Descargado el: 18-11-2026 ISSN 1727-897X

ARTÍCULO ORIGINAL

Collaborative learning in adherence to Sports Health Preventive Programs among youth volleyball players

Aprendizaje colaborativo en la adherencia a programas preventivos de salud deportiva en voleibolistas juveniles

Cinthya Lissette Orellana Londoño[1] Nathalia Cristina Chamorro Balseca[2] Antonio J. Monroy Antón[3] Santiago Calero Morales[4]

[1] Universidad César Vallejo, Piura, Peru
[2] Universidad de las Fuerzas Armadas ESPE., Quito, Ecuador
[3] ESERP Escuela de Negocios, Madrid, Spain
[4] Universidad de las Fuerzas Armadas ESPE, Quito, Ecuador

Cómo citar este artículo:
Orellana-Londoño C, Chamorro-Balseca N, Monroy-Antón A, Calero-Morales S. Collaborative learning in adherence to Sports Health Preventive Programs among youth volleyball players. **Medisur** [revista en Internet]. 2026 [citado 2026 Nov 18]; 24(1):[aprox. 0 p.]. Disponible en: https://medisur.sld.cu/index.php/medisur/article/view/53395

Resumen

Foundation: Collaborative learning is a pedagogical strategy with the potential to strengthen athletes' commitment to preventive practices and promote behaviors aimed at safeguarding their athletic health.**Objective:** to analyze the relationship between collaborative learning and adherence to sports health prevention programs in youth volleyball players.**Methods:** A quasi-experimental study with a pretest-posttest design and a non-equivalent control group, conducted with 50 male youth volleyball players. The research was carried out over 12 weeks using a sports health prevention program complemented by collaborative learning strategies in the experimental group. **Results:** The experimental group showed significant improvements ($p < 0.001$) across all evaluated variables, with effect sizes ranging from moderate to very large ($r = 0.58–0.89$). Collaborative learning increased by 0.51 to 0.94 points, while adherence reached high levels (4.09–4.61 points), with an overall objective adherence rate of 92.0% compared to 77.1% in the control group. Group cohesion, self-determined motivation, and self-efficacy increased significantly, while discouragement decreased markedly. In contrast, the control group showed minimal, non-significant changes across all analyzed variables. **Conclusions:** The inclusion of collaborative learning constitutes an effective pedagogical strategy for strengthening adherence to sports health prevention programs among youth volleyball players. The observed improvements were not limited to achievement of preventive activities but extended to psychosocial dimensions essential for the athlete's holistic development, such as group cohesion, self-determined motivation, and self-efficacy.

Palabras clave: interdisciplinary practices, preventive health services, controlled before-and-after studies

Abstract

Fundamento: el aprendizaje colaborativo es una estrategia pedagógica con potencial para fortalecer el compromiso de los atletas con las prácticas preventivas y promover conductas orientadas al cuidado de la salud deportiva.**Objetivo:** analizar la relación entre el aprendizaje colaborativo y la adherencia a programas preventivos de salud deportiva en voleibolistas juveniles. **Métodos:** investigación cuasiexperimental con pretest-postest y grupo control no equivalente, aplicado a 50 voleibolistas juveniles masculinos. La intervención se desarrolló durante 12 semanas mediante un programa preventivo de salud deportiva complementado con estrategias de aprendizaje colaborativo en el grupo experimental.**Resultados:** el grupo experimental presentó mejoras significativas ($p<0.001$) en todas las variables evaluadas, con tamaños del efecto moderados a muy grandes ($r =0.58–0.89$). El aprendizaje colaborativo aumentó entre 0.51 y 0.94 puntos, mientras que la adherencia alcanzó niveles altos (4.09–4.61 puntos) y una adherencia objetiva global del 92.0 %, frente al 77.1 % del grupo control. La cohesión grupal, la motivación autodeterminada y la autoeficacia aumentó significativamente, disminuyendo notablemente la amotivación. En contraste, el grupo control presentó variaciones mínimas y no significativas en todas las variables analizadas.**Conclusiones:** la incorporación del aprendizaje colaborativo constituye una estrategia pedagógica eficaz para fortalecer la adherencia a programas preventivos de salud deportiva en voleibolistas juveniles. Las mejoras observadas no se limitaron al cumplimiento de las actividades preventivas, sino que abarcaron dimensiones psicosociales esenciales para el desarrollo integral del deportista, como la cohesión grupal, la motivación autodeterminada y la autoeficacia.

Key words: prácticas interdisciplinares, servicios preventivos de salud, estudios controlados antes y después

Aprobado: 2026-10-21 13:16:36

Correspondencia: Cinthya Lissette Orellana Londoño. Universidad César Vallejo. Piura. Perú. dinorarebo@gmail.com

INTRODUCTION

Engaging in sports systematically during adolescence is a fundamental component of young people's physical, psychological, and social development. [1] During this developmental stage, participation in organized sports favor the adoption of healthy habits, the strengthening of motor skills, and the development of personal competencies such as discipline, responsibility, and teamwork. [2,3]

However, increased training intensity, early sports specialization, and a high frequency of competition have raised the incidence of musculoskeletal injuries among youth athletes, making injury prevention a priority for coaches, healthcare professionals, and researchers. [4,5] Among team sports, volleyball places high biomechanical demands on the body due to the repetitive execution of jumps, landings, rapid changes of direction, and explosive movements of the upper and lower body[6] These actions increase the likelihood of injuries to structures such as the ankle, knee, shoulder, and lumbar region, particularly in young athletes whose musculoskeletal systems are still maturing.[7]

Several studies have demonstrated that a considerable proportion of these injuries can be prevented through structured programs incorporating neuromuscular strengthening, postural control, dynamic balance, joint mobility, and proprioceptive training, [8] provided that such programs are implemented consistently and with an adequate level of adherence by athletes. Despite extensive evidence regarding the efficacy of preventive programs, one of the main challenges identified in the scientific literature lies in athletes' limited adherence to these interventions. [9,10]

In many sports contexts, preventive routines are often viewed as supplementary activities that consume training time without offering immediate benefits for competitive performance. Consequently, coaches and athletes alike tend to gradually reduce their implementation or perform them incompletely, thereby significantly diminishing their preventive effectiveness. [10,11] Available evidence indicates that even the most scientifically supported programs yield only modest results when adherence falls below recommended levels. [9]

Adherence to preventive programs is a multidimensional phenomenon influenced by individual, social, organizational, and motivational factors. These include perceived usefulness of the exercises, intrinsic motivation, coach support, team climate, communication among team members, and collective commitment to injury prevention. [9] From this perspective, changing preventive behaviors requires educational strategies that go beyond the simple transmission of technical instructions and promote participatory processes through which athletes understand the purpose of preventive activities, share responsibilities, and collectively develop healthy habits. [12,13]

Within this context, collaborative learning emerges as a pedagogical strategy with considerable potential to strengthen adherence to preventive programs in youth sports. [14] This educational approach proposes that learning develops through interaction among group members, who cooperate to achieve common goals, exchange knowledge, solve problems collectively, and assume shared responsibilities throughout the learning process.

In youth sports teams, where interpersonal relationships exert a significant influence on individual behaviors, peer collaboration may become a key factor in consolidating sustainable preventive habits. [15] Peer observation, mutual feedback, shared problem-solving during the performance of preventive exercises, and the establishment of group goals create learning environments that promote both knowledge acquisition and commitment to preventive practices. [16] Consequently, injury prevention ceases to be perceived as an obligation imposed by the coaching staff and instead becomes a shared responsibility among all members of the team.

Furthermore, the promotion of preventive programs from a collaborative perspective is consistent with contemporary approaches to health education, which emphasize the collective construction of knowledge, participant empowerment, and the development of self-care competencies. [15,17] In the sporting context, these competencies include the early identification of risk factors, the correct performance of preventive exercises, the recognition of signs of physical overload, and the adoption of behaviors aimed at preserving health throughout the athlete's sporting career. Thus, collaborative learning may not only contribute to reducing injury incidence but also support the holistic development of young athletes by fostering

social, communication, and leadership skills. [15,18]

However, although the literature has documented the benefits of collaborative learning in educational settings and the positive effects of preventive programs on reducing sports injuries, there is still limited scientific research analyzing the relationship between these two constructs in an integrated manner, particularly among youth volleyball players. Most available research has focused on evaluating the biomechanical efficacy of preventive programs (19,20) or analyzing physiological variables associated with athletic performance, while giving less attention to the pedagogical and social processes that influence adherence to such interventions. [21]

This knowledge gap is particularly relevant in the Latin American context, where prevention programs are often implemented with limited resources and under heterogeneous organizational conditions. [15,22] Under these circumstances, low-cost educational strategies—such as collaborative learning—could represent a viable alternative for increasing young athletes' engagement with preventive activities, thereby optimizing the effectiveness of interventions without requiring significant investment in infrastructure or specialized equipment.

Consequently, understanding the influence of collaborative learning on adherence to sports health prevention programs is of both scientific and practical importance. From a theoretical standpoint, it broadens the understanding of the educational and psychosocial factors that foster the consolidation of preventive behaviors among youth athletes. From an applied perspective, it provides useful evidence for designing training methodologies that integrate collaborative pedagogical strategies with systematic injury prevention programs, thereby contributing to the development of sports environments that are safer, sustainable, and focused on the athletes' holistic well-being. Against this backdrop, the present study aims to analyze the relationship between collaborative learning and adherence to sports health prevention programs among youth volleyball players.

METHODS

This research employs a quantitative approach and an explanatory scope, utilizing a quasi-experimental, pretest-posttest design with a non-equivalent control group; the hypothesis is that "the implementation of a collaborative learning strategy integrated into a sports health prevention program significantly improves youth volleyball players' adherence to the prevention program."

A representative sample of male youth volleyball players in the U18/U19 age category was studied. Participants were selected using unrestricted random sampling (N = 57; 95% confidence level; 5% margin of error; n = 50). The aforementioned representative sample was subsequently allocated into two independent groups without randomization, with an equivalent group size (n = 25 per independent group). This sample size was considered sufficient for each independent group to establish the relevant correlations, assuming a medium effect size (Cohen’s d = 0.50), a significance level of 0.05, and statistical power of $1 - \beta = 0.80$.

The following inclusion criteria were considered when selecting the representative sample: (a) male youth volleyball players according to the regulations of the International Volleyball Federation (U18/U19) and members of the Havana provincial volleyball team, Republic of Cuba; (b) regular competitive participation with scientifically trained teams for at least the previous five years; (c) a minimum training load of ≥4 sessions per week or ≥8 hours per week; (d) health status compatible with participation and absence of recent sports injuries; (e) availability and ability to complete at least 90% of the intervention as an effective adherence criterion; and (f) provision of signed informed consent.

The study was conducted between September and December 2024 (a 12-week intervention), following a pre-planned, standardized methodological protocol to ensure consistency in data collection. Authorization was initially obtained from the technical management of the Havana (Cuba) provincial men's youth volleyball team, as well as approval from the coaches responsible for the sports training program. Subsequently, all athletes and their legal guardians received verbal and written information regarding the study's objectives, procedures, benefits, and potential risks, and signed informed consent forms prior to the start of any assessment activities.

The assessments were conducted during the preparatory phase of the competitive season to

minimize the influence of accumulated fatigue and competitive demands on the participants' responses. All measurements took place at the team's regular sports facilities, at similar times, and under comparable environmental conditions, following previously standardized protocols. The researchers in charge received specific training on the administration of the instruments and the standardization of instructions given to the athletes, thereby reducing inter-rater bias.

Subsequently, the participants individually completed instruments designed to assess collaborative learning and adherence to sports health prevention programs. Before administration began, the purpose of each questionnaire was explained, with an emphasis on the fact that responses would be confidential and anonymous and would have no repercussions on their sports participation, in order to minimize social desirability bias. Coaching staff were not present during the administration of the instruments, allowing responses to be provided completely independently.

The questionnaires were administered in a quiet, interruption-free environment, with approximately 20–30 minutes allocated for completion of the assessment instruments. The researchers remained available solely to clarify questions concerning the interpretation of individual items, avoiding any intervention that could influence participants’ responses.

Upon completion of the assessment phase, the questionnaires were immediately reviewed to identify any omissions or incomplete responses. If a missing response was detected, the participant was given the opportunity to complete it on the spot, provided this did not compromise the spontaneity of their answers. Subsequently, all data were coded using anonymous numerical identifiers and entered into a database specifically designed for the study. An independent double-data-entry process and cross-verification of the records were carried out to minimize transcription errors and ensure data quality.

The program was incorporated into the experimental team's regular training regimen without altering the technical and tactical workloads planned by the coaching staff; this integration is described in Table 1 from both methodological and chronological perspectives. Activities were conducted three times a week prior to the main training session, lasting approximately 25 minutes per session (75 minutes per week). The program comprised two complementary components: (a) a sports health prevention program based on neuromuscular exercises, aimed at reducing injury risk factors common in youth volleyball, and (b) a collaborative learning strategy designed to foster the athletes' understanding, commitment, and adherence to these preventive activities (Table 1).

Table 1. Intervention Schedule

Week	Main objective	Preventive programme	Collaborative strategy	Duration
0	Initial assessment	Administration of instruments	Organization of collaborative groups	60 min
1–2	Adaptation	Neuromuscular activation, mobility, and balance	Work rules, shared leadership, peer observation	3 × 25 min
3–4	Preventive technique	Trunk stability, proprioception, and landing technique	Peer feedback	3 × 25 min
5–6	Strengthening	Knee, ankle, and shoulder strengthening	Collaborative correction of exercise execution	3 × 25 min
7–8	Functional integration	Volleyball-specific exercises	Group-based resolution of technical problems	3 × 25 min
9–10	Consolidation	Integrated preventive circuits	Establishment of group goals	3 × 25 min
11	Automatization	Simulation under training conditions	Self-assessment and peer assessment	3 × 25 min
12	Final assessment	Administration of post-test instruments	Group reflection on adherence	60 min

The preventive exercises included neuromuscular activation, dynamic balance, trunk stability, strengthening of the musculature of the lower and upper limbs, proprioceptive training, landing control following jumping, joint mobility, and preventive exercises specifically targeting the shoulder, knee, and ankle. The intensity and complexity of the tasks progressed gradually throughout the intervention in accordance with the principles of progressive overload and training specificity.

The collaborative strategy was structured around small, stable groups of four to five players, with heterogeneous distribution according to sporting experience and playing position. Each group appointed a rotating leader responsible for coordinating task execution, encouraging the participation of all members, and facilitating peer feedback. During the sessions, athletes engaged in peer observation, collaborative correction of execution technique, joint problem-solving, establishment of group goals, and final reflection on adherence to the preventive activities.

The coaches and researchers acted as facilitators of the process, limiting their interventions to providing technical feedback when necessary and ensuring compliance with the previously established protocol. To ensure intervention fidelity, all sessions followed a standardized methodological guide and were supervised by the principal researcher using structured checklists.

Adherence to the program was monitored throughout the intervention using individual records of attendance and activity completion. Adequate adherence was defined as participation in at least 90% of the scheduled sessions. In parallel, at the end of each week, the groups conducted a brief collaborative self-assessment of the extent to which the preventive tasks had been completed, the difficulties encountered, and the strategies implemented to improve collective participation.

In contrast, the control group continued with the usual training program planned by the coaching staff during the same intervention period, maintaining conventional preventive routines without incorporating the collaborative learning strategy. The control group was also assessed under the same conditions and at the same time points as the experimental group (pretest and post-test), in order to ensure comparability of the results and attribute the observed changes to the implemented intervention.

The study was conducted in accordance with the ethical principles established in the Declaration of Helsinki, ensuring respect for participants' autonomy, confidentiality of information, and the

acquisition of informed consent prior to their inclusion in the study. ChatGPT (23) was also used exclusively as a support tool for language editing, improvement of academic writing, manuscript organization, and translation, under the continuous supervision of the authors, who verified the accuracy of the content and assumed full responsibility for the final version of the manuscript.

The following assessment instruments were considered for the study and implementation of the research:

1. Cooperative Learning Scale (CLS) developed by Fernández-Río et al. (24).** This instrument assesses students' perceptions of the extent to which cooperative learning is implemented during the educational process. **Dimensions:** Positive interdependence; promoter interaction; individual accountability; interpersonal and social skills; group processing. **Scoring:** Five-point Likert scale (1 = Strongly disagree to 5 = Strongly agree). The total score is obtained by summing or averaging the responses (1.00–2.33 points = Low; 2.34–3.66 points = Moderate; 3.67–5.00 points = High).
2. Objective compliance record + study-specific validated adherence scale (Adherence).** The researcher directly records each session, including indicators of attendance, exercises completed, percentage completed, execution time, and technical compliance. **Scoring:** Each session receives a completion percentage (Did not perform = 0%; Partially performed = 50%; Fully performed = 100%). Adherence is subsequently calculated as follows: **Adherence = Completed sessions / Scheduled sessions × 100**, where <60% = Low adherence; 60–79% = Moderate adherence; and ≥80% = High adherence. For the study-specific adherence scale, (25,26) a five-point Likert scale was applied (1 = Never to 5 = Always), comprising the following dimensions: Commitment (interest in completing the program); Compliance (systematic performance of exercises); Persistence (continuity despite difficulties); Motivation (willingness to participate); and Perceived usefulness (perceived benefits). Interpretation was based on the overall mean score (1.00–2.33 points = Low adherence; 2.34–3.66 points = Moderate adherence; 3.67–5.00 points = High adherence). The instrument had previously been validated through expert judgement (Aiken's V coefficient ≥0.80).
3. Group Environment Questionnaire (GEQ).** This instrument assesses group cohesion in sports teams. (27) **Methodology:** 18 items answered using a nine-point Likert scale (1 = Strongly disagree to 9 = Strongly agree). **Dimensions:** Group integration-task (GI-T); group integration-social (GI-S); individual attraction to the group-task (ATG-T); and individual attraction to the group-social (ATG-S). **Scoring:** The score for each dimension corresponds to the mean of its respective items, whereas overall cohesion may be estimated using the mean of the four dimensions (1.00–3.99 points = Low cohesion; 4.00–6.99 points = Moderate cohesion; 7.00–9.00 points = High cohesion).
4. Sport Motivation Scale II (SMS-II).** This instrument assesses the different types of motivation regulating sports participation, ranging from highly self-determined forms to indifference. (26,28) **Methodology:** The scale comprises 18 items distributed across six dimensions. **Dimensions:** Intrinsic motivation; integrated regulation; identified regulation; introjected regulation; external regulation; and indifference . **Scoring:** Seven-point Likert scale (1 = Does not correspond at all to 7 =

Corresponds exactly). Each dimension is calculated as the mean of its three items (1.00–2.99 points = Low; 3.00–4.99 points = Moderate; 5.00–7.00 points = High).

5. General Self-Efficacy Scale.** This instrument assesses individuals' general perception of their ability to effectively cope with difficult situations, solve problems, and achieve personal goals. (29) **Methodology:** The scale consists of 10 items with responses provided on a four-category Likert scale (1 = Not at all true; 2 = Hardly true; 3 = Moderately true; 4 = Exactly true). **Scoring:** Scores range from a minimum of 10 to a maximum of 40 points, with an adapted classification (10–20 points = Low self-efficacy; 21–30 points = Moderate self-efficacy; 31–40 points = High self-efficacy).

The data were analyzed using descriptive and inferential statistics. Means, medians, and standard deviations were calculated to characterize the variables under study. The distribution of the data was assessed prior to analysis, and non-parametric tests were selected for hypothesis testing. Within-group comparisons between pretest and post-test measurements were performed using the Wilcoxon signed-rank test ($p \leq 0.05$), whereas differences between the independent groups (control and experimental) were assessed using the Mann–Whitney U test. Effect sizes (r) were also calculated to estimate the magnitude of the observed differences, with statistical significance set at $p < 0.05$. Data processing and analysis were performed using SPSS version 25, while G*Power 3.1 was used to determine sample size adequacy.

RESULTS

In the pretest, the mean scores of both groups ranged from 3.28 to 3.47 points, with medians ranging from 3.25 to 3.50, corresponding to a moderate level of cooperative learning, with no significant differences between groups ($Z = -0.09$ to -0.34; $p > 0.05$). In the control group, the increases observed after the intervention were small (0.07–0.14 points), with medians remaining practically stable and without reaching statistical significance ($Z = -0.71$ to -1.37; $p > 0.05$). In contrast, the experimental group showed differentiated improvements across dimensions, with increases ranging from 0.51 to 0.94 points, with the greatest improvement observed in Positive Interdependence (4.29 ±), followed by Promotive Interaction (4.18) and Interpersonal Skills (4.00). The Wilcoxon tests showed significant differences across all dimensions ($Z = -3.05$ to -4.21; $p \leq 0.002$), with moderate-to-high and high effect sizes ($r = 0.61$–0.84). Likewise, between-group post-test comparisons using the Mann–Whitney U test confirmed significant differences in favour of the experimental group across all five dimensions ($Z = -3.29$ to -4.46; $p \leq 0.001$; $r = 0.47$–0.63), demonstrating a positive effect of the intervention on perceived cooperative learning. (Table 2).

Table 2. Cooperative Learning Scale (CLS)

Dimension	Group	Pre-test (Mean / Median)	Post-test (Mean / Median)	Sign test (+ / − / =)	Wilcoxon (Z / p / r)	Mann–Whitney Pre-test (Z / p / r)	Mann–Whitney Post-test (Z / p / r)
Positive interdependence	Control	3.31 / 3.33	3.45 / 3.50	13 / 8 / 4	−1.37 / .171 / .27	−.18 / .857 / .03	−4.46 / <.001 / .63
Positive interdependence	Experimental	3.35 / 3.33	4.29 / 4.33	22 / 1 / 2	−4.21 / <.001 / .84	—	—
Promotive interaction	Control	3.47 / 3.50	3.56 / 3.58	11 / 9 / 5	−.98 / .327 / .20	−.26 / .793 / .04	−3.89 / <.001 / .55
Promotive interaction	Experimental	3.42 / 3.42	4.18 / 4.17	20 / 3 / 2	−3.74 / <.001 / .75	—	—
Individual accountability	Control	3.39 / 3.42	3.48 / 3.50	10 / 10 / 5	−.86 / .389 / .17	−.11 / .914 / .02	−3.54 / <.001 / .50
Individual accountability	Experimental	3.37 / 3.33	3.96 / 4.00	18 / 5 / 2	−3.28 / .001 / .66	—	—
Interpersonal/social skills	Control	3.28 / 3.25	3.40 / 3.42	12 / 8 / 5	−1.19 / .233 / .24	−.34 / .734 / .05	−3.77 / <.001 / .53
Interpersonal/social skills	Experimental	3.32 / 3.33	4.00 / 4.00	19 / 4 / 2	−3.46 / .001 / .69	—	—
Group processing	Control	3.44 / 3.42	3.51 / 3.50	10 / 11 / 4	−.71 / .479 / .14	−.09 / .928 / .01	−3.29 / .001 / .47
Group processing	Experimental	3.40 / 3.42	3.91 / 3.92	17 / 6 / 2	−3.05 / .002 / .61	—	—

Both independent groups showed similar levels of perceived adherence, with means ranging from 3.33 to 3.57 points and medians ranging from 3.33 to 3.58, corresponding to a moderate level of adherence, with no significant differences between groups ($Z = -0.09$ to -0.22; $p > 0.05$). Following the intervention, the control group showed small increases (0.11–0.13 points), remaining at a moderate level of adherence and without significant within-group differences ($Z = -0.94$ to -1.29; $p > 0.05$). In contrast, the experimental group showed heterogeneous improvements across dimensions, with increases ranging from 0.74 to 1.06 points, reaching a high level of adherence across all dimensions (4.09–4.61 points). The greatest improvements were observed in Perceived usefulness ($\Delta = 1.06$), Compliance ($\Delta = 0.98$), and Commitment ($\Delta = 0.97$), whereas Persistence showed the most moderate increase ($\Delta = 0.74$). The Wilcoxon tests confirmed statistically significant differences across all dimensions in the experimental group ($Z = -3.58$ to -4.43; $p < 0.001$), with large effect sizes ($r = 0.72$–0.89). Likewise, between-group post-test comparisons using the Mann–Whitney U test showed significant differences in favor of the experimental group across all dimensions ($Z = -3.71$ to -4.57; $p < 0.001$; $r = 0.52$–0.65), demonstrating greater adherence to the intervention program (Table 3).

Table 3. Results of the Objective Compliance Record and Specific Adherence Scale

Dimension	Group	Pre-test (Mean / Median)	Post-test (Mean / Median)	Sign test (+ / − / =)	Wilcoxon (Z / p / r)	Mann–Whitney Pre-test (Z / p / r)	Mann–Whitney Post-test (Z / p / r)
Commitment	Control	3.41 / 3.40	3.54 / 3.50	12 / 9 / 4	−1.24 / .215 / .25	−.15 / .881 / .02	−4.38 / <.001 / .62
Commitment	Experimental	3.39 / 3.42	4.36 / 4.42	22 / 1 / 2	−4.18 / <.001 / .84	—	—
fulfillment	Control	3.52 / 3.50	3.63 / 3.67	11 / 10 / 4	−.94 / .346 / .19	−.22 / .824 / .03	−4.11 / <.001 / .58
fulfillment	Experimental	3.49 / 3.50	4.47 / 4.50	23 / 0 / 2	−4.36 / <.001 / .87	—	—
Persistence	Control	3.33 / 3.33	3.45 / 3.50	12 / 8 / 5	−1.11 / .267 / .22	−.09 / .928 / .01	−3.71 / <.001 / .52
Persistence	Experimental	3.35 / 3.33	4.09 / 4.08	19 / 4 / 2	−3.58 / <.001 / .72	—	—
Motivation	Control	3.46 / 3.50	3.58 / 3.58	13 / 8 / 4	−1.18 / .238 / .24	−.18 / .857 / .03	−4.24 / <.001 / .60
Motivation	Experimental	3.44 / 3.42	4.31 / 4.33	21 / 2 / 2	−3.97 / <.001 / .79	—	—
Perceived usefulness	Control	3.57 / 3.58	3.70 / 3.67	13 / 8 / 4	−1.29 / .198 / .26	−.13 / .896 / .02	−4.57 / <.001 / .65
Perceived usefulness	Experimental	3.55 / 3.58	4.61 / 4.58	23 / 1 / 1	−4.43 / <.001 / .89	—	—

The objective compliance record showed that the control group achieved an overall adherence rate of 77.1%, corresponding to a moderate level of adherence, whereas the experimental group achieved an overall adherence rate of 92.0%, classified as high adherence. Between-group differences were statistically significant across all objective indicators ($Z = -4.21$ to -4.61; $p < 0.001$), with large effect sizes ($r = 0.60–0.65$). Technical compliance and attendance showed the greatest differences between groups. These findings support the consistency between objective compliance measures and the subjective perception of adherence obtained through the specific scale (Table 4).

Table 4. Objective record of program fulfillment

Variable	Control Group	Experimental Group	Mann–Whitney U (Z / p / r)
Mean attendance (%)	76.4 ± 8.5	91.8 ± 5.6	−4.49 / <.001 / .64
Completed Exercises (%)	74.9 ± 9.1	90.6 ± 6.3	−4.37 / <.001 / .62
Execution time (%)	79.1 ± 7.4	92.4 ± 5.2	−4.21 / <.001 / .60
Technical compliance (%)	77.8 ± 8.2	93.2 ± 4.8	−4.61 / <.001 / .65
Overall adherence (%)	77.1 ± 7.8	92.0 ± 5.1	−4.56 / <.001 / .64

Both groups presented average scores between 5.51 and 5.97 points, with medians ranging from 5.50 to 6.00, corresponding to a moderate level of group cohesion (4.00–6.99 points). Between-group comparisons revealed no statistically significant differences in any dimension ($Z = -0.14$ to -0.24; $p > 0.05$), confirming the initial homogeneity of the sample. In the control group, the improvements observed after the intervention were small (0.15–0.19

points), remaining within the moderate cohesion level and without reaching statistical significance (Z = −0.94 to −1.29; p > 0.05). In contrast, the experimental group showed substantial increases ranging from 1.47 to 1.72 points, reaching a high level of cohesion across all four dimensions (7.02–7.58 points). The greatest improvement was observed in Group Integration–Task (GI-T) (Δ = 1.72), followed by Individual Attraction to the Group–Task (ATG-T) (Δ = 1.55), Group Integration–Social (GI-S) (Δ = 1.53), and Individual Attraction to the Group–Social (ATG-S) (Δ = 1.47). The Wilcoxon tests confirmed statistically significant differences across all dimensions in the experimental group (Z = −3.81 to −4.39; p < 0.001), with large effect sizes (r = 0.76–0.88). Likewise, post-test comparisons using the Mann–Whitney U test showed significant differences in favour of the experimental group across all dimensions (Z = −3.89 to −4.58; p < 0.001), with moderate-to-high and high effect sizes (r = 0.55–0.65), indicating a consistent increase in group cohesion following the intervention (Table 5).

Table 5. Group Environment Questionnaire (GEQ) Results

Dimension	Group	Pre-test (Mean / Median)	Post-test (Mean / Median)	Sign test (+ / − / =)	Wilcoxon (Z / p / r)	Mann–Whitney Pre-test (Z / p / r)	Mann–Whitney Post-test (Z / p / r)
GI-T	Control	5.82 / 5.80	6.01 / 6.00	13 / 8 / 4	−1.29 / .197 / .26	−.24 / .810 / .03	−4.58 / <.001 / .65
GI-T	Experimental	5.86 / 5.83	7.58 / 7.67	23 / 1 / 1	−4.39 / <.001 / .88	—	—
GI-S	Control	5.64 / 5.67	5.79 / 5.83	12 / 8 / 5	−1.08 / .279 / .22	−.18 / .857 / .03	−4.11 / <.001 / .58
GI-S	Experimental	5.68 / 5.67	7.21 / 7.17	21 / 2 / 2	−4.02 / <.001 / .80	—	—
ATG-T	Control	5.97 / 6.00	6.13 / 6.17	11 / 9 / 5	−.94 / .346 / .19	−.14 / .889 / .02	−4.33 / <.001 / .61
ATG-T	Experimental	5.91 / 5.92	7.46 / 7.50	22 / 1 / 2	−4.18 / <.001 / .84	—	—
ATG-S	Control	5.51 / 5.50	5.67 / 5.67	12 / 9 / 4	−1.16 / .246 / .23	−.20 / .842 / .03	−3.89 / <.001 / .55
ATG-S	Experimental	5.55 / 5.58	7.02 / 7.08	20 / 3 / 2	−3.81 / <.001 / .76	—	—

In the motivational pre-test, both groups showed mean scores between 4.13 and 4.86 points across the motivation dimensions—corresponding to a moderate level—while amotivation registered values close to 3.00 points, placing it at the lower limit of the moderate range. Initial inter-group comparisons revealed no significant differences in any dimension (Z = −0.11 to −0.28; p > 0.05), confirming the equivalence of both groups prior to the intervention. In the control group, variations observed in the post-test were minor (0.07–0.16 points) and did not reach statistical significance (Z = −0.68 to −1.31; p > 0.05), with the initial motivational profile remaining virtually unchanged. In contrast, the experimental group showed substantial increases in forms of self-determined motivation—specifically intrinsic motivation (Δ = 1.32), integrated regulation (Δ = 1.37), and identified regulation (Δ = 1.19)—reaching a high level of motivation (5.89–6.14 points). Likewise, introjected regulation increased moderately (Δ = 0.92), while external regulation showed the smallest increase (Δ = 0.65), with moderate effect sizes (r = 0.59). Meanwhile, amotivation decreased significantly (Δ = −1.06 points), reaching a low level (1.96 points), which reflects a significant psychological improvement. Wilcoxon tests revealed significant differences across all dimensions for the experimental group (Z = −2.97 to −4.45; p ≤ 0.003), with effect sizes

ranging from moderate to very large (r = 0.59–0.89). Finally, intergroup comparisons using the Mann–Whitney U test at post-test confirmed significant differences favoring the experimental group across all dimensions (Z = −2.61 to −4.62; p ≤ 0.009), with effect sizes ranging from moderate to large (r = 0.37–0.65), indicating that the intervention fostered a more self-determined motivational profile and significantly reduced disinterest (Table 6).

Table 6. Results of the Sport Motivation Scale II (SMS-II)

Dimension	Group	Pre-test (Mean / Median)	Post-test (Mean / Median)	Sign test (+ / − / =)	Wilcoxon (Z / p / r)	Mann–Whitney (Pre-test Z / p / r; Post-test Z / p / r)
Intrinsic motivation	Control	4.86 / 4.83	5.02 / 5.00	13 / 8 / 4	−1.31 / .190 / .26	Pre: −.19 / .849 / .03 (ns); Post: −4.62 / <.001 / .65 (*)
Intrinsic motivation	Experimental	4.82 / 4.83	6.14 / 6.17	23 / 1 / 1	−4.45 / <.001 / .89	Pre: −.19 / .849 / .03 (ns); Post: −4.62 / <.001 / .65 (*)
Integrated regulation	Control	4.58 / 4.67	4.73 / 4.67	12 / 8 / 5	−1.09 / .276 / .22	Pre: −.24 / .810 / .03 (ns); Post: −4.29 / <.001 / .61 (*)
Integrated regulation	Experimental	4.61 / 4.67	5.98 / 6.00	22 / 1 / 2	−4.18 / <.001 / .84	Pre: −.24 / .810 / .03 (ns); Post: −4.29 / <.001 / .61 (*)
Identified regulation	Control	4.74 / 4.67	4.88 / 5.00	12 / 9 / 4	−1.17 / .242 / .23	Pre: −.11 / .913 / .02 (ns); Post: −4.08 / <.001 / .58 (*)
Identified regulation	Experimental	4.70 / 4.67	5.89 / 5.92	22 / 2 / 1	−4.01 / <.001 / .80	Pre: −.14 / .889 / .03 (ns); Post: −3.94 / <.001 / .56 (*)
Introjected regulation	Control	4.35 / 4.33	4.44 / 4.42	11 / 9 / 5	−.82 / .412 / .16	Pre: −.28 / .780 / .06 (ns); Post: −3.21 / .001 / .64 (*)
Introjected regulation	Experimental	4.35 / 4.33	5.27 / 5.25	20 / 3 / 2	−3.62 / <.001 / .72	Pre: −.28 / .780 / .06 (ns); Post: −3.48 / <.001 / .70 (*)
External regulation	Control	4.13 / 4.17	4.21 / 4.17	10 / 10 / 5	−.68 / .497 / .14	Pre: −.22 / .826 / .04 (ns); Post: −2.61 / .009 / .52 (*)
External regulation	Experimental	4.13 / 4.17	4.78 / 4.75	18 / 5 / 2	−2.97 / .003 / .59	Pre: −.22 / .826 / .04 (ns); Post: −2.61 / .009 / .52 (*)
Amotivation	Control	3.01 / 3.00	3.10 / 3.08	10 / 10 / 5	−.74 / .459 / .15	Pre: −.17 / .865 / .03 (ns); Post: −2.88 / .004 / .58 (*)
Amotivation	Experimental	3.02 / 3.00	1.96 / 2.00	2 / 22 / 1	−3.21 / .001 / .64	Pre: −.17 / .865 / .03 (ns); Post: −3.02 / .003 / .60 (*)

According to the results presented in Table 6, both groups showed very similar scores on the General Self-Efficacy Scale (27.28 and 27.44 points), with medians of 27 points, corresponding to a moderate level of self-efficacy (21–30 points). Between-group comparisons showed no statistically significant differences (Z = −0.16; p = 0.873), confirming the initial equivalence of both groups. In the control group, the mean score increased slightly to 28.16 points (Δ = 0.88), remaining within the moderate level and without significant within-group differences (Z = −1.12; p = 0.263; r = 0.22). In contrast, the experimental group increased its mean score by

6.24 points, reaching 33.68 points, corresponding to a high level of self-efficacy (31–40 points). The Wilcoxon test confirmed a highly significant improvement (Z = −4.46; p < 0.001), with a very large effect size (r = 0.89). Finally, post-test between-group comparisons using the Mann–Whitney U test showed statistically significant differences in favor of the experimental group (Z = −4.08; p < 0.001; r = 0.58), indicating that the intervention produced a substantial increase in participants' perceived self-efficacy (Table 7).

Table 7. Results of the General Self-Efficacy Scale (GSES)

cale	Group	Pre-test (Mean / Median)	Post-test (Mean / Median)	Sign test (+ / − / =)	Wilcoxon (Z / p / r)	Mann–Whitney (Pre-test Z / p / r; Post-test Z / p / r)
General self-efficacy	Control	27.28 / 27.00	28.16 / 28.00	12 / 9 / 4	−1.12 / .263 / .22	Pre: −.16 / .873 / .02 (ns); Post: −4.08 / <.001 / .58 (*)
General self-efficacy	Experimental	27.44 / 27.00	33.68 / 34.00	23 / 1 / 1	−4.46 / <.001 / .89 (*)	—

DISCUSSION

This research purpose was to analyze the relationship between collaborative learning and adherence to sports health preventive programs among youth volleyball players. Accordingly, the research hypothesis is confirmed, showing that the systematic implementation of collaborative strategies during a preventive program significantly increases athletes' adherence and simultaneously promotes psychosocial variables closely related to the maintenance of preventive behaviors, such as group cohesion, self-determined motivation, and self-efficacy.

One of the key contributions of this study is demonstrating that adherence to preventive programs depends not only on the technical quality of the neuromuscular exercises used but also on the pedagogical methodology employed for their implementation. Traditionally, literature on sports injury prevention has focused on the biomechanical efficacy of preventive protocols [19,20], whereas the educational processes that foster acceptance and continuity have received considerably less attention. The findings help bridge this knowledge gap by showing that collaborative learning is a significant facilitator of adherence [21], strengthening both the active participation and sustained commitment of young athletes throughout the preventive program.

Regarding collaborative learning, the experimental group showed significant improvements across the five dimensions assessed by the Cooperative Learning Scale. These results suggest that organizing the training around stable small groups—incorporating shared leadership, peer observation, and collaborative feedback—created a more participatory learning environment, [14] thereby encouraging athletes to assume shared responsibilities for injury prevention.

From a theoretical perspective, these findings align with the tenets of collaborative learning, which maintain that the collective construction of knowledge enhances participation, individual responsibility, and engagement with the assigned tasks. [14] The observed improvement in positive interdependence is particularly significant, as this dimension constitutes a fundamental pillar of cooperative learning, enabling group members to perceive that individual achievement also depends on collective success.

Likewise, the findings are consistent with research conducted by Fernández-Río et al. [24], who demonstrated that the systematic application of cooperative methodologies significantly increases social interaction,

individual responsibility, and student engagement during the educational process. Similarly, Game et al. [14] reported that the use of collaborative strategies among volleyball players promotes active participation, improves communication between teammates, and strengthens skill acquisition during sports training.

The central finding of the study corresponds to the significant increase in adherence to the preventive program. Whereas the control group maintained moderate levels of adherence in both the subjective assessment and the objective compliance records, the experimental group achieved high levels across all dimensions analyzed. In particular, perceived usefulness, compliance, and commitment showed the greatest increases, accompanied by objective adherence above 90% throughout the twelve-week intervention.

The above finding has considerable clinical and sporting relevance. The scientific literature has repeatedly indicated that the effectiveness of preventive programs depends to a large extent on the level of adherence achieved by athletes [17]. Various meta-analyses have shown that even preventive protocols with the strongest scientific support substantially lose their capacity to reduce injury risk when athlete participation falls below recommended levels. In this regard, the findings obtained support the conclusions of Viiala et al. [9], who identified adherence as one of the main determinants of the effectiveness of exercise-based preventive programs. Consequently, increasing adherence through educational strategies may be as important as optimizing the biomechanical content of preventive exercises.

The findings are also consistent with reviews conducted by Donaldson and Finch [12], who argue that one of the main obstacles to the effective implementation of preventive programs lies in the processes of transfer and implementation within everyday sporting contexts. On many occasions, coaches and athletes gradually abandon these routines because they perceive them as consuming training time without producing immediate benefits for competitive performance. In contrast, the collaborative strategy developed in the present study appears to have modified this perception through the collective construction of meaning around preventive activities, promoting a greater understanding of their benefits and more committed participation.

Similarly, the findings support the recommendations formulated by Minnig et al. [10], who identified poor athlete motivation, limited involvement of coaching staff, and the absence of strategies that encourage active athlete participation as major barriers to the implementation of preventive programs. In the present study, the use of rotating leaders, peer feedback, and the establishment of group goals probably acted as facilitating mechanisms capable of reducing these barriers and strengthening collective commitment to injury prevention.

Another particularly relevant finding concerns the increase observed in group cohesion. After the intervention, the experimental group achieved high levels across all four dimensions of the Group Environment Questionnaire, whereas the control group remained at moderate levels. The greatest improvements were recorded in group integration towards the task and individual attraction to the task, indicating that the athletes developed a stronger sense of belonging in relation to collective goals associated with injury prevention.

These findings are consistent with the conceptual model proposed by Carron and colleagues [27], who consider cohesion to be one of the principal factors promoting the effective functioning of sports teams. When members perceive common goals, interpersonal trust, and shared responsibility, cooperation during training activities increases significantly.

Similarly, Holt et al. [18] argue that sporting environments characterized by high levels of cooperation simultaneously promote the development of social competencies, leadership, communication, and group commitment. These benefits extend beyond immediate competitive performance and contribute to the athlete's holistic development, an aspect that is particularly relevant during adolescence. The findings of the present study extend this perspective by demonstrating that these social competencies may also facilitate health-related behaviors and sports injury prevention.

Finally, the improvement observed in group cohesion may be interpreted as one of the mediating mechanisms explaining the increase in adherence to the preventive program. Several recent studies, such as the narrative review

conducted by Bjørndal et al. [16], have highlighted those interpersonal relationships within youth teams exert a considerable influence on the adoption of health-related behaviors. Consequently, when injury prevention is collectively assumed as a shared responsibility, the likelihood of maintaining such behaviors over time increases, thereby promoting the consolidation of more stable preventive habits.

The findings obtained for the motivational dimension complement and strengthen the interpretation of the effects observed on adherence to the preventive program. Whereas the control group maintained a virtually unchanged motivational profile throughout the twelve-week intervention, the experimental group experienced significant increases in all forms of self-determined motivation, particularly intrinsic motivation, integrated regulation, and identified regulation, accompanied by a significant reduction in demotivation. This pattern of findings is highly relevant from the perspective of sport psychology, as the literature recognizes that the quality of motivation constitutes one of the main predictors of the long-term maintenance of health-related behaviors.

From the perspective of Self-Determination Theory proposed by Ryan and Deci [28], individuals show greater persistence in activities that simultaneously satisfy their psychological needs for autonomy, competence, and relatedness. The collaborative strategy implemented during the intervention probably facilitated these three needs simultaneously. Autonomy was stimulated through athletes' active participation in problem-solving, self-assessment, and rotating leadership; competence was strengthened through continuous peer feedback and progressive improvement in technical execution; while the need for relatedness was satisfied through ongoing cooperation within small working groups.

These findings are consistent with the validation of the Sport Motivation Scale II conducted by Pelletier et al. (26), who demonstrated that self-determined motivation promotes continuity in sports participation, increases commitment to training tasks, and improves persistence in the face of difficulties. In the present study, this pattern appears to have extended specifically to adherence to preventive programs, an aspect that has received limited attention in previous research. Consequently, the findings suggest that motivation should not be interpreted solely as a factor associated with competitive performance, but also as an essential determinant of the consolidation of preventive behaviors aimed at preserving athletes' health.

Likewise, the significant reduction in demotivation constitutes a particularly relevant finding. Various studies have indicated that perceptions of monotony, limited understanding of preventive benefits, and the absence of active participation are among the main causes of withdrawal from preventive programs during the sporting season. Consequently, the exercises ceased to be perceived as an obligation imposed by the coaching staff and instead became an activity integrated into the team's everyday functioning.

Another result that deserves particular attention is the significant increase in general self-efficacy observed in the experimental group. Whereas the control group remained within moderate levels of self-efficacy, the intervention group reached values corresponding to a high level, with a very large effect size. This finding is consistent with social cognitive theory, which proposes that perceived personal efficacy constitutes one of the principal determinants of human behavior, particularly in contexts in which individuals must maintain complex behaviors over extended periods.

The improvement in self-efficacy was probably determined by several mechanisms present during the intervention. First, repeated and successful practice of the preventive exercises allowed athletes to accumulate mastery experiences, considered the most important source of self-efficacy. Second, continuous observation of teammates' performance facilitated processes of vicarious learning that reinforced perceptions of individual competence. Finally, the positive feedback received from both peers and coaches contributed to consolidating positive expectations regarding personal ability to perform preventive activities correctly.

These findings are consistent with the research of Scholz et al. [29], who demonstrated that higher levels of self-efficacy are associated with greater persistence, better coping with difficult situations, and greater achievement of personal goals. In the sporting context, these characteristics are particularly relevant because preventive programs require consistency, discipline, and continuity even when their benefits are not

immediately visible.

The integration of the findings obtained makes it possible to identify a logical sequence of events that explains the overall effect of the intervention. Collaborative learning initially promoted greater interaction among athletes, increasing shared responsibility and strengthening team cohesion. In parallel, this new social context stimulated more self-determined forms of motivation and increased perceived personal competence, reflected in the high levels of self-efficacy achieved at the end of the program. Finally, the interaction of these psychological and social factors resulted in a substantial increase in both subjective and objective adherences to the preventive exercises. This integrative model provides empirical evidence regarding the mechanisms through which collaborative pedagogical strategies may optimize the implementation of injury prevention programs in youth sport.

From an applied perspective, the findings have important implications for coaches, strength and conditioning professionals, and sports health professionals. Traditionally, preventive programs have been designed from a predominantly biomedical perspective, focusing on the selection of exercises intended to reduce biomechanical risk factors. However, the findings of this study indicate that the effectiveness of such programs may be significantly enhanced when implementation incorporates educational strategies aimed at strengthening athletes' active participation. Consequently, relatively simple methodological elements, such as shared leadership, peer feedback, collaborative problem-solving, and collective goal-setting, could be systematically incorporated into preventive programs without generating substantial increases in implementation costs.

Furthermore, the findings are particularly relevant to Latin American sporting systems [15,22], where economic constraints frequently limit the incorporation of advanced monitoring technologies or large multidisciplinary teams. The collaborative strategy used in this study represents a low-cost intervention that is readily reproducible and compatible with routine training programs, thereby enhancing its potential transferability to different school, provincial, and national sporting contexts.

Nevertheless, the study also presents several limitations that should be considered when interpreting the findings, as the research was conducted exclusively with male youth volleyball players belonging to a Cuban provincial team, which limits the generalizability of the findings to female athletes, other age categories, or different sports. Moreover, although the duration of the intervention made it possible to identify significant changes in the variables studied, it was not possible to determine whether these effects are maintained throughout complete competitive seasons or during subsequent longitudinal follow-up. Additionally, the study primarily assessed psychosocial variables related to adherence and did not incorporate clinical indicators of actual injury incidence; therefore, future research should examine whether the improvements observed effectively translate into reductions in the number or severity of sports injuries. Finally, variables such as coaching leadership style, team motivational climate, or certain individual personality characteristics may have partially influenced the findings and should be considered in subsequent studies.

In light of these limitations, future research should increase sample sizes and include athletes of both sexes, different competitive categories, and different sports in order to enhance the external validity of the findings. It would also be advisable to conduct multicenter and longitudinal studies to examine the stability of the observed effects across several sporting seasons. Likewise, the incorporation of multivariate statistical models or structural equation modelling would be appropriate to identify the mediating effects of group cohesion, motivation, and self-efficacy on adherence to preventive programs. Finally, future research could examine whether integrating collaborative strategies with digital technologies, mobile applications, or automated feedback systems further enhances the effectiveness of preventive programs among young athletes.

It can be concluded that the evidence generated by the present study demonstrates that the incorporation of collaborative learning constitutes an effective pedagogical strategy for strengthening adherence to sports health preventive programs among youth volleyball players. The observed improvements were not limited to compliance with preventive activities, but also encompassed psychosocial dimensions that are essential for the athlete's holistic development, such as group cohesion, self-determined motivation, and self-efficacy. Taken together, these findings support the need

to conceive injury prevention from an interdisciplinary perspective integrating biomechanical, psychological, social, and pedagogical components, thereby promoting the development of safer, more participatory, and more sustainable sporting environments. This approach broadens the understanding of the processes underlying adherence to preventive interventions and provides applicable evidence for the design of training programs aimed simultaneously at sports performance and athlete health protection.

Acknowledgments

The authors would like to acknowledge the Teaching Innovation Project entitled “Active methodologies for the teaching-learning process in physical education and sports” ASESDECO-PI14/22, and the AFIDESA Research Group (Physical Activity, Sport, and Health), from the Armed Forces University ESPE.

Conflicts of interest

The authors declare no conflicts of interest.

Author contributions

Conceptualization: Cinthya Lissette Orellana Londoño

Investigation: Cinthya Lissette Orellana Londoño; Santiago Calero Morales

Data curation: Nathalia Cristina Chamorro Balseca

Formal analysis: Nathalia Cristina Chamorro Balseca; Antonio J. Monroy Antón

Methodology: Antonio J. Monroy Antón; Santiago Calero Morales

Validation: Nathalia Cristina Chamorro Balseca; Santiago Calero Morales

Project administration: Cinthya Lissette Orellana Londoño

Funding acquisition: Cinthya Lissette Orellana Londoño

Writing – original draft: Cinthya Lissette Orellana Londoño

Writing – review and editing: Cinthya Lissette Orellana Londoño.

Financing

Without external financing

REFERENCES

1.Wade L, Eime R, Pankowiak A, Vella S, Robinson K, Kennedy S, et al. The impact of sports participation on psychological health and social outcomes in children and adolescents: a systematic review and update to the “Mental Health through Sport” conceptual model. Systematic reviews. 2026;15(121):2-79.

2.Burton AM, Cowburn I, Thompson F, Eisenmann JC, Nicholson B, Till K. Associations between motor competence and physical activity, physical fitness and psychosocial characteristics in adolescents: A systematic review and meta-analysis. Sports Medicine. 2023;53(11):2191-2256.

3.Shao T, Zhou X. Correlates of physical activity habits in adolescents: A systematic review. Frontiers in physiology. 2023;14:1131195.

4.Morales S, Mena Pila FM. Estudio de las lesiones más comunes en el rugby ecuatoriano, categoría senior. Rev Cubana Invest Bioméd. 2018;37(4):1-9.

5.Renner MN, Keefe MW, Srygler EC, Adler SN, Bentley TS, Bell DR. Youth sport specialization and overuse injury risk: A critically appraised topic. International Journal of Athletic Therapy and Training. 2025;30(3):135-40.

6.Rebelo A, Pereira JR, Cunha P, Coelho-e-Silva MJ, Valente-dos-Santos J. Training stress, neuromuscular fatigue and well-being in volleyball: a systematic review. BMC Sports Science, Medicine and Rehabilitation. 2024;16(1):17.

7.de Azevedo Sodré Silva A, Sassi LB, Martins TB, de Menezes FS, Migliorini F, Maffulli N, et al. Epidemiology of injuries in young volleyball athletes: a systematic review. J Orthop Surg Res. 2023;18(1):748.

8.Liddle N, Taylor JM, Chesterton P, Atkinson G. The effects of exercise-based injury prevention programmes on injury risk in adult recreational athletes: a systematic review and meta-analysis. Sports medicine. 2023;54(3):645-58.

9.Viiala J, Čech P, Bakalár P, Paravlic AR,

Ružbarský P, Sučka J, et al. Effect of adherence to exercise-based injury prevention programmes on the risk of sports injuries: a systematic review and meta-analysis of randomised controlled trials. Injury Prevention. 2026;32(1):31-40.

10.Minnig MC, Hawkinson L, Root HJ, Driban J, DiStefano LJ, Callahan L, et al. Barriers and facilitators to the adoption and implementation of evidence-based injury prevention training programmes: a narrative review. BMJ Open Sport Exerc Med. 2022;8(3): e001374.

11.Donaldson A, Callaghan A, Bizzini M, Jowett A, Keyzer P, Nicholson M. Awareness and use of the 11+ injury prevention program among coaches of adolescent female football teams. International Journal of Sports Science & Coaching. 2018;13(6):929-38.

12.Donaldson A, Finch CF. Applying implementation science to sports injury prevention. British J Sports Medic. 2013;47(8):473-5.

13.Valencia RJ, Barbosa ED, Palomino CO, Arroyo AA. Prevention of sports injuries in physical education. Arrancada. 2024;24(49):290-4.

14.Game KM, Burgos GD, Rivera D, Morales SC. Efectos de las estrategias colaborativas en el proceso académico de enseñanza-aprendizaje de voleibolistas prejuveniles. Retos. 2024;61:1172-83.

15.Lutz D, Van Den Berg C, Räisänen AM, Shill IJ, Kim J, Vaandering K, et al. Best practices for the dissemination and implementation of neuromuscular training injury prevention warm-ups in youth team sport: a systematic review. British J Sports Medic. 2024;58(11):615-25.

16.Bjørndal CT, Hausken-Sutter S, Møller MM, Myklebust G, Grindem H. Exploring the interplay of interpersonal and contextual dynamics in youth sports injuries: a comprehensive narrative review. BMJ Open Sport Exerc Med. 2024;10(3):234-9.

17.Liu H, Liu X, Yin L. Effects of multicomponent exercise injury prevention programs on adolescent team athletes (10–19 years old): a systematic review and meta-analysis. Frontiers Pediatrics. 2025;13:1561993.

18.Holt NL, Neely KC, Slater LG, Camiré M, Côté J, Fraser-Thomas J, et al. A grounded theory of positive youth development through sport based on results from a qualitative meta-study. Int Rev Sport Exerc Psychol. 2017;10(1):1-49.

19.Bathe C, Fennen L, Heering T, Greif A, Dubbeldam R. Training interventions to reduce the risk of injury to the lower extremity joints during landing movements in adult athletes: a systematic review and meta-analysis. BMJ Open Sport Exerc Med. 2023;9(2): e001508.

20.González-Millán S, Illera-Domínguez V, Toro-Román V, Fernández-Valdés B, Morral-Yepes M, Albesa-Albiol L, et al. Effects of adding dual-task or sport-specific task constrains to jump-landing tests on biomechanical parameters related to injury risk factors in team sports: a systematic review. PeerJ. 2024;12:e17720.

21.Bekker S, Bolling C, Ahmed OH, Badenhorst M, Carmichael J, Fagher K, et al. Athlete health protection: why qualitative research matters. J Sci Med Sport. 2020; 23(10): 898-901.

22.Mendonça LD, Schuermans J, Denolf S, Napier C, Bittencourt NF, Romanuk A, et al. Sports injury prevention programmes from the sports physical therapist's perspective: An international expert Delphi approach. Physical Ther Sport. 2022;55:146-54.

23.OpenAI. ChatGPT. Version 5.2[Internet]. San Francisco: OpenAI; 2026 [citado 25/04/2026]. Disponible en: https://chat.openai.com/.

24.Fernandez-Rio J, Cecchini JA, Méndez-Giménez A, Méndez-Alonso D, Prieto JA. Diseño y validación de un cuestionario de medición del aprendizaje cooperativo en contextos educativos. Anal Psicol. 2017;33(3):680-8.

25.Atxurra C, Villardón-Gallego L, Calvete E. Diseño y validación de la Escala de Aplicación del Aprendizaje Cooperativo (CLAS). Rev Psicodidáctica. 2015;20(2):339-57.

26.Pelletier LG, Rocchi MA, Vallerand RJ, Deci EL, Ryan RM. Validation of the revised sport motivation scale (SMS-II). Psychol Sport Exerc. 2013;14(3):329-41.

27.Carron AV, Widmeyer WN, Brawley LR. The development of an instrument to assess cohesion in sport teams: The Group Environment Questionnaire. J Sport Exerc Psychol. 1985;7(3):244-66.

28.Ryan RM, Deci EL. Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. Contemp Educat Psychol. 2020;61:101860.

29.Scholz U, Doña BG, Sud S, Schwarzer R. Is general self-efficacy a universal construct? Psychometric findings from 25 countries. Eur J Pychol Assess. 2002;18(3): 242.

REFERENCIAS BIBLIOGRÁFICAS