, flexibility routines, yoga, and jogging [31,32,35,36]. The remaining two studies focused on specific exercises for upper limbs and gait, respectively [33,34].

The comparison groups varied across studies: Dockx, Sayar, and Takei et al. studies compared active video games to another active intervention, while Kruse and Oesch et al. compared them to videos or exercise leaflets. Ferreira et al.'s trial contrasted active video games with watching television. In terms of immersion, five studies employed augmented reality, while Kruse's study utilized virtual reality.

Regarding session duration and frequency, training times typically ranged from 30 minutes to one hour, except for Kruse's et al. study, which had sessions lasting between 7 and 10 minutes [34]. Four studies conducted only one session of active video games [31,32,34,36], while Oesch and Dockx et al. implemented interventions 2 to 3 times per week, with overall durations varying between 10 days and 6 weeks [33,35].

Two studies included exercise intensity parameters measured using the Rate of Perceived Exertion (RPE) scale, allowing participants to self-regulate the intensity of their interventions [32,36]. In both cases, participants adjusted their exercise levels based on their own perceptions of effort. The study by Oesch mentioned that exercise was self-regulated, but it did not provide specific data on how this was measured or its effects [35].

Secondary outcomes, such as adherence, was investigated only by Oesch et al. (2017), who reported an overall adherence rate of 85% for both groups. However, the control group showed higher adherence, as the exergame group had more dropouts due to dissatisfaction with the intervention [35]. Regarding adverse effects, Oesch et al. (2017) and Takei et al. (2023) both reported no adverse effects in their studies [35,36]. The remaining studies did not specify whether any adverse effects occurred.

Characteristics of included studies is available in Table 1 and Table 2.

ID Study	Study design	Participants	Age	Pathology	Frequency	Time
Dockx K, et al. 2017	RCT	n=281 (114M, 167W)	73,75 (± 6.66)	Older adults without reported health conditions, older adults with mCI, older adults with Parkinson's disease	3 days a week for 6 weeks	45 min
Ferreira JA, et al.	Crossover study	n=32 (15M, 17W)	66,7 (±	Older adults without reported	1 session	50 min

2022			4.98)	health conditions		
Kruse L, et al. 2021	Crossover study	n=25 (3M, 22W)	81,24 ($\pm$ 4.97)	Older adults without reported health conditions	1 session	7-10 min
Oesch P, et al. 2017	RCT	n=54 (29M, 25W)	74,05 ($\pm$ 9.25)	Older adults in rehabilitation	Twice a day for 10 days	30 min
Sayar R, et al. 2023	Crossover study	n=40 (17M, 23W)	69,6 ($\pm$ 4.16)	Older adults without reported health conditions	1 session	30 min
Takei K, et al. 2023	Crossover study	n=16 (3 M, 13W)	83 ($\pm$ 7)	Older adults in rehabilitation	1 session	60 min
RCT: Randomized controlled trial; M: Men; W: Women; mCI: mild cognitive impairment						

Table 1: Study characteristics

Study	Experimental group	Control group	Videogame type	Hardware	Software	Movement required	Outcomes	Intensity
Lockx, et al. 2017	Treadmill with augmented reality	Treadmill	AR	Screen for projecting visual content	Screen simulating of walking in the street	Gait	USQ	NA
Perreir JA, et al. 2022	"Your shape fitness evolved" videogame	Watch TV	AR	Xbox Kinect	"Your Shape Fitness Evolved" (Stack' in up, zen develop it, pump it, wall breaker, hurricane	Full-body movement	PACES	NA
Kruse, et al. 2021	VR videogame	Exercise video	VR	Valve Index VR headset	Maestro game VR	Upper limbs exercises	IMI	NA
Oesch, et al. 2017	Windows Kinect videogames from GameUp Project	Exercise leaflet	AR	Windows kinect	Game up	Full-body movement	Enjoyment (Likert type scale) adherence and adverse effects	Self-regulated
Sayar, et al. 2023	Xbox Kinect videogame	Brisk walking	AR	Xbox Kinect	"Kinect Adventures !" and "Your Shape Fitness Evolved 2012"	Full-body movement	PACES	RPE (1-10)
Takei, et al.	Nintendo switch videogame	Physical therapy	AR	Nintendo switch, ring fit	Nintendo switch videogame	Full-body movement	Enjoyment (Likert type	RPE (6-20)

023				and leg sensor	s		scale) and adverse effects	
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R: Virtual Reality; AR: Augmented reality; NA: Not Applicable; PACES: Physical Activity Enjoyment scale; IMI: Intrinsic Motivation Inventory; USQ: User Satisfaction Questionnaire; RPE: Rate of Perceived exertion

Table 2: Study characteristics

Risk of bias of the included studies:

The agreement rate achieved between the two authors that completed risk of bias assessment was 80 %, in case of disagreement (20%), a third reviewer resolved it. Risk of bias of the 6 articles included is represented in Figure 2.

(Figure 2)

Egger's regression-based test was conducted to evaluate the presence of publication bias. The results indicated that the intercept was not significantly different from zero (Intercept = 2.985, $p = 0.832$), suggesting no evidence of small-study effects.

The funnel plot (Figure 3) visually supports these findings, showing a relatively symmetric distribution of effect sizes around the estimated overall effect size. The absence of asymmetry further suggests that publication bias is unlikely to have significantly influenced the results of this meta-analysis.

Based on these findings, there is no statistical evidence of publication bias in the included studies.

(Figure 3)

Quantitative analysis:

An improvement in overall enjoyment or satisfaction was observed in the active videogame group compared to control at post-treatment as shown in Figure 4, showing a low effect size and low heterogeneity (SMD: 0.34; 95% CI (0.05 to 0.64); $p=0.02$; $I^2=24\%$). The certainty of evidence for this outcome according to GRADE was low (Table 3).

From this analysis the study by Oesch was removed after sensitivity analysis. This study had a low sample size and a large effect size (SMD: -0,86 (95% CI - 1.42 to -0.3)) which increased heterogeneity by 55% for a study weight of 20.6%, its inclusion affected significantly the overall effect result (SMD: 0.12; 95% CI (-0.41 to 0.64); $p=0.67$; $I^2=79\%$), as shown in Annex 2.

(Figure 4)

Certainty assessment							N _e of patients		Effect		Certainty	Importance
N _e of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Active videogames	control interventions	Relative (95% CI)	Absolute (95% CI)		
Overall enjoyment videogames vs control interventions												
4	randomised trials	very serious ^a	not serious ^b	not serious ^c	not serious ^d	none	235	227	-	SMD 0.34 SD higher (0.05 higher to 0.64 higher)		IMPORTANT

Table 3: Assessment of evidence according to GRADE. CI: Confidence interval; SMD: Standardized mean difference. (a) The studies present a high risk of bias. (b) Heterogeneity <25%. (c) No publication bias detected (Egger test $p>0.05$). (d) Heterogeneity <75%.

Effect on exercise enjoyment or satisfaction by subgroups is shown in Table 4. No significant differences were found based on session time, target population, immersion type, number of sessions, or control group type. However, some subgroup comparisons were close to reaching statistical significance. Notably, when active video games were compared to an active intervention, there was a trend toward higher enjoyment with active video games ($p = 0.08$). Additionally, two other subgroup analyses approached significance: older adults without reported health conditions appeared to enjoy active video games more ($p = 0.12$), and fewer sessions seemed to result in greater enjoyment or satisfaction ($p = 0.12$).

Subgroup	Studies n	Participants n	Random effect SMD (CI95%) p value	Heterogeneity I^2 %	Subgroup difference Chi ² (p value)
Session time <10 minutes >10 minutes	1 4	25 394	-0.04 (-0.83 to 0.74) $p=0.91$ 0.15 (-0.48 to 0.78) $p=0.67$	Not applicable 79%	0.14 ($p=0.71$)
Target population Older adults without reported health conditions Older adults with reported health conditions	3 2	97 322	0.44 (-0.09 to 0.96) $p=0.10$ -0.27 (-1.37 to 0.83) $p=0.63$	39% 92%	1.31 ($p=0.25$)
Immersion type Virtual reality Augmented reality	1 4	25 394	-0.04 (-0.83 to 0.74) $p=0.91$ 0.15 (-0.48 to 0.78) $p=0.64$	Not applicable 84%	0.14 ($p=0.71$)
Number of sessions					

1 session >10 sessions	3 2	97 322	0.44 (-0.09 to 0.96) p=0.10 -0.27 (-1.37 to 0.83) p=0.63	39% 92%	1.31 (p=0.25)
Control group type					
Active intervention	2 3	308 111	0.49 (-0.1 to 1.09) p=0.10 -0.21 (-0.98 to 0.57) p=0.60	68% 74%	1.99 (p=0.16)
Passive intervention					

Table 4: Subgroup analysis**DISCUSSION**

This systematic review with meta-analysis evaluates the specific impact of active video games on enjoyment and satisfaction, outcomes that are crucial for adherence to physical activity programs. The findings indicate that active video games could provide greater enjoyment or satisfaction when compared to control interventions.

Enjoyment is a key determinant in long-term adherence to physical activity, as it enhances engagement and sustainability. Consequently, incorporating enjoyable components, such as active video games, into exercise regimens aligns with proposals to include fun within the FITT principles (Frequency, Intensity, Time, and Type) for a more holistic exercise prescription [16]. Studies have shown that enjoyment could serve as either a barrier or a facilitator in the adherence to exercise routines [15,26]. Therefore, incorporating enjoyable elements, such as active video games, into exercise routines or treatments could potentially help individuals stay engaged in physical activity, as the overall effect on enjoyment and satisfaction in this review suggests that active video games may offer a modest advantage over control interventions, potentially enhancing the appeal of exercise for participants.

In this systematic review, only the study by Oesch examined adherence to active video game interventions, revealing better results in the control group [35]. The experimental group experienced a higher dropout rate due to participants disliking the treatment.

Notably, Oesch's study was the sole investigation in this review to analyze adherence, finding unexpectedly higher dropout rates in the experimental group due to participant dissatisfaction with the treatment. These findings contrast with prior research, such as Valenzuela et al. (2018), which demonstrated

improved adherence in technology-based interventions [24]. The divergence may stem from differences in intervention design, participant characteristics, or contextual factors, warranting further exploration. However, the results from Oesch's study may align with general adherence trends for physical activity, where non-adherence rates range from 47-96% within the first year in healthy populations and 50-70% in patients undergoing physical therapy, while adherence rates in older adults range from 65 to 86% [26,37-39].

Among the reviewed studies, only Oesch et al. (2017) and Takei et al. (2023) reported adverse effects, with neither identifying any incidents during their interventions. While these findings suggest that active video game interventions are generally safe, the absence of reporting in other studies limits definitive conclusions regarding their safety profile [35,36]. However, most of the studies included did not report the occurrence of adverse effects.

Subgroup analyses revealed no statistically significant differences between active video games and control interventions; however, comparisons between active video games and active control groups approached significance ($p=0.08$). This trend suggests a potential for differential effects that may become apparent with larger sample sizes or more targeted studies. Sayar's study utilized a crossover design, allowing participants to experience both interventions and compare them directly in terms of enjoyment [32]. This design made it possible to observe which intervention generated a greater sense of enjoyment among participants. In contrast, Dockx's study compared treadmill walking with a screen to standard treadmill walking, suggesting that the added visual and auditory distractions may have contributed to participants' preference for the screen-enhanced intervention as participants might have perceived less exertion [40,41].

Other comparisons approaching significance ($p=0.12$) were found in older adults without reported health conditions vs older adults with reported health conditions adults and 1 session vs >10 sessions, with the same studies included in each subgroup for the number of sessions. One possible explanation for greater enjoyment in fewer sessions is that repeated exposure to the same intervention might lead to decreased motivation, as older adults could lose interest in the video game or view the technology as more of a barrier than a

facilitator [19,24]. Similarly, this may also explain why some older adults with health issues did not favor this type of treatment. Previous studies in older adults experiencing chronic low back pain have indicated that continued engagement in physical activity was often due to the enjoyable experience of the exercise itself [42]. In contrast, in Oesch's study, older adults who did not find the activity enjoyable frequently might have perceived it as a barrier, which in some cases contributed to their decision to drop out of the study [35].

Limitations

This review has several limitations. The generalizability of findings is limited by the small number of included studies and their high risk of bias, primarily due to issues in randomization and blinding of participants and assessors. While statistical heterogeneity was low after removing one study that significantly increased variability, differences in intervention types and outcome measurement methods still contribute to some methodological inconsistencies. Additionally, only two studies reported on exercise intensity, a factor known to influence enjoyment and satisfaction through established models [21,43,44]. Future research should explore how exercise enjoyment impacts adherence in rehabilitation programs and examine whether perceived exertion influences enjoyment or satisfaction. Addressing these gaps could strengthen the evidence base. Other possible research directions include a systematic review on the role of active video games in adherence or a qualitative study exploring factors that influence older adults' adherence to exercise programs.

Clinical implications

From a clinical perspective, this review does not establish a definitive advantage of active video games over traditional interventions. However, tailoring exercise programs to individual preferences and integrating enjoyable elements may optimize patient adherence and satisfaction, aligning with patient-centered care principles.

CONCLUSION

Active videogames could help improve enjoyment or satisfaction in older adults with a low certainty of evidence. In the present systematic review, active videogames did not show a superior effect to conventional treatment on adherence. Future research should explore optimizing gamification techniques

to maximize adherence and satisfaction.

Conflicts of interest:

The authors declare no conflicts of interest.

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Supplementary Files

Figures

Flow diagram.

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only

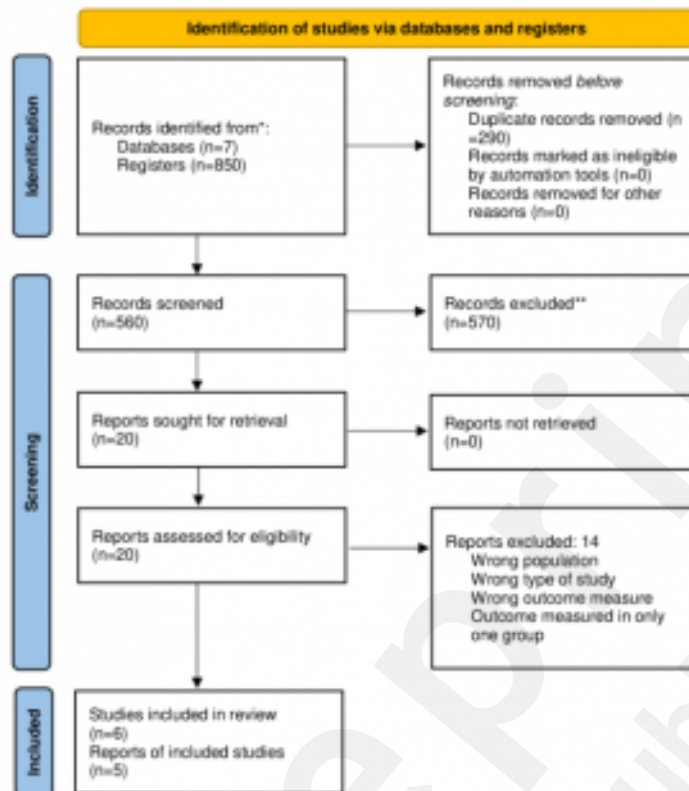
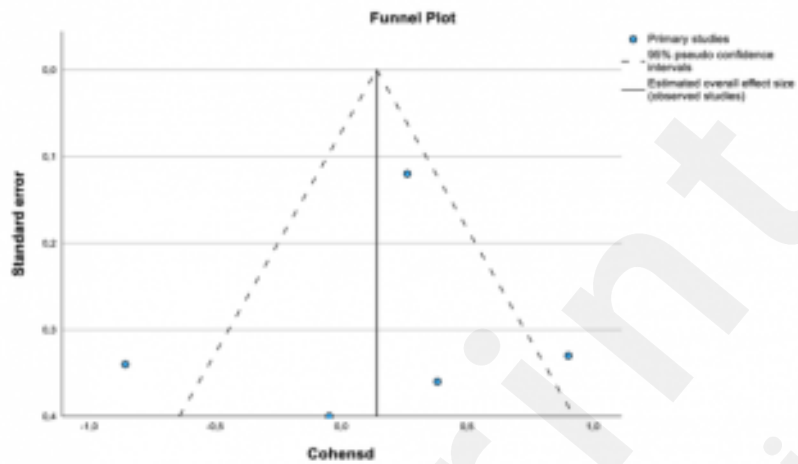


Figure 1. Flow diagram

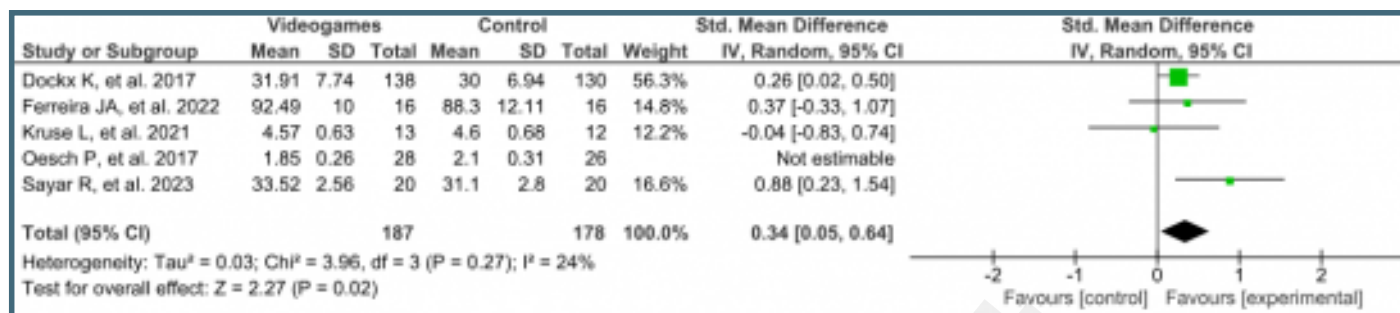
Risk of bias assessment.

Study ID	D1	D5	D2	D3	D4	D5	Overall	
Dockx et al 2017	!		!	+	-	!	-	+ Low risk
Ferreira et al 2021	-	+	+	+	+	!	-	! Some concerns
Kruse et al 2021	-	!	+	+	-	!	-	- High risk
Oesch et al 2017	!		+	-	-	!	-	
Sayar et al 2023	!	+	+	+	-	+	-	
Takei et al 2022	-	+	+	+	-	!	-	

Funnel plot of the included studies.



Forest plot overall enjoyment.



Multimedia Appendixes

Search strategy.

URL: <http://asset.jmir.pub/assets/964409d34638d418695367c0fc352ff5.docx>

Forest plot overall enjoyment including Oesch's study.

URL: <http://asset.jmir.pub/assets/0bb9e989d3f7990fc762c7b987deceae.png>



CONSORT (or other) checklists

PRISMA checklist.

URL: <http://asset.jmir.pub/assets/899469356f951858580d545f1233a387.pdf>