INPLASY PROTOCOL

To cite: Man et al. Effect of VR training on physical and skills performance of team sports: A Systematic Review. Inplasy protocol 202340103. doi: 10.37766/inplasy2023.4.0103

Received: 28 April 2023

Published: 28 April 2023

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Support: **The research funding for this review is entirely supported by the authors.**

Review Stage at time of this submission: **Completed but not published.**

Conflicts of interest:
None declared.

Effect of VR training on physical and skills performance of team sports: A Systematic Review

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Review question / Objective: **By searching the database and conducting statistical analysis on the relevant applications of VR training in group sports training in the past 10 years, the population, interference, comparison, and output of the selected studies were statistically analyzed to identify the research gaps in the impact of VR training in team sports training.**

Information sources: **The expected medical data for this review are all from the National Academy of Sciences of China (https://www.cas.cn/kx/) provide relevant sports and medical information; The VR device information involved in this review comes from https://patent.nweon.com Patents registered in, which specifically include the following patents: Magic Leap Patent | Multi-camera cross reality device, Magic Leap Patent | Virtual and augmented reality display systems with emissive micro-displays, Apple Patent | Head-mounted display for virtual and mixed reality with inside-out positional, user body and environment tracking.**

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 28 April 2023 and was last updated on 28 April 2023 (registration number INPLASY202340103).

INTRODUCTION

Review question / Objective: **By searching the database and conducting statistical analysis on the relevant applications of VR training in group sports training in the past 10 years, the population, interference, comparison, and output of the selected studies were statistically analyzed to identify the research gaps in the impact of VR training in team sports training.**

Condition being studied: **The training auxiliary equipment used in this research is a VR device equipped with intelligent virtual reality technology, which can provide athletes with a high-definition and realistic virtual training environment, allowing them**

to fully experience more realistic training experiences from hearing, smell, and touch than traditional training methods.

Recovery: the recovery status of athletes includes training recovery under health and training recovery after injury. Muscle recovery is easier and more efficient than nerve recovery. Since VR technology can stimulate the activity of the user's cerebral cortex and transmit the electric wave signal of the cerebral cortex to the innervated nerve end limb or muscle, the use of VR training can improve the recovery ability of athletes.

Interest: Sports interest refers to the level of concentration of athletes during training. The higher the athlete's interest in training content, the better their training effectiveness, and the faster and more efficient their training progress is.

Technical and tactic: Improving technical and tactical abilities is an essential requirement for an excellent athlete and the ultimate goal of training. The improvement of individual technical and tactical abilities of athletes also represents an improvement in the overall strength of the team, which can indirectly improve the chances of the team winning in team sports.

METHODS

Search strategy: SCOPUS, PubMed, CNKI, and Web of Science.

Participant or population: (1)Sample size: totally 447 participants, the range was 8—60, mean : 29.8 sample size and median: 26; (2)Gender: 277 males and 123 females; (3)Age: range was 8 to 36, mean: 22.6; (4)tTraining experience: professional athletes and sports students; (5)Sport: this review contains 8 sports program research: basketball, football, volleyball, team rowing, table tennis, softball, ice hockey and baseball; (6)Physical condition: healthy and injured.

Intervention: Team sports training in various VR technologies, tactics, recovery, and interests.

Comparator: All of the included studies in this review were RCTs with a pre-post design. 12 studies owned an experimental (EG) and a control group (CG), 2 studies owned two experimental and a control group, only 1 studies had two experimental and no CGs.

Study designs to be included: Study design: The included studies in this review must used a randomized controlled trial (RCT) or a non-RCT (non-RCT), and the experimental design of Pre-post test can clearly compare the different effect of VR training and traditional training on the skill and physical training of athletes in team sports.

Eligibility criteria: This study includes five factors: Population, intervention, comparison, outcome, and study design (PICOS) (Table 1). The following points must be included in order to be used in this study: (1) the study that has been selected must be a peer-reviewed publication written in English that uses a randomized controlled trial (RCT) or a non-RCT (non-RCT) and assessed the effect of VR training intervention on physical and skill performance; (2) participants in the selected study must be professional athletes or students who have certain interest and understanding in sports (female and male); (3) this study probably use any VR training method on physical and skill . This study can include not only one training method for the skill and physical performance of team sports athletes, but also two or more training methods as experimental intervention; (4) This study investigated the effect of VR training on team sports and evaluated at least one athletes' physical and skill performance outcome, such as tactics, muscle, decision-making, injured investigate, batting and throwing; (5) all selected studies must be published no earlier than 2012.The conditions for excluding the studies are: (1) other experimental items of non-team sports; (2) only explore the feasibility and advantages of applying VR technology to sport teaching class and training; (3) simply

explain the development and use of VR APP and promote commercial investment; (4) experimental research conducted with obsolete VR equipment or VR App; (5) exclude relevant articles published and unpublished in languages other than English, business plan descriptions, conference summaries, case summaries, editorial contributions and short essays.

Information sources: The expected medical data for this review are all from the National Academy of Sciences of China (https://www.cas.cn/kx/) provide relevant sports and medical information; The VR device information involved in this review comes from https://patent.nweon.com Patents registered in, which specifically include the following patents: Magic Leap Patent | Multi-camera cross reality device, Magic Leap Patent | Virtual and augmented reality display systems with emissive micro-displays, Apple Patent | Head-mounted display for virtual and mixed reality with inside-out positional, user body and environment tracking.

Main outcome(s): VR training can significant improve basketball players' training interesting (Affection, Self-esteem scale, Reaction speed, UBR, and UBT), 2-3 and 2-5 basic tactics (Selection time, Rationality score, and Application), large muscle recovery (UL MBOS, UL MHC, LL MBOS, and LL MHC) and shooting ability (33-36 years old, female, 195-200cm, Shooting power, Coordination, and Shots success); VR training can significant improve the recovery of football players' low back pain (Motion perception rate, Knee extension, and Knee bending), anterior cross (pain intensity, player wellness, 40 m sprint, 4 × 5 m sprint, SSR,CMJ, and SJ), and football basic tactics (FTA score); VR training can significant improve volleyball specific technical (Front overhand service, and Spike); VR training can significant improve rowing specific technical (Breaths/min, Movement, Rhythm, Time(s), SAM1, MAA, CO, TT, AE, MS, and VQ); VR training can significant improve table tennis specific technical (backhand, forehand, and alternating hits); VR training can significant improve softball specific technical (Imagery, Confidence, and Pitch); VR training can significant improve ice-hockey special technical (Angles, RT test, head); VR training can significant improve baseball batting ability (responsiveness, consistency, naturalness, delay, high).

Quality assessment / Risk of bias analysis: Using the Physiotherapy Evidence Database (PEDro) scale, and 11 items was comprised that evaluates four methodological domains :randomization, blinding, group comparison, and data analysis. The scoring rules are: "YES" and a score of 1 point are given if the evaluation criteria are fully met, and "NO" and a score of 0 point are given if the evaluation criteria are not met. Finally, the model of the scoring scale is established through the above rules. The final score for each inclusive study is the sum of the scores obtained for the 11 evaluations. Since the eligibility criteria for the study depend on its external validity, it is not included in the total score. The minimum score of the PEDro measurement table for measuring the quality of the method is 0, and the maximum score is 10, with a higher PEDro score indicating higher methodological quality: Obtaining 8-10 points represents excellent quality of the research method; 5-7 indicates that the method is good; 3-4 indicates that the method is average, < 3 represents a poor method. Additionally, this analysis made use of best evidence synthesis (BES) to assess all of scientific data. BES divides evidence results into five categories by measuring the quality of research methods, the number of studies, and the consistency of research results in a study: (1) Compelling evidence: research result more than two high-quality research institutes; (2) general evidence: A study result is recognized by both a high-quality study and many low-quality studies; (3) limited evidence: one study is extremely lacking or the conclusions of many studies are different; (4) conflicting evidence: the research results are contradictory, but the results still have 75% of the same; (5) invalid evidence: did not have any valid results.

Strategy of data synthesis: Two independent reviewers (Man and Sun) recorded the relevant data of each included study in detail, such as the study title, participant characteristics, study design, indicators and specifications of VR training, and outcomes. By using EXCEL, the data collected from the paper is tabulated in the order of PICO arrangement.

Subgroup analysis: Conduct subgroup analysis on the effect of VR training by setting up two experimental groups on sex ratio, height, age, and training experience (student or major).

Sensitivity analysis: A total of 5 different types of VR devices were used in the study to analyze the related effects of different devices and the software they are equipped with on training. In addition, when wearing VR devices, athletes will bear the weight of the device and external loads, and the effect of these loads on athletes during training should also be included in the sensitivity analysis.

Language restriction: Selected studies in this review were all written by using English.

Country(ies) involved: China and Malaysia.

Keywords: VR training, physical, skill, decision-making, sports psychology, training applications, team sports.

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