Effectiveness of Virtual Reality in Balance Training for Fall Prevention in Older Adults: Systematic Review

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Effectiveness of Virtual Reality in Balance Training for Fall Prevention in Older Adults: Systematic Review

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Objective: The purpose of this study was to determine the effectiveness of virtual reality (VR) in balance training for the prevention of falls in older adults.

Methods: We included studies with experimental designs, cohort studies, and quasi-experimental studies of older adults who underwent balance training associated with the use of VR for the prevention of falls. The comparison of control and intervention groups in the studies reported statistically significant improvements in terms of balance for VR.

Results: The effects and benefits from the use of VR were seen by the fourth week of intervention, with significant improvements in balance and lower fall rates, the improvements became greater for groups using VR.

Conclusions: The benefits presented by the studies were related not only to balance but also to fear of falling, reaction time, gait, physical fitness, independence in activities of daily living, muscle strength, and even quality of life.

Key Words: older adult, balance, fall prevention, virtual reality therapy

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The exponential increase in the older adult population is one of the most important global challenges in terms of public health.[1] In Colombia, 63.12% of the adult population lives in Cundinamarca (318,757), Antioquia (818,096), and Valle del Cauca (609,176), with most residing in the cities of Bogotá, Medellín, and Cali.[2] Falls are one of the 4 geriatric syndromes with a higher prevalence in older adults, increasing their morbidity and mortality while decreasing functionality. Approximately 5% of falls lead to hospitalization and 40% of admissions to geriatric institutions are due to falls.[1]

In Colombia, among women and men older than 60 years, 52% and 23% of trauma and violence-related injuries, respectively, are due to falls.[3] In 2007, the highest rates of death and accidental injuries were found in the group 80 years and older (26 per 100,000 inhabitants), followed by 75 to 79 years (19 per 100,000).[4] Fractures, traumatic brain injury, and contusions, among others, are direct consequences of falls. At the functional level, they are associated with decreased balance and muscle strength, generating dependency. In turn, the post-fall syndrome is one of the psychological consequences that occur after suffering falls, which materializes as fear and insecurity. Economically, the resulting dependence generates an increase in socio-medical costs.[3] This scenario obliges all health personnel to work towards promoting the functional independence of older adults, in addition to preventing disabling events.[4]

Considering that falls in older adults are related to loss of functionality and disability, physical therapy becomes a service of great importance for this population, such as by offering fall prevention programs designed to improve balance by increasing strength, endurance, flexibility, aerobic fitness, and function.[5] Physical therapy can also help older adults reintegrate into the environment and recover their maximum capacity after suffering some injury or illness[6] because it addresses changes in balance, stability, muscular strength, and tendon reflexes, which are important predictors of falls in older adults.[7]

Recently, virtual reality (VR) has been used as a strategy for the prevention of falls, as it emphasizes balance training. As evidenced in the study conducted in 2016 by Tsang and Fu,[7] who compared balance training with Wii Fit versus conventional balance training in a group of older adults, VR simulates the activities of daily life by presenting an illusion of 3-dimensional vision and visual feedback and direct hearing, facilitating improved balance and showing high effectiveness in preventing falls. Considering the above, it is important to recognize that physical therapy in elderly people should not only be directed at relieving pain or increasing muscle strength and coordination or joint range of movement but should also focus on improving stability. For these goals, technological aids that contribute to achieving therapeutic targets can be used, and they can also increase the patient's adherence to treatment. The objective of the present study was to determine the effectiveness of VR in balance training for the prevention of falls in older adults.

METHODS

This paper is a systematic review following the recommendations of the Cochrane Collaboration[8] and PRISMA.[9]

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Eligibility Criteria

- Study designs: the following were included: experimental designs, cohort studies, and quasi-experimental studies.
- Participants: older adults in Colombia composed of women and men aged 50 years or older, with or without underlying pathologies.
- Intervention: balance training associated with the use of VR for the prevention of falls.

Comparisons

A comparison of VR for balance training versus conventional physical therapy (strength training, aerobic fitness, functional mobility, etc), unconventional physical therapy (Tai Chi, hydrotherapy, hippotherapy, etc), and conventional balance exercises.

Primary Outcome

Balance

Defined as the ability to control the center of mass in relation to the base of support.[10] Balance is usually measured through tests, such as the modified Tinetti test (also known as performance-oriented mobility assessment), Berg balance scale (BBS), timed up and go (TUG), unipedal stance test, and activities-specific balance confidence scale-6.

Secondary Outcome

Fall Risk

Defined as increased susceptibility to falls that may cause some physical harm.[11] The decrease or increase in fall risk is usually measured through tests, such as the physiological profile assessment (PPA), short-form version of the PPA, modified falls efficacy scale (FES), FES, and the fall risk index.

Follow-up Time

For all outcomes, the studies had to have at least 4 weeks of follow-up to be included in the review.

Languages

All languages were included.

Information Sources

We searched databases such as MEDLINE (OVID), EMBASE, LILACS, and the Cochrane Central Register of Controlled Trials (CENTRAL) from inception until nowadays. To ensure, we pulled all the relevant studies, the references of the relevant articles identified through the searches, conferences, thesis databases, Google Scholar, CLINICAL TRIALS, and others were also searched. There was no need to communicate with the authors by email, as the information found was sufficient for conducting this review.

Selection of Studies

Two researchers reviewed each title and abstract. Then they analyzed the complete texts of the relevant studies, applied prespecified inclusion criteria, and finally extracted the data. Disagreements were resolved by consensus, and when the disagreement could not be resolved, a third reviewer resolved the conflict.

Data Collection Process

Two trained reviewers used a standardized form to extract data independently. For each article, the following information was obtained: study design, geographic location, names of the authors, title, objectives, inclusion and exclusion criteria, number of patients included, loss to follow-up, timeline, definitions of outcomes, outcomes, measures of association, and source of funding.

Risk of Bias Assessment

The risk of bias for each study was assessed using the Cochrane Collaboration tool to evaluate the risk of bias, which includes sequence generation, allocation concealment, blinding, incomplete outcome data, selective reporting, and other sources of bias. Two independent researchers evaluated the possible risk of bias from the information extracted and rated it as high risk, low risk, or uncertain risk. The graphical representation of the potential bias was calculated using RevMan 5.3.

Additional Analysis

Quantitative analysis was not done due to the clinical heterogeneity shown in the outcomes.

RESULTS

Selection of Studies

A total of 2235 articles were found, of which only 10 studies were selected after having carried out 2 screenings with their respective filters (inclusion criteria) and excluding those articles that did not have a complete text available that was free to read and those that were duplicates.[12–21] (Fig. 1).

Characteristics of the Studies

The studies included in this review were all randomized controlled clinical trials. The size of the populations in the studies varied from 16 to 282 participants,[18,19] respectively. The average sample size was 74.7 participants; for a total of 747 participants analyzed in all studies; 415 (55.55%) were women and 332 (44.44%) were men.

Regarding the health status of participants, 6 of the 10 articles selected;[15–18,20,21] (60%) performed interventions with older adults (healthy) without reporting specific diseases. Three articles[13,14,19] (30%) performed interventions in older adults with comorbidities and/or a history of falls. Finally, one article[1] (10%) described older adults with imbalance problems.

Regarding the type of VR used, 5 used the Nintendo Wii Fit platform[13,18–21] (50%). In the rest, independent VR systems were used. Ku et al 2019[15] used the 3-dimensional interactive augmented reality system through a screen with a Microsoft Kinect (10%). Mirelman 2016[17] used a VR system on a treadmill with a motion capture camera and a computer-generated simulation (V-Time) projected on a large screen (10%). Gschwind 2015[14] used an iStoppFalls system through a television and a Microsoft Kinect (10%). Duque et al 2013[12] used a balance rehabilitation unit (10%). Lai et al 2013[16] used the Xavix Measured Step System (10%). The length of intervention with VR ranged from 4[15] to 16 weeks[14] with a mean of 7.2 weeks. With the exception of the study by Gschwind et al 2015,[14] they measured the duration of treatment in minutes per week, estimating a total of ~3000 minutes as the expected duration of treatment, with 180 minutes of balance and strength training per week.

All articles measured the total duration of the treatment in minutes per week in addition to the frequency of sessions per week and minutes per session. The total number

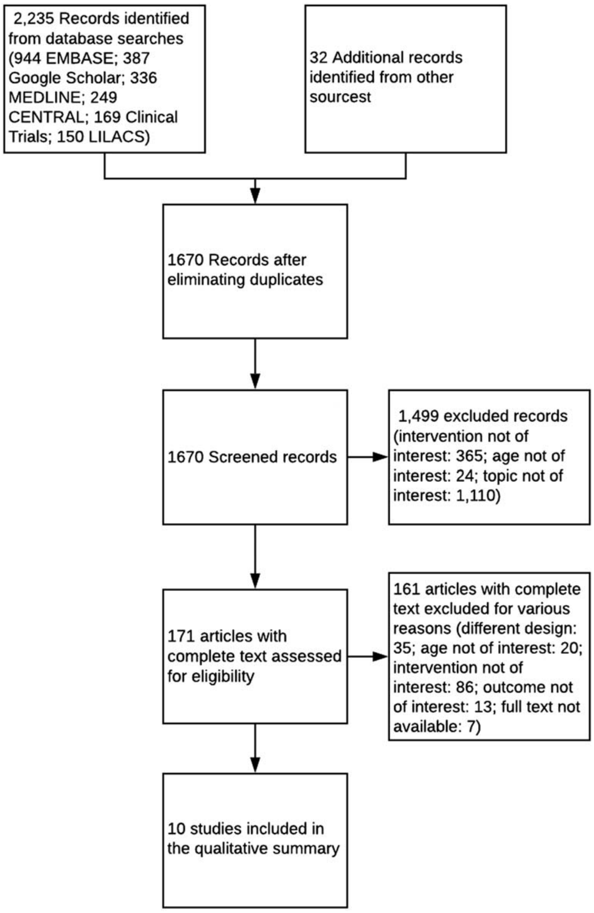

FIGURE 1. Flowchart: selection of studies.

of sessions ranged from 12[2,12,13,20] to 18[1,13,16] sessions, with an average of 14.88 sessions. The total duration of treatment ranged from 360[12,15] to 1080 minutes,[13] with an average of 696.66 minutes. The frequency of intervention varied from 2[12,18–21] to 3 sessions per week (15),[13,16,17] with an average of 2.44 sessions per week; The time of each session varied from 30[12,15,16] to 60 minutes,[15,18,20,21] with an average of 46.66 minutes per session.

The main instruments to measure the outcomes were the TUG scale (50%, N = 5);[14–16,18,19] the PPA (40%, N = 4),[13,14,20,21] the BBS (20%, N = 2),[15,16] the functional ambulation categories (20%, N = 2),[13,15] the FES (20%, N = 2),[16,18] the Activities-specific balance confidence scale-6 (20%, N = 2),[20,21] and the quality of life questionnaire SF-36 (10%, N = 1).[17]

Of the 10 studies selected, 6 studies (60%)[13,15–17,20,21] were conducted in Asia, 2 (20%)[18,19] were conducted in the Americas, one of which[18] was performed in Latin America (Brazil), and 2 studies (20%)[12,14] were conducted in Oceania.

Table 1 shows the sociodemographic aspects of the participants, the interventions performed, the outcome measures used, and the conclusions of each study.

Risk of Bias in Studies

The risk of bias assessment showed that all the studies[12–21] had a low-risk score for the majority of the items. High risk was only found in the article by Duke 2013[12] for the item pertaining to the blinding of participants and personnel (Fig. 2A).

Risk of Bias Among Studies

In the domain of random sequence generation and allocation concealment of the patients, the first was classified as low risk for all articles, but the second was not specified in half of the studies[12,16,18,20,21]

With respect to the risk of bias in the blinding of the participants and personnel, it was classified as low in only 2 of the studies: Gschwind et al 2015[14] and Singh and colleagues 2012. Blinding was the only bias classified as high risk because Duque et al 2013[12] designed an open experiment. The remaining articles[13,15–19] did not adequately specify the concealment process and were, therefore, classified as having an unclear risk of bias.

In the domain of blinding of the outcome assessment (detection bias), this bias was graded as low risk in 7 of the 10 articles.[12,13,15–17,20,21] These were the only 7 to describe blinding. The other studies did not mention this process, so they were classified as having unclear risks.

Attrition bias, in its domain of incomplete outcome data, was classified in 8 studies as low risk,[12,13,15,17,19–21]. In the studies by Gschwind et al 2015[14] and Lai et al 2013,[16] attrition bias was classified as unclear risk, the first because their attrition rate was 20% of the sample total and the second because they did not adequately report the loss to follow-up during execution.

Finally, the domain of selective reporting (reporting bias) and other biases were classified as low risk in all studies. The graphic representation of the biases between the studies is shown in Figure 2B.

Study Outcomes

Of the 10 articles included in this study, only 7[12–15,18,20,21] made a comparison between the use of VR and other interventions (conventional exercise, Tai Chi, another type of VR), in which statistically significant differences were reported for balance in both interventions, but VR obtained better scores in the scales used.

Regarding the duration of the interventions, it was found that the most common intervention time interval was 6 weeks, in 60% of the articles,[12,13,16,17,20,21] with an average of 15 sessions and 705 minutes of intervention. Ku et al 2019[15] used a protocol of 4 weeks, 12 sessions, and 360 minutes, which was the lowest number of weeks among these studies. Panassol 2017[18] and Pluchino et al 2012[19] performed their intervention in 8 weeks, 16 sessions, and an average of 840 minutes. The article with the greatest number of weeks for the intervention was that of Gschwind et al 2015,[14] with 16 weeks, and 3000 total minutes of intervention.

The shorter-duration protocol used by Ku et al 2019[15] yielded statistically significant improvements in both groups in the BBS (control group [CG]: $P = 0.009$; intervention group [IG]: $P = 0.001$), TUG (CG: $P = 0.002$; IG: $P = <0.0001$), and the fall risk index (CG: $P = 0.386$; IG: $P = 0.053$). The longest protocol, in the study by Gschwind et al 2015,[14] yielded significant results in the risk of physiological falls (ie, PPA), as it decreased more in the IG than the CG ($P = 0.035$). This study did not find between-group differences in the TUG test (CG: 9.2 ± 2.1; IG: 9.5 ± 2.7; $P = 0.504$). Thus, we can see that the effects of VR manifested from the fourth week of intervention, yielding significant improvements in balance and fall

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TABLE 1. Characteristics of the Studies

Author/year	Participants N (mean age; y)	Condition/diagnosis	Intervention	Duration	Measurement scales	Conclusions
Duque 2013[12]	N = 60 GC = 30 (75) GE = 30 (79.3)	Imbalance	CG: conventional balance training. IG: BRU to evaluate and train balance	6 wk, 2 times per week, each training session lasted 30 min	BRU posturography Smedley's hand dynamometer SAFFE	The balance parameters improved significantly in the BRU training group. BRU training was an effective and well-accepted intervention to improve balance, increase confidence, and prevent falls in the elderly
Fu 2015[13]	N = 60 GC = 30 (82.3) GE = 30 (82.4)	Healthy elderly with a history of falling	CG: conventional balance exercise. IG: Wii Fit by Nintendo	6 wk of training, 3 times per week and 60 min per session	PPA FAC	In both groups, the PPA scores and the incidence of falls were significantly improved, but the subjects in the Wii Fit training group showed a significantly greater improvement in both outcome measures
Gschwind 2015[14]	N = 160 (74.7) GC = 75 (74.7) GE = 78 (74.7)	Elderly patients with comorbidity	CG: conventional training. IG: the iStoppFalls system and video games that use Exergame technology	16 wk, ~50 total hours. The duration of the weekly training should be ~120 min for balance training and 45 to 60 min for strength training	TUG PAQ-50 PPA	The risk of physiological fall (PPA) was significantly reduced in the intervention group compared with the control group. The iStoppFalls exercise program reduced the risk of physiological falls in the study sample. Association between adherence and improvement in outcomes
Ku 2019[15]	N = 34 GC = 16 (64.7) GE = 18 (65.0)	Healthy elderly	CG: conventional training for strengthening the lower extremities and balance training. IG: 3D-ARS for balance and rehabilitation of mobility	4 wk, 3 times per week for both groups. 3D-ARS Group 30 min per session	BBS TUG Fall risk index FAC Modified Barthel Index FMA-LE: lower extremities section FMA-C: coordination section of motor assessment FMA-B: balance section of motor assessment	The general improvements occurred in the stability index, the weight distribution index, the fall risk index, and the Fourier transform index of posturography for both groups. The changes in the score were significantly higher in the experimental group
Lai 2013[16]	N = 30 (72.1) GC = 15 GE = 15	Healthy elderly	GA: IVGB training in the first 6 wk, followed by no exercise in the following 6 wk GB: no treatment in the first 6 wk, followed by IVGB training in the following 6 wk	6 wk, 3 times a week, for 30 min of IVGB for both groups	BBS TUG MFES Bipedal balance test on a strength platform: Eyes open Eyes closed	Improved balance after 6 wk of training; the effects persisted partially after 6 wk without intervention

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Mirelman 2016[17]	N = 282 GC = 136 (73.3) GE = 146 (74.2)	Elderly with a history of falling and/or comorbidity	CG: treadmill training IG: the VR system with a motion capture camera and a simulation generated on a treadmill	6 wk, 3 times per week each session lasts ~45 min	2 min walk test SPPB PASE Health questionnaire SF-36 Motor examination (section III) of the UPDRS-III	The incidence of falls significantly decreased only in the experimental group. Treadmill training plus VR reduced fall rates compared with treadmill training alone
Panassol 2017[18]	N = 16 (69,63) GC = 8 (70) GE = 8 (69,25)	Healthy elderly	CG: conventional kinesiology training. IG: Wii Fit platform and the Nintendo Wii console	8 wk, 2 times per week, and each session lasted 45 min	Measure of functional independence POMA Functional reach TUG TC6M	Both groups improved mobility, balance, postural control, aerobic fitness, and gait. No significant differences between groups
Pluchino 2012[19]	N = 40 (72.5) GC1 = 14 (69.28) GC2 = 14 (76.00) GE = 12 (70.72)	Healthy elderly	CG1: Tai Chi CG2: conventional balance training. IG3: balance board Wii Fit–type video games	8 wk, 2 times per week, 1 h per session	FES TUG (3 meters) One leg stance Functional reach Static postural sway Dynamic postural sway	Wii balance board produced similar improvements in control and postural balance compared with the other interventions. No significant changes were found between any of the interventions
Singh 2012[21]	N = 36 GC = 18 (64.00) GE = 18 (61.12)	Healthy elderly	CG: conventional balance exercises. IG: Nintendo Wii Fit with a balance board (VRBG)	6 wk, 2 times per week for 1 h	PPA ABC-6	Both the experimental group and the control group had a significant decrease in PPA and ABC-6. No significant effects were demonstrated between the groups
Singh 2011[20]	N = 36 GC = 18 (64.00) GE = 18 (61.12)	Healthy elderly	CG: conventional therapy based on balance training by Seidler and Martin. IG: Wii Fit by Nintendo and the Wii balance board	6 wk, 2 times per week, 1 h per session	PPAz ABC-6	Both groups had a significant decrease in the risk of falling after exercise interventions using VR games and conventional balance exercise

ABC-6 indicates activities-specific balance confidence scale; BBS, Berg balance scale; BRU, balance rehabilitation unit; CG, control group; 3D-ARS, 3-dimensional augmented reality system; FAC, functional ambulation categories; FES, falls efficacy scale; FMA-LE, fugl-meyer assessment lower extremity; GA, group A; GB, group, B; GC, group control; GE, exposed group; IVGB, interactive video-game based; MFES, modified falls efficacy scale; PAQ-50, Physical Activity Questionnaire-50+; PASE, physical activity scale for the elderly; POMA, performance-oriented mobility assessment; PPA, physiological profile assessment; PPAz, short-form version of the PPA; SAFFE, survey of activities and fear of falling in the elderly; SPPB, short physical performance battery; TUG, timed up and go; UPDRS, unified Parkinson disease rating scale; VR, virtual reality; VRBG: Virtual Reality-based game.

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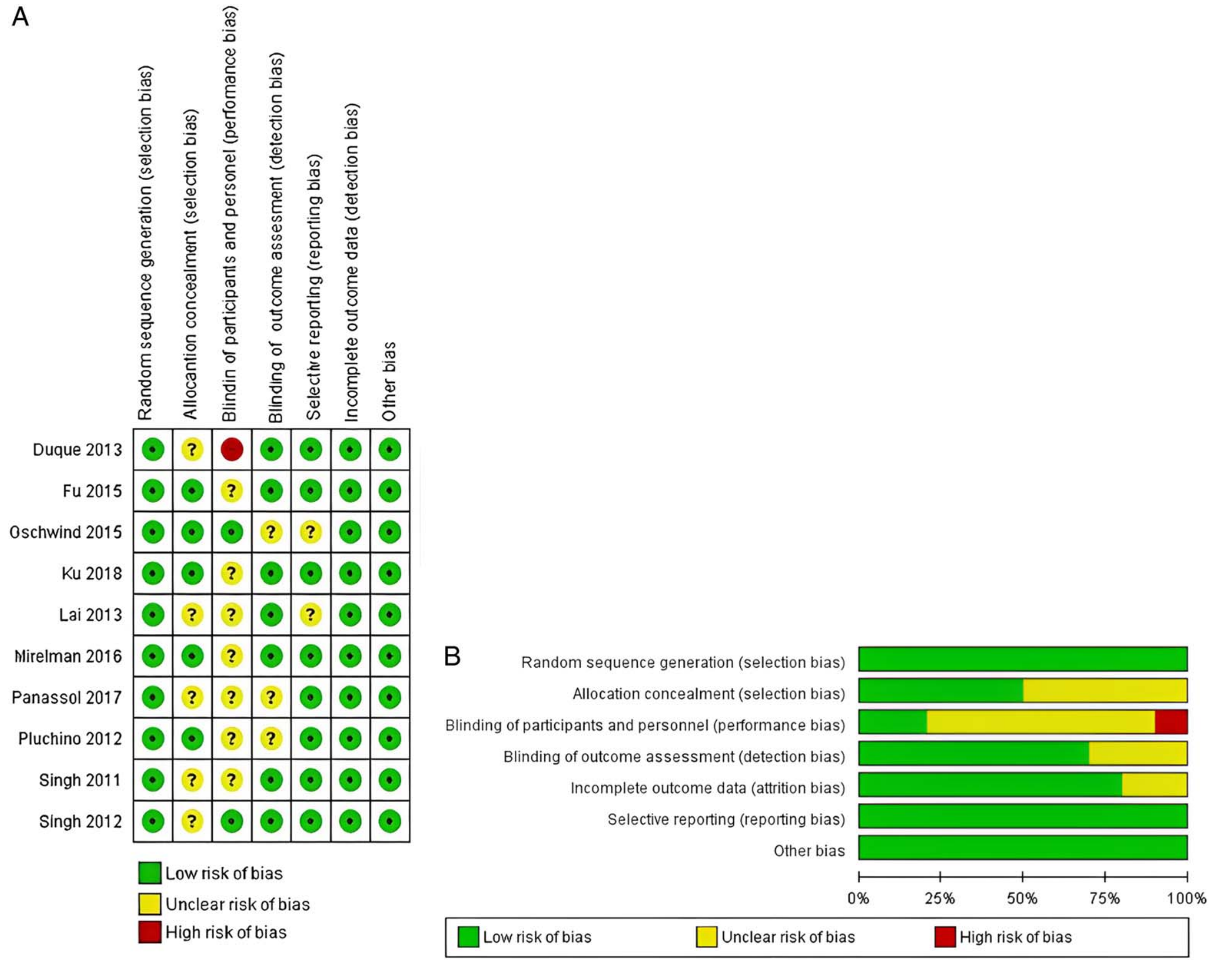

FIGURE 2. A, Risk of bias within studies. B, Risk of bias among studies.

measures, and continued until week 16, when the outcomes became most improved in groups that used VR. As a complement to this information, the study by Mirelman et al 2016[17] was the only one, in which statistically significant differences were found concerning balance and falls 6 months after the intervention.

From the above, it is evident that the majority of the studies included in this review reported statistically significant differences in terms of balance for the intervention group[12,13,15–20]. In addition, in the studies by Duque et al 2013,[12] Fu and colleagues 2015 and Mirelman et al 2016,[17] a decrease in the incidence of falls was observed. In the studies by Gschwind et al 2015[14] and Ku et al 2019,[15] the decrease in the risk of falling was greater for the IG than for the CG. It should be noted that in the study conducted by Lai et al 2013,[16] both groups underwent a VR intervention, which significantly decreased falls, compared with what if there were no CGs and these outcomes were partially maintained after 6 weeks without intervention.[18,19] Singh et al 2011[20] and Singh et al 2012[21] reported improved balance and lower risk of falling for both groups but did not report statistically significant differences between the groups.

Due to the wide heterogeneity between the variables of the evaluation scales used in the selected studies concerning balance and falls, comparing the outcome variables is not possible because this would generate an error in determining the effect of the intervention when analyzing the data and results. As evidence of the above, in the study conducted by Duque et al 2013,[12] it was observed that some of its variables, for example, the number of falls per year, were collected through questionnaires, and the rest of the variables were collected from a systematic training program (balance rehabilitation unit).

Among VR instruments and equipment used in the field of rehabilitation, there are certain precautions taken to prevent any problems arising during their use, which is why there is a noticeable difference with conventional software that is marketed. Among the selected studies, Ku et al 2019[15] used conventional VR equipment (Wii Fit) for the intervention in the chosen population, with which data were collected on the study variables (balance and falls); however, there was a risk of a secondary outcome.

Supplemental Table 2 (Supplemental Digital Content 1, http://links.lww.com/SMAR/A40) shows the results reported in each of the selected articles in this systematic review.

DISCUSSION

Summary of the Main Findings

The included studies assessed outcomes using balance and fall risk scales, such as TUG, which was used in 5 of the

10 studies,[14–16,18,19] and the PPA, used in 4 of the 10 studies.[13,14,20]

Balance training carried out through standard rehabilitation, conventional balance exercises, treadmill training, Tai Chi, and VR is effective. The evidence shows statistically significant advantages of VR in terms of fall risk as it obtained better outcomes on the scales applied in 7[12–17,19] of the 10 studies included in this review.

Effects of Interventions

The benefits presented by the studies are related not only to balance but also to fear of falling, reaction time, gait, physical fitness, independence in activities of daily living, muscle strength, and even quality of life.

The use of VR to improve balance in the elderly population shows statistically significant positive effects in all included studies. However, these outcomes are similar to those found when intervening with conventional or unconventional physical therapy.[20] It can be inferred that balance interventions can be performed in older adults with any of these strategies to obtain effective outcomes. It must be considered that the balance and the fall risk outcomes are not comparable to each other due to the different scales used to measure them and the diversity of variables included in the studies.

VR balance training, unlike conventional and unconventional interventions, generates a notable increase in adherence to treatment because the treatment is more didactic, which makes it easier for the user to understand.[14] Consoles for VR training can be located in the user's home, which allows for easy access and less need for assistance or professional supervision, thus increasing user autonomy, which decreases the costs of personnel who apply the treatment, the costs of moving the user to a rehabilitation center, and the costs associated with patients being seen by each professional, which in economic terms means savings for the health system.[14]

Nine different scales were used in the studies to assess balance and fall risk, but no article applied all the scales presented, and there was no scale that was applied in all the studies.

Another point to discuss is the length of intervention, in that, there was no standard protocol in the interventions. While Ku et al 2019[15] performed their interventions in 4 weeks, Panassol 2017[18] and Pluchino et al 2012[19] performed their interventions in 8 weeks, and the interventions applied by Gschwind et al 2015[14] lasted 16 weeks. Despite the differences, the studies showed statistically significant improvements in balance. With respect to the risk of falling, Ku et al 2019[15] showed that VR had a greater improvement compared with the control program, and in Gschwind et al 2015,[14] this difference reached statistical significance with a $P = 0.035$.

Lai et al 2013[16] compared the balance training outcomes from VR at 0 weeks, 6 weeks, and 12 weeks after the intervention, showed improvement in balance (TUG and BBS) after 6 weeks of training as well as improvement in the modified FES, with outcomes partially persisting 6 weeks after the intervention.

Interventions using VR improve visual processing and attention by training the subject to multitask, which can be cognitively demanding. The ability to multitask is related to the decreased incidence of falls in this population because it improves their ability to maintain balance while carrying out other activities.[14]

Other systematic reviews conducted on balance training in elderly subjects have reported the effectiveness of VR. Laufer et al 2014[22] concluded that a Wii-based exercise program improves balance in older adults living in the community. In 2017, Neri et al[23] showed positive clinical effects of VR games to improve balance and mobility compared with conventional and nontreatment interventions in adults in the community. This and other reviews have demonstrated the effectiveness of this intervention in terms of balance, which is associated not only with falls but also with mobility, strength, functional independence, and multitasking.

Practical Implications

Taking into account the results presented by this review, the use of VR significantly contributes to the improvement of balance in older adults, which in turn decreases their fall risk. Authors, such as Duque et al 2013[12] and Gschwind et al 2015,[14] show a greater treatment adherence to the VR protocol, which indicates that this training is a feasible option to obtain favorable results in terms of balance. If possible, it should be used for training. It would be important for physiotherapists to consider and be instructed in the use of this type of therapy to take advantage of its benefits.

VR as a balance training strategy for the prevention of falls in the elderly adult can be used as an intervention for telerehabilitation programs that provide care to populations that have difficulties accessing institutions that provide rehabilitation services. This addresses what was proposed by the "Ten-Year Public Health Plan 2012–2021," which reflected the hope that society will become one, in which future generations of older adults are less dependent, healthier, and more productive, which will lead to a decrease in burdens put on the Colombian health care system and an increase in its sustainability. The kinds of VR training studied here could be fundamental and important strategies to improve the quality of life of this population.

CONCLUSIONS

The use of VR in older adults improves their balance capabilities. The benefits presented by the studies analyzed in this article are related not only to balance but also to fear of falling, reaction time, gait, physical fitness, independence in activities of daily living, muscle strength, and even quality of life. Randomized controlled trials that include larger groups, as well as standardized protocols and outcome measures, would further enhance the favorable results presented in this review and are needed to make definitive statements about the effectiveness of a VR intervention as a safe and effective method to improve balance and fall risk in older adults.

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