Roller Skating Promotes the Physical Health of Children and Adolescents: A Systematic Review and Meta analysis

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Systematic Review

Keywords: Roller skating, children and adolescents, physical health, meta-analysis

Posted Date: October 2nd, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-85702/v1>

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Abstract

Background: This meta-analysis aimed to systematically analyse the influencing factors of roller skating on the physical health of children and adolescents and to discuss the intervention effect of roller skating on the physical health of children and adolescents.

Methods: Taking "Roller Skating", "Children", "Youth", "roller-skating", "minors", "childhood", and "adolescent" as the subject words, a combination of subject words and free text was used to perform a comprehensive search of 7 electronic databases: China Knowledge Network (CNKI), WanFang and Weipu Periodicals, Web of Science, PubMed, PsycINFO, and SPORTDiscus. We searched for randomized controlled trials of roller skating with respect to promoting the health of children and adolescents. We searched from inception to 31 December 2019, with no language restrictions.

Results: Sixteen studies with 1296 patients were included. Pooled analysis showed a favorable effect of Roller Skating in total effective rate. Balance ability (SMD=0.86, 95%CI: 0.72-1.01; Z=11.94, P<0.0001), Lower Limb power (SMD=0.52, 95%CI: 0.33-0.70; Z=5.55, P<0.0001), Speed quality (SMD=0.17, 95%CI: 0.14-0.20; Z=11.67, P<0.01), Social adaptability (SMD=0.68, 95%CI: 0.32-1.04; Z=3.67, P<0.01) and Endurance quality (SMD=-0.24, 95%CI: -0.38-0.10; Z=3.42, P<0.01) while no significant differences were found in Body height (SMD=0.13, 95%CI: -0.01-0.27; Z=1.79, P>0.01), Flexibility (SMD=0.05, 95%CI: -0.09-0.19; Z=0.65, P>0.01), Sensitive quality (SMD=0.64, 95%CI: -1.13-2.41; Z=0.71, P>0.01) and Vita capacity (SMD=1.92, 95%CI: 0.17-3.67; Z=2.15, P>0.01) between the two groups.

Conclusion: The current evidence shows that roller skating effectively promotes balance, lower limb strength, speed quality, body endurance and social adaptability in children and adolescents; the improvement in male endurance was lower than that in females in the adolescent stage. However, the improvement in male lower limb strength was greater than that of females, and there was no improvement in the flexibility and agility of males or females in these two periods.

Background

Nowadays, the pace of modern life is accelerating. A sedentary lifestyle combined with a lack of physical activity is becoming an increasingly serious health problem, especially for children and adolescents. Due to a lack of interest in physical exercise, most children and adolescents in China have little time for physical exercise and cannot form good exercise habits. The 19th National Congress of the Communist Party of China made a major decision-making arrangement for the implementation of a healthy China action strategy, emphasizing adherence to prevention, advocating a healthy and civilized lifestyle, and preventing and controlling major diseases. The strategy promotes a change from treating disease as central to people's health and clearly raises concerns about the physical and mental health of young people. A number of cross-sectional surveys by the American College of Sports Medicine (ACSM) found that the incidence of obesity among children and adolescents aged 2 to 19 years is as high as 4 to 17% [1], and that the obesity rate of children and adolescents in Asia in recent years has also shown a rapidly upward trend, leading to early stages of various chronic diseases, directly threatening the physical and mental health problems of children and adolescents.

As an important part of ensuring a healthy life, sport not only promotes health and improves the body's ability to resist diseases but also regulates people's psychological activities towards health [2]. In recent years, roller skating has been favoured by the majority of children and adolescents. Some studies have shown that roller skating can fully exercise the muscular system and small joints, thereby playing a positive role in the balanced development of various parts of the body [3,4]. Roller skating exercises impose high requirements on muscle strength and endurance of the participants' upper and lower limbs, waist and abdomen, as well as the flexibility of the hips [5]. Principal component analysis in many experimental studies has shown that the main physiological factors that are affected by roller skating training are strength, aerobic capacity and body fat percentage. However, there has been no systematic review and meta-analysis of the effect of roller skating on the improvement of children and adolescents' physical health. Therefore, it is necessary to use the meta-analysis method to extract and combine research results, to prove the reliability of the research results.

Methods

Search strategy

According to the PICO model, the subject terms of the research content were graded. This study used "roller skating", "children", "teenagers", "impact", "rollerskating", "child", "minors", and "adolescent" as the subject words. We used a combination of subject words and free words, supplemented by literature tracking. The subject words and free text of the research were searched, screened and determined from the CBM, PubMed and Weipu databases. Relevant Chinese and foreign language documents are searched using the Chinese literature search platforms HowNet, Wanfang and Weipu Journals and the Web of Science, PubMed, psycINFO, and SPORTDiscus foreign language databases. Articles published through 31 December 2019 were searched. On the basis of strict paper retrieval requirements and publication times, the papers that met the research conditions were imported into literature reading and management software, and human-machine combination screening was performed on the document titles, abstracts and full-text reading methods. The retrieval process is shown in (Fig 1)

Study selection

The meta-analysis-based literature incorporation is based on the PICO method of evidence-based medicine, which considers five factors (participants, interventions, control groups, research results and research design) to determine the following inclusion criteria: 1) The research subjects are healthy and well-developed children and adolescents without organic lesions and obvious physiological defects, regardless of gender; 2) the study complies with the requirements of randomized controlled studies and non-simultaneous controlled trials of non-randomized controlled studies; 3) the result measurement index is the content of 3 dimensions of physical fitness; 4) the test is blinded or not; and 5) the length of the intervention is no less than 4 weeks.

We determined the criteria for excluding literature based on the "Systematic Review and Meta-Analysis Priority Report Entry: PRISMA Statement" [6]:1) Duplicate literature; 2) Systematic review, conference report, or meta-analysis; 3) Research content does not match, no data literature; and 4) Experimental method design is not rigorous, the outcome index gap is large. and RevMan 5.3 software is used to draw the literature process Figure.

Data extraction

To ensure the quality of the first time the literature is included, the literature search, screening, and data extraction were arranged by two researchers. If the statistical results and opinions differed, a third party's suggestions were sought to and adopted. The basic characteristics of the included literature included: first author, year of publication, age of subjects, sample size of EG and CG groups, intervention plan design and test index data.

Quality evaluation

A randomized controlled trial Cochrane risk bias assessment tool[7] was used to evaluate the quality of the included literature. The quality assessment included the following 7 aspects: random allocation method, concealment of allocation scheme, blinding method, blinding method of result evaluation, completeness of result data, selective reporting of research results, and other sources of bias. A total of 7 points, satisfying a score of 1 point, classifies the quality evaluation statistical results: satisfying 6 points or more indicates a low degree of bias risk; 4 to 5 points indicates moderately biased risk, and 3 points or less indicates highly biased risk.

Statistical analysis

According to the meta-analytic scientific method to summarize the classification requirements of the effect quantity, the Q-test or I² test were used to evaluate heterogeneity. When the result of the Q-test indicated that the heterogeneity was significant (I² ≥ 50%), the random effect model was used, otherwise the fixed combination and calculation of effect model data were used. If the heterogeneity was too large, we used descriptive analysis.

To ensure the heterogeneity test of the extracted data, it is necessary to select at least the data obtained from the two groups of experiments in the pretest and posttest to calculate the effect amount of the test data[8], to calculate the effect size of the selected variable and to generate a forest map[9,10].

The data in this study were continuous variables, the effects were expressed as standardized mean difference (SMD) or standard deviation (MD), and a 95% confidence interval was calculated. The heterogeneity test between the studies used the consistency coefficient I² and P test, P<0.1, I²≥50%, using RevMan 5.3 software to analyse and merge the amount of research included[11,12].

Results

Study selection. We retrieved 83 articles through the database search. After repeated literature elimination, title reading and abstract screening to exclude non-RCTs, rigorous experimental design and unsuccessful research data, 16 articles were ultimately included, including 14 Chinese articles and 2 English articles. There were a total of 1296 experimental participants.

Characteristics of the exercise interventions

The literature inclusion criteria and exclusion criteria generated a total of 16 studies. We recorded the study characteristics of the author, the year of publication of the article, the type of study, the frequency and duration of intervention.

All included studies reflect the effects of roller skating on children and adolescents in terms of their body shape, physiological function, physical fitness and adaptability(**Table 1**). The most frequently used evaluation indicators, balance ability and explosive force, are used to measure changes in neuromuscular control of movement after participating in roller skating; secondary evaluation indicators include speed, endurance, sensitivity, flexibility, vital capacity, and social adaptation.

Table 1. Four aspects of physical health consisting of 9 Variables

Aspects	Variables
Body Shape	Body Height
Physical Fitness	Speed, Lower limb Strength, Endurance, Sensitivity, Balance, Flexibility
Physiological Function	Vital Capacity
Adaptive Capacity	Social Adaptive Capacity

In the 16 articles included in this study, a total of 1296 participants with mixed genders, age range of 4 to 21 years and experiment range from 8 weeks to 36 weeks. There were large differences in the intervention programmes among the studies. The duration of a single intervention ranged from 15 to 120 minutes, and most concentrated on 30 to 60 minutes. The frequency of interventions ranged from 1 to 7 times per week, and the intervention cycles also varied greatly. The shortest cycle was 8 weeks, and the longest cycle was 36 weeks. Table 2 lists the basic characteristics of each study.

Table 2. Summary of the observed data from the included studies n=1296

NO.	Study	Age mean±SD	Quantity EG/CG	Intervention period	Exercise intensity	Intervention time	Exercise frequency	Variables
ID1	Chen Siping [13]	15-16	43/43	20 wk	—	4 min	3 times/week	↑, ↑, ↑, ↑, →, →
ID2	Chen Siping [27]	15-16	43/43	20 wk	—	4 min	3 times/week	↑
ID3	Fan Peng[14]	19.21±0.37 19.34±0.37	F:48/50	36 wk	Medium/high intensity	90 min	3 times/week	↑
ID4	Han Qi [15]	19.15±1.6	20	16 wk	Medium/high intensity	90 min	4 times/week	↑
ID5	Hu Jiayi[16]	20.1±0.6	20/20 10/10	12 m	—	90 min	1 times/week	↑, ↑, →, ↑
ID6	Jing Xiaowei [17]	20-22	23/40	18 wk	—	90 min	1 times/week	↑, ↑, →, ↑ ↑, ↑
ID7	Kong Xiangzhen [24]	11.25±0.64 11.35±0.67	20/20	16 wk	medium intensity	50 min	1 times/week	↑, ↑, ↑, ↑
ID8	Liu Lexing [19]	4—6	25/27	20 wk	—	—	—	↑, ↑, ↑, ↑, ↑, ↑
ID9	Liu Zhongxi [20]	4—6	20/20	12 wk	—	—	—	↑
ID10	Qi Hongchun [21]	19. 21±0. 37 19. 34±0. 37	50/50	36 wk	medium intensity	90 min	1 times/week	↑, ↑, ↑, ↑, ↑
ID11	SunChao [26]	11±2.3	12/12	18 wk	High intensity	40 min	3 times/week	↑, ↑
ID12	Wang Hai [22]	20±0.3	F40/40	15 wk	medium intensity	90 min	1 times/week	↑
ID13	You Yang [25]	19-20	271/280, 131/140	16 wk	medium intensity	90 min	2 times/week	↑, ↑, ↑, ↑, ↑, ↑
ID14	zhang Jian[28]	21.32±0.78 20.88±0.72	42/37	12 wk	—	90 min	3 times/week	↑, ↑, ↑
ID15	Zhou You[23]	5-6	20/20, 20/20	24 wk	—	—	—	↑, ↑, ↑, →, ↑
ID16	LidaZare Dizajdizi [18]	14-16	F10/10 /10/10	8 wk	—	105 min	—	↑→, ↑

Abbreviations: F=female; EG=experimental group; CG=control group; ↑Balance ability, ↑Flexibility, ↑Sensitivity, ↑Lower limb strength, ↑Speed quality, ↑Endurance, ↑Body Height, ↑Vital capacity, ↑Social Adaptability

Methodological quality and risk assessment of bias

Using the Cochrane risk bias assessment tool for randomized controlled trials, the evaluation results of the included 16 studies showed that there were 1 low-risk study, 14 medium-risk studies, and 1 high-risk study(12). In Fig 2, "+" means compliance, "-" means failure, and "?" means that the text has not been described in detail. Figure 3 is a statistical chart of the proportion of each item of methodological assessment.

Meta-analysis results

The full text reading of the 16 included documents revealed that the focus of the studies on the effect of roller skating on the improvement of children and adolescents' physical health varied. The performance of the same indicator used different test methods, and some research subjects had different genders. A comprehensive analysis of the 9 indicators identified in the 16 studies involved independent analysis of each indicator to analyse the effect size heterogeneity and research publication bias. The results are as follows.

Balance ability

The meta-analysis of the balance ability of children and adolescents included 17 sets of test data from 11 studies involving 960 participants[13-23]. It included 4 sets of independent men and women, and 2 sets of dynamic and nondynamic balance ability test data[14-17,22-23]. After the heterogeneity test, $I^2=93\%$, and Q-test $P<0.1$, suggesting that there is strong heterogeneity between the selected studies, and random effects were selected for meta-analysis. The data from this study strongly suggest that the source of heterogeneity was inconsistent test methods. Random effects meta-analysis results showed that the experimental group's balance ability improved by 1.29, $Z=11.94$, $P<0.01$, indicating that roller skating has a positive effect on improving the balance ability of children and adolescents Fig 4.

Lower Limb Power

The meta-analysis of the strength and quality of children and adolescents was based on seven studies and 17 sets of test data involving 502 participants[13,16-17,19-21,23-24], including 3 independent test data for men and women. After heterogeneity testing, $I^2=78\%$, and Q-test $P<0.1$, suggesting that there was strong heterogeneity between the selected studies, and random effects were selected for meta-analysis. There is strong evidence that the source of heterogeneity is the inconsistency of strength evaluation methods and test methods. Random effects meta-analysis results showed that $Z=5.55$, $P<0.01$, indicating a significant difference between the experimental group and the control group, which shows that roller skating can improve the strength and quality of children and adolescents Fig 5.

Body Height

Meta-analysis data on the effect of roller skating on the height of children and adolescents comes from 9 sets of data involving 866 participants[16,19,23-26], including 3 sets of independent data sets for men and women[16,24,26]. The height data of the experimental group and the control group increased after exercise intervention testing. The total SMD value was 0.13, the 95% confidence interval was $[-0.01, 0.27]$, $Z=1.79$, $P>0.05$, the data were not statistically significant Fig 6.

Flexibility

For studies of roller skating on improvement in the flexibility of children and adolescents, we performed analysis of 6 studies and 9 groups of balance ability test data, involving 771 participants[13,17,21-25], including 6 independent test data for males and females[13,17,23]. The heterogeneity test showed $I^2=87\%$, and in the Q-test, $P<0.1$, suggesting that there is strong heterogeneity between the studies, and random effects were selected for meta-analysis. A total of 2 articles were left out of the sensitive analysis process, and the remaining 4 articles showed no heterogeneity ($I^2=0\%$ and Q- test $P>0.1$); then, the combined fixed effect was used. The results showed that the flexibility of the experimental group was increased by 0.05 compared with the control group; however, the results were not statistically significant ($P=0.52>0.01$), indicating that the effect of roller skating on the flexibility of children and adolescents is not obvious Fig 7.

Speed quality

A meta-analysis of the effect of roller skating on children's and adolescents' speed and quality included data from 8 sets of data involving 810 participants in 5 studies[13,17,23-25], and three separate data sets for male and female students[17,23,25]. After exercise intervention, the speed quality of the experimental group and the control group improved (95% CI, $[0.14$ to $0.20]$, $Z=11.62$, $P<0.01$), indicating that roller skating can improve the speed ability of children and adolescents Fig 8.

Sensitive quality

Meta-analysis data on the relationship between roller skating and children's and adolescents' sensitive qualities came from 5 studies involving 6 sets of data from 276 participants[13,16,18,19,21], including 1 group of independent data set of males and females[17]. The total SMD value was 0.64, and the 95% confidence interval was $[-1.13, 2.41]$, with $Z=0.71$ and $P=0.48>0.05$. The studies showed that the effect of roller skating on the sensitivity of children and adolescents is not significant Fig 9.

Vital capacity

The meta-analysis data of the relationship between roller skating and the vital capacity of children and adolescents comes from 9 groups of data involving 770 participants from 5 studies[16-17,24-26], two independent data sets of 3 groups of males and females were included[16,17,26]. The heterogeneity test $I^2=99\%$ and Q-test $P<0.1$ indicates that the included studies showed strong heterogeneity, and the random effect of the combined effect size was selected. Based on the overall study of the included studies, it is highly suspected that the heterogeneity source test methods were inconsistent. The results showed that the total SMD value was 1.92, the 95% confidence interval was $[0.17, 3.67]$, and it was statistically significant ($Z=2.15$, $P=0.03<0.05$), suggesting that roller skating can improve the cardiopulmonary function of children and adolescents Fig 10.

Social Adaptability

For meta-analysis of the social adaptability of children and adolescents affected by roller skating, the data were derived from 5 sets of information involving 298 participants in 5 studies[17,18,20,27,28]. Overall, the total SMD value was 0.68, and the 95% confidence interval was $[0.32$ to $1.04]$, and was statistically significant ($Z=3.67$, $P=0.0002<0.05$). Studies showed that roller skating can effectively improve the social adaptability of children and adolescents Fig 11.

3.4.9 Endurance quality

For meta-analysis of the effect of roller skating on children and adolescents' endurance quality, data were from 5 studies involving 5 groups of information from 803 participants. The heterogeneity test showed $I^2=32\%$, and the Q-test $P>0.1$; there was no heterogeneity among the studies involving endurance quality, and the fixed effect of the combined effect amount was selected. The results were $Z=3.42$ and $P<0.01$, suggesting that roller skating can significantly improve the endurance quality of children and adolescents. Fig 12.

Discussion

Participation in physical activity is very important to improve the physical fitness and body composition of children and adolescents, to improve cardiopulmonary function, to reduce cardiovascular risk, to promote brain maturity and to improve cognitive function[29]. The data included in this article show that roller skating has an effect on improving the flexibility, sensitivity and height of children and adolescents; however, the combined effect was not statistically significant. In this article, roller skating had a significant effect on the improvement of children and adolescents' balance ability, strength, speed, endurance, cardiopulmonary function, and social adaptability. One of the most important factors for participating in sports activities is the efficiency of sports, and studies have shown that children and adolescents with strong athletic ability can derive more fun from sports activities, so they have formed a lifelong connection with this sport[30]. A number of studies have shown that sensitivity and balance ability are important parameters that affect participation in physical activity and participation satisfaction[31], which is consistent with the conclusion of this study on balance ability. Studies have also confirmed that roller skating is associated with significant improvements in the core strength and limb balance of sedentary children and adolescents. Moreover, different sports have different demands on balance ability, and balance sensitivity is a basic ability that can be acquired through the acquired sports skill learning process on a regular basis[32].

Roller skating can significantly improve the strength of young people's lower limb muscles. Regarding strength, researchers determined muscle strength and endurance by testing children's and adolescents' upper extremity (tennis throw, grip), waist and abdominal strength (sit-ups, push-ups, curls), and lower extremity strength (standing long jump). The research suggests that children's and adolescents' mastering of motor skills can promote the development of strength and quality[33]. The combined effect size results reflect the lack of specificity of the training design of current exercise programmes. The strength improvement of children and adolescents may be due to improvement of lower limb strength caused by improvements of other body components during running. Tracking the future development of children and adolescents should consider adding resistance-based coordinated movement exercises on the basis of roller skating to help improve muscle fitness.

Physical function refers to life activities engaged in by the whole person and each organ system that composes them[34]. Children and adolescents who participate in high-level physical activity are unlikely to be at risk for cardiovascular disease[35] and will produce positive results in terms of weight regulation. Studies have shown that appropriate physical activity has an important impact on the cardiopulmonary function of children and adolescents, and it is believed that high levels of cardiopulmonary function may suppress the adverse effects of obesity caused by a sedentary lifestyle and a lack of exercise and can promote the improvement of strength and muscle endurance[36]. Cardiopulmonary endurance comprehensively reflects the body's ability to ingest, transport, and use oxygen, including the heart's pumping function, the lung's ability to take up oxygen and exchange gases, and the ability of the circulation system to carry oxygen to provide more energy to the muscles[37]. At present, cardiovascular diseases and endocrine diseases are gradually occurring at younger ages, and unfavourable factors that threaten the physical health of children and adolescents are gradually increasing. In recent years, research shows that there is a significant, graded, and independent relationship between the level of cardiopulmonary endurance and cardiovascular outcomes and that the level of cardiopulmonary endurance in children and adolescents is related to the incidence of cardiovascular and other chronic diseases. A high level of cardiopulmonary function can reduce the incidence of cardiovascular and other diseases[38]. During roller skating exercise, participants often stretch muscle fibres, increase circulation and metabolism, and increase muscle oxygen absorption capacity, thereby maximizing the absorption of oxygen. Frequent stretching of muscle fibres may increase microcirculation and metabolism, thereby improving muscle aerobic capacity, muscle strength and ultimately cardiopulmonary function[39].

A large number of early studies have confirmed that participation in exercise can increase sensitivity, flexibility, self-confidence and balance ability. In future research, it will be necessary to arrange exercise duration and exercise load reasonably. The effect of the flexibility index in this study is not obvious. The reason for this analysis may be due to the neglect of warm-up before the activity and the relaxation content after the exercise. Some studies have also proved that warm-up and relaxation before and after exercise, and the completion of the stretching exercise of the body can promote flexibility[40]. Another reason may be that the muscles around the spine are strengthened, resulting in decreased flexibility. The stronger the muscles, the greater the tension provided[41]. The adverse effect of strength on flexibility is obvious in many sports[42]. Lida (2016) proposed that the effect on sensitivity has a relationship with the type and intensity of exercise and is related to the duration of exercise. After repeated movements to stimulate the central and peripheral nervous systems, the movement centre sends movement instructions to the muscles, and muscles that receive the signals correct the deviation of the centre of gravity to withstand the anti-balance effect of the centre of gravity and shaking during running, jumping and flipping[18], realizing the control, optimization and development of self-action. The window period based on the development of sensitivity quality is 10 to 15 years old. Only 5 of the studies included in the sensitivity study were conducted in the window period, and the ES of the experimental data was low. This suggests that follow-up research should focus on the type of exercise, exercise intensity and exercise time in order to obtain the ideal test results. Vandendriessche et al. (2011) demonstrated the relationship between flexible fitness and motor skills development using the seated body flexion test and believed that children's motor skills are positively related to flexibility[43].

The results of this study showed that roller skating has no significant effect on flexibility and sensitivity. This is mainly due to the existence of a sensitive period for the development of physical fitness of children and adolescents that determines the impact of research test indicators. Second, measurement errors, sample size, differences in sample characteristics and different analysis strategies increase the possibility of inconsistency in the study. However, in the analysis of the impact of the intervention environment on the physical health of children and adolescents in Salmon et al. and other studies have shown that physical education, extracurricular activities, and after-school training on campus have a significant impact[44], and the measured environment of the selected research basically meets the requirements.

Heterogeneity and Deficiency analysis

An original RCT meta-analysis shows inevitable differences between studies when the test indicators are combined and analysed. Therefore, heterogeneity testing and analysis of the causes of heterogeneity are required. The author believes that this meta-analysis has the following 6 shortcomings. First, the number of foreign journals included was slightly less, affecting the breadth of information to a certain extent. Second, four of the 16 RCTs included mainly females, and only three of the other mixed trials of men and women explained the grouping and proportion of men and women. The difference in gender and age of the test subjects are another reason for the heterogeneity of the meta-analysis. Third, due to the use of different standards and test methods, the ES value and heterogeneity test results of the combined effect of various indicators included in the literature are not ideal. Fourth, the details of the sports intervention plan for the impact of children's physical health have not been detailed, and the lack of information is more serious. To avoid the heterogeneity problem caused by the intervention measures during meta-analysis, it is recommended that the exercise intervention target setting and evaluation be more precise. Fifth, due to the obviousness of exercise intervention, it is difficult for such tests to achieve blinding on the part of experimenters and subjects required by RCT, and this also increases the heterogeneity of meta-analysis methods. Finally, five articles in the funnel graph of the meta-analysis bias test showed a high risk of bias, which is also an influencing factor on the heterogeneity of this meta-analysis.

Exercise intervention methods for physical health, physical and mental development, training performance improvement, sports injury and rehabilitation, and chronic disease prevention and treatment are different from those of double-blind tests of clinical trials in RCTs. It is recommended that future researchers fully consider the basis of the intervention environment from the optimization of experimental design, monitoring and data collection, evaluation and other links, so that the research results and conclusions may be more scientific and practical.

Conclusions

Roller skating can effectively promote balance ability, lower limb strength, speed quality, physical endurance and social adaptability in children and adolescents. In the adolescent stage, the improvement effect of male endurance quality was lower than that of females, but the improvement effect of male lower limb strength was better than that of females. During both periods, males and females showed no improvement in flexibility and sensitivity. Additionally, due to the limitation of the quantity and quality of the included research literature and the obviousness of exercise intervention, it is difficult to achieve completely blinded testing of the experimental staff and subjects required by Randomized controlled trial. This study still needs more authoritative research to provide data support and verification.

Abbreviations

BMI:Body mass index

RCT: Randomized controlled trial.

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

The data source of this paper is original literature research, which focuses on the references [13]-[28] in this paper. There are a total of 16 literatures, including 14 Chinese literatures and 2 foreign literatures.

Competing interests

The authors declare that they have no competing interests

Funding

No funding was obtained for this study.

Authors' Contributions

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Acknowledgements

We would like to thank the researchers who have done research on roller skating, and provide data support and help for the research of this paper.The authors would like to thank all those who participated in the study.

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Figures

Figure 3

The overall assessment of risk of bias

Figure 4

Relationship between roller skating and balance ability of children and adolescents

Figure 5

Relationship between roller skating and lower limb strength of children and adolescents

Figure 6

Relationship between roller skating and the height of children and adolescents

Figure 7

Relationship between roller skating and the flexibility of children and adolescents

Figure 8

Relationship between roller skating and speed quality of children and adolescents

Figure 9

Relationship between roller skating and sensitivity quality of children and adolescents

Figure 10

Relationship between roller skating and vital capacity of children and adolescents

Figure 11

Relationship between roller skating and the social adaptability of children and adolescents

Figure 12

Relationship between roller skating and endurance quality of children and adolescents