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One Sport or Many? Comparing Athletics and Multiactivity Training on Motor Competence in 6-10-Year-Olds

Nataniel Lopes [1,2,3], Miguel Jacinto [3,4], Diogo Monteiro [3,4], Rui Matos [3,4] and Sérgio J. Ibáñez [1,*]

1 Faculdad de Ciencias del Deporte - Universidad de Extremadura, 10071 Cáceres, España
2 Life Quality Research Centre (CIEQV), 2040-413 Leiria, Portugal
3 Research Center in Sports, Health, and Human Development (CIDESD), 6201-001 Covilhã, Portugal
4 ESECS, Polytechnic University of Leiria, 2411-901 Leiria, Portugal
* Correspondence: sibanez@unex.es

Abstract

Background: Motor competence (MC) is defined as the ability to perform a wide range of motor skills with varying degrees of proficiency and control. The present randomized, controlled trial (RCT) design examines the impact of two structured intervention programs on MC in children aged 6 to 10 years, implemented over ~~a~~ 12-weeks. **Methods**: The sample consisted of 64 children, assigned to two intervention groups: The Intervention group A (IG_A) composed of 15 male and 17 female (9.57 ± 0.86 years) and the Intervention group (IG_B), of 14 male and 18 female (9.08 ± 1.33 years). IG_A received athletics-based training exclusively, three times per week and IG_B two weekly athletics sessions and one complementary activity session, such as handball, gymnastics, swimming and motor games. MC was assessed using the modified Körperkoordinationstest für Kinder (KTK3+). The KTK3+ consists of three original KTK tasks, [Backward Balance (BB), Sideways Moving (MS) and Jumping Sideways (JS)] and an additional Eye-Hand Coordination (EHC) task. For statistical analysis, ANOVA repeated measures 2x2 was used. **Results**: In relation to JS, the performance on this test did not change with the intervention programs in none of the two groups. For BB and MS, both groups improved their performances in a similar way through programs implementation. Differently, for EHC, results showed that only IG_B improved significantly ($p < .001$) its performance with the program' intervention, with a large Cohen's d effect size (.84). Finally, as a general analysis, KTK3+ raw results (RS) and results translated to global motor quotient (GQM), revealed significant differences between IG_A and IG_B groups post-intervention, with $p < .001$ for both variables' comparison and with large Cohen's d effect sizes also on both (1.581 for RS and 1.595 for GQM), favouring IG_B. **Conclusions**: Both programmes led to improvements in various KTK3+ battery tests. However, only the programme that combined athletics training with multi-activity training led to significant improvements in the EHC test and in the overall KTK3+ results of the children involved.

Keywords: assessment; intervention; coordination; KTK3+

1. Introduction

Motor competence (MC), defined as the ability to perform a wide range of motor skills with varying degrees of proficiency and control [1,2], is a fundamental construct in the promotion of children's physical, cognitive, and social development. It encompasses both gross and fine motor skills and reflects underlying neuromotor mechanisms such as coordination, balance, and motor control [3,4]. A growing body of literature has emphasized the importance of MC during childhood, as it serves as a critical foundation for future engagement in physical activity (PA), sport participation, and healthy lifestyle habits [5,6]. It is increasingly recognized for its positive associations with psychosocial factors, cognitive functions, and academic performance [7–9].

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Over the years, several standardized tools have been developed to assess MC in children, such as the Movement Assessment Battery for Children (MABC) of Henderson and Sugden [10], the Körperkoordinationstest für Kinder (KTK) of Kiphard and Schilling [11], and the Motor Competence Assessment (MCA) of Luz et al. [12]. These instruments have predominantly focused on assessing gross motor competence. More recently, to capture a broader range of motor abilities, adaptations of some protocols have been proposed. Among them, the KTK3+ battery of Platvoet et al. [13], an extended version of the original KTK [11] that includes an eye-hand coordination (EHC) task of Faber et al. [14], has been shown to provide a more comprehensive evaluation of both dynamic balance [15] and fine motor integration [13,16]. The KTK3+ consists of three items from the KTK and the Faber test Eye-hand Coordination [14,17]. The Raw Score (RS) from each subtest were transformed into percentile scores based on all the data each grade [13,17]. This study adopts the KTK3+ as the primary assessment tool, offering a nuanced understanding of motor skill development in children aged 6–10.

The period between ages 6 and 10 represents a critical window for the acquisition and refinement of fundamental movement skills (FMS) [18], which are essential for motor proficiency across the lifespan [19–22]. Evidence [5,21,23] indicates that children with higher levels of MC are more likely to engage in regular PA, exhibit superior physical fitness, and experience better psychological and academic outcomes. Conversely, children with poor MC are more likely to be sedentary [24], exhibit lower levels of self-efficacy [24,25], and show reduced participation in organized physical activities [26–28].

Athletics, a sport rooted in the mastery of basic locomotor and object control skills such as running, jumping, and throwing, holds relevance for MC development in childhood. Despite this alignment, few studies have empirically evaluated the impact of athletics-based training on MC, particularly in comparison to multicomponent programs that integrate complementary disciplines like gymnastics, handball, and structured motor games. Some evidence supports the hypothesis that diversified motor experiences may enhance MC by promoting neuromuscular adaptability, enjoyment, and cognitive engagement [29,30]. Recent research has suggested that diversified interventions, including structured motor games [31–33], dance [8], exergames [9], and aquatic activities [34,35], can enrich children's motor experiences by promoting neuromuscular adaptability, enjoyment, creativity, and cognitive engagement. This diversified exposure has been linked to superior gains in MC and PA levels when compared to single-modality training [36,37]. In addition, the sustainability of MC has been highlighted as an emerging area of interest, especially in the context of school-based programs designed to maximize skill retention beyond the intervention period [38]. Such findings align with the ecological dynamics' perspective, which posits that varied and adaptable learning environments foster greater motor learning and transferability [7,30].

In this context, the proposed complementary activities (on IG_B program) were selected considering the conclusions of a recent systematic review conducted by the authors [39]. The present study examines the impact of two structured, coach-led intervention programs on motor competence (MC) in children aged 6 to 10 years, implemented over a 12-week period. Specifically, it compares: (i) a training program focused exclusively on athletics, and (ii) a combined program that integrates athletics with a broader range of motor experiences. Employing the KTK3+⁺ assessment protocol, the study aims to advance the current evidence based on the relative effectiveness of sport-specific versus multicomponent training approaches in promoting MC development.

2. Materials and Methods

2.1. Study Design

This study followed a randomized controlled trial design with parallel groups and a 1:1 allocation ratio and was carried out according to the intervention protocol of Lopes et al. [40].Participants were randomly assigned to one of two intervention groups: (i) Intervention Group A (IG_A): received athletics-based training exclusively, three times per week; (ii) Intervention Group B (IG_B): received two weekly athletics sessions and one complementary activity session (either gymnastics, handball, swimming or motor games), maintaining the same weekly volume (3 sessions/week × 60 minutes).

The athletics sessions were conducted in the same setting for both groups and supervised by trained instructors under standardized conditions. The handball and swimming sessions were held during training hours, but in designated areas. The gymnastics sessions were held at the Leiria Municipal Stadium, swimming at the Leiria Municipal Swimming Pool and handball at the Dr. Correia Mateus School Pavilion.

Furthermore, the study was conducted in an athletics training context. This choice was intentional, as the principal investigator is a qualified athletics coach and sought to explore whether a multiactivity approach could be meaningfully integrated within an athletics training framework without compromising the sport's technical development. Given the central role of FMS such as running, jumping, and throwing in athletics, it is crucial to assess whether complementing athletic training with activities from other domains can foster more rounded MC in middle childhood.

All the participants undergo MC assessments at two times: (i) at baseline (T0), prior to the beginning of the intervention; and (ii) at post-intervention (T1), immediately following the 12-week training period.

The post-intervention evaluations were carried out three days after the final training session, always in the afternoon, to ensure consistency in the testing conditions.

2.2. Participants

The sample consisted of 64 children, (29 male and 35 female), 32 in each group (IG_A 15 male and 17 female (9.57 ± 0.86 years) and IG_B 14 male and 18 female (9.08 ± 1.33 years), aged between 6 and 10, all of whom took part in athletics. It should be noted that all the children in the sample were members of the Federação Portuguesa de Atletismo and were all covered by sports insurance; therefore, they were protected in the event of an incident during data collection, since it took place during training sessions.

To be eligible for inclusion in the study, participants must meet the following criteria: (i) be aged between 6 and 10 years; (ii) be officially registered in the Portuguese Athletics Federation; and (iii) have provided written informed consent signed by their legal guardians, along with the child's verbal assent. We exclude our sample children: (i) any diagnosed physical or intellectual disability; (ii) medical contraindications to physical exercise; (iii) failure to obtain parental consent; (iv) failure to complete the entire assessment protocol; (v) and being outside the stipulated age range. Children meeting all eligibility criteria will be randomly assigned to one of the two intervention groups, as described in the study design: (i) Intervention Group A (IG_A) and (ii) Intervention Group B (IG_B), with 25 participants in each group.

Sample size and power calculations were developed using G*Power (v.3.1.9.7) [41]. Considering the analysis to be performed on the outcomes, a between-within ANOVA-RM (2 [groups] x 2 [time points]), anticipating a "large" effect size (f = 0.4), with an $\alpha = .05$, a statistical power of $(1 - \beta) = .95$, the correlated dependent variables with a r = .50, and a violation of sphericity $(\varepsilon) = .80$, will require a total sample size of 18 individuals. The suggested effect size and remaining parameters were defined according to similar studies [42–44].

2.3. Informed Consent

At an initial meeting, a comprehensive explanation of the study (including materials and methods) was presented by the research leader and the host institution to ensure that participants/family members/guardians were fully informed. In this meeting, all information about the distribution of children and the composition of the groups was also provided. A time was set for parents to decide on their participation by signing the informed consent form. During that time, all parents have signed the informed consent.

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2.4. Motor Competence Assessment

MC was assessed using the KTK3+ test battery [13], which is an adaptation of the original Körperkoordinationstest für Kinder (KTK) by Kiphard and Schilling [11].

The original KTK primarily assessed gross motor coordination through balance and locomotor tasks; however, the KTK3+ introduces an additional Eye-hand Coordination (EHC) task, thereby expanding its capacity to evaluate manipulative skills, a core component of motor competence. This makes KTK3+ a more holistic and ecologically valid tool, aligning with theoretical frameworks that define MC as comprising locomotor, stability, and manipulative components [1,2,13].

The use of KTK3+ was therefore methodologically strategic, as it allowed us to comprehensively assess the multidimensional impact of both mono-sport and multiactivity training programs on children's MC.

2.5. KTK3+ Test Application and procedures

The test is made up of four tasks: Task 1, balancing backwards (BB); Task 2, Jumping Sideways (JS); Task 3, moving sideways (MS) [45]; and Task 4, Eye-hand Coordination (EHC). According to Gorla et. al. [45–47], in the first task, dynamic balance is mainly checked; in the second, lower limb strength; in the third, laterality and spatial-temporal structuring and in the fourth, locomotion, balance and object control.

In the BB task, with three trials per balance beam, which decreases in width as the test progressed (6.0 cm to 4.5 cm to 3.0 cm), subjects must walk backwards over the beams. The maximum number of steps that can be performed in each beam is eight. In each essay, the count is interrupted whenever the subject loses balance and touches the ground with one foot. In each beam, subject must perform three essays. Thus, the maximum number of steps in this task, which will correspond to test raw results is 72.

In the JS task, participants had to jump with two feet over a wooden slat for 15 s. The final score resulted from the sum of the number of jumps in both trials.

In the MS task, participants had to move sideways on a straight-line handling two wooden platforms for 20 s. The total score results from summing the number of times participants put down a wooden platform as well as the number of times participants stepped on the displaced wooden platform during both trials.

The EHC task is a valid and reliable product-oriented test [13] that determines the level of controlling a tennis ball while conducting repetitive movements (i.e., left hand throw, right hand catch, followed by right hand throw, and left hand catch, etc.) as frequently as possible in a time-constrained task of 30 s [14]. The participants were free to use overhand and/or underhand techniques or a combination of both for throwing and catching. For this purpose, participants had to stand 1 m from a wall and throw the tennis ball at eye-level in a square (1 m^2) taped on the wall with the bottom side of the square 1 m above the ground. Participants conducted this test twice, with the number of successful balls catching across both trials resulting in the test score.

The raw score (RS) of each task is compared with the normative values for that task and then converted into a motor quotient (MQ). The four motor quotients thus determined (one for each of the four KTK3+ tasks) are then summed to find the overall motor quotient (OMQ) obtained by each subject in the battery in question [13].

2.6. Intervention Protocols

Participants were randomly assigned into one of two intervention groups: (i) Intervention Group A (IG_A): Received a structured athletics-only training program, delivered three times per week for 12 consecutive weeks. Each session lasted 60 minutes and included drills and exercises focused on running, jumping, and throwing techniques, emphasizing the development of FMS within an athletics context (Appendix A); (ii) Intervention Group B (IG_B): Participated in a multicomponent training program, consisting of two weekly athletics sessions identical to IG_A, and one additional

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60-minute session per week involving complementary activities (gymnastics, handball, swimming or motor games). These additional sessions were designed to stimulate a broader range of motor abilities through exposure to diverse task demands, promoting adaptability and motor transfer (Appendix B).

All sessions were supervised by coaches certified in the intervention protocols. A total of 6 coaches were involved in the two intervention programs. Two athletics coaches, one for each group, two swimming coaches, one handball coach and one gymnastics coach. The motor games sessions were led by one of the athletics coaches. Training fidelity was monitored through weekly checklists and periodic observations. As a result, 28 children (87.5%) in group A participated in 91.7% of training sessions and 4 (12.5%) participated in 88.9%, while in group B, 29 children (90.6%) participated in 91.7% of training sessions and 3 (9.4%) participated in 88.9%.

2.7. Statistical Analysis

Means and standard deviation were calculated for all studied variables. Normality and homoscedasticity were verified with the Shapiro-Wilk ($n < 50$) and Levene's tests, respectively. Next, a within-between ANOVA repeated measures 2x2, (2 [groups] x 2 [time points]) was conducted to examine differences on dependent variables. For all tests, the significance level to reject the null hypothesis was set at 5%. Sphericity assumptions were examined using Mauchly's test. When this assumption was not met, the Greenhouse-Geisser adjusted values and degrees of freedom were reported [48] and are indicated by the presence of decimal degrees of freedom. The η^2_p effect size was calculated and the assumed reference values were as follows: "small" effect = .01, "medium" effect = .06, and "large" effect = .14 [49]. Bonferroni-adjusted post-hoc tests followed the repeated measures analyses to analyze pairwise comparisons. To determine effect sizes on significant pairwise interaction, independent and paired t-tests were used, assuming Cohen's d reference values [50] as follows: "small" effect= 0.2, "medium" effect = 0.5, and "large" effect = 0.8. Statistical analyses were conducted in IBM SPSS Statistics version 27.

3. Results

3.1. Participants

A total of 70 children were assessed for eligibility, with 64 initiating the Program and meeting the inclusion criteria, which were randomized into two intervention groups: Group 1, IG_A (n = 32) and group 2, IG_B (n = 32). All participants completed the intervention and post-testing, with no dropouts or adverse events reported.

All variables in both groups presented normally distributed data, after performing a Shapiro-Wilk test, with p>.05.

Table 1 presents the pre- and post-intervention results for each KTK3+ subtest (BB, MS, JS and EHC), RS and GMQ by group. The values shown refer to the average of the quotient attributed to the results of each subtest.

Table 1. Results for each KTK3+ subtest, the RS and GMQ by group and time.

Groups/ Variables	Time (moments)	BB	MS	JS	EHC	RS	GMQ
1 (IG_A)	1	105.28±13.4	92.38±12.6	118.59±19.3	94.66±7.7	410.91±37.2	102.75±9.2
2 (IG_B)	1	106.41±12.1	97.13±12.7	122.47±15.1	98.66±9.4	424.66±34.2	106.12±8.5
1 (IG_A)	2	110.50±8.6	95.50±11.6	116.47±14.2	95.88±10.5	418.34±32.0	104.53±8.0
2 (IG_B)	2	114.44±10.2	100.59±11.7	125.59±12.5	109.53±16.1	450.16±27.7	112.56±6.9

Caption: IG_A, Intervention Group A; IG_B, Intervention Group B; BB, Balancing Backwards; MS, Moving Sideways; JS, Jumping Sideways; EHC, Eye-Hand Coordination; RS, Raw Score; GMQ, Global Motor Quotient

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Table 2 presents the statistical analysis of the pre- and post-intervention results for each KTK3+ subtest, the RS, the GMQ and their interaction with the independent values (time, group and time*group).

Table 2. Differences between groups in pre- and post-intervention.

KTK3+ Variables	Independent variables	Mean Square	F	df1	df2	p	η^2_p	Pairwise Comparisons
BB	Time	2809.000	24.337	1	31	.001**	.440	2≠1
	Group	102.516	1.413	1	31	.244	.044	NS
	Time*Group	126.56	.591	1	31	.448	.019	NS
MS	Time	695.641	5.647	1	31	.024*	.154	2≠1
	Group	387.598	2.472	1	31	.126	.074	NS
	Time*Group	1.891	.016	1	31	.902	.001	NS
JS	Time	16.000	.101	1	31	.753	.003	NS
	Group	676.000	3.697	1	31	.064	.107	NS
	Time*Group	441	2.098	1	31	.164	.061	NS
EHC	Time	2340.141	25.327	1	31	<.001**	.450	2≠1
	Group	1246.973	14.003	1	31	<.001**	.311	2≠1
	Time*Group	1491.891	12.272	1	31	.001**	.284	2≠1
RS	Time	17358.063	26.494	1	31	<.001**	.461	2≠1
	Group	8303.766	10.838	1	31	.002**	.259	2≠1
	Time*Group	5220.063	5.537	1	31	.025*	.152	2≠1
GMQ	Time	1080.766	26.304	1	31	<.001**	.459	2≠1
	Group	520.410	10.906	1	31	.002**	.260	2≠1
	Time*Group	346.891	5.808	1	31	0.22*	.158	2≠1

Caption: BB, Balancing Backwards; MS, Moving Sideways; JS, Jumping Sideways; EHC, Eye- Hand Coordination; RS, Raw Score; GMQ, Global Motor Quotient; NS, Non-significant. **p < .01; *p < .05.

Following the analysis, data revealed a significant main effect of Time for both the BB and MS tests ($p < .001$ and $p = .024$, respectively), with higher post-intervention (Moment 2) scores compared to pre-intervention (Moment 1). The corresponding effect sizes were large ($\eta^2_p = .440$ and $\eta^2_p = .154$, respectively). No significant main effects were found for Group or for the Time × Group interaction, indicating that both groups (IG_A and IG_B) improved BB and MS performance similarly across the intervention period.

For the JS test, no significant main effects were observed for Time, Group, or the Time × Group interaction, indicating that performance on this test remained stable across time and between groups.

In contrast, for the EHC test, significant main effects were found for Time ($p < .001$), Group ($p < .001$), and the Time × Group interaction ($p = .001$), all with large effect sizes ($\eta^2_p = .450$, .311, and .284, respectively). Bonferroni-adjusted pairwise comparisons showed that only the IG_B group significantly improved from pre- to post-intervention ($p < .001$; Cohen's d = .84). Significant differences were also observed between groups at both time points, being more pronounced post-intervention ($p < .001$; Cohen's d = 1.00) than pre-intervention ($p = .034$; Cohen's d = .46).

Extending the analysis to the overall KTK3+ composite score, both raw results (RS) and global motor quotient (GMQ) demonstrated significant main effects for Time ($p < .001$ for both RS and GMQ), Group ($p < .001$ for both), and their interaction ($p = .025$ for RS; $p = .022$ for GMQ). All effects were associated with large effect sizes (RS: $\eta^2_p = .461$, .259, .152; GMQ: $\eta^2_p = .459$, .260, .158). Bonferroni-adjusted pairwise comparisons indicated that significant between-group differences were present only at the post-intervention time point ($p < .001$ for both RS and GMQ), with large Cohen's d effect sizes (1.581 for RS and 1.595 for GMQ).

4. Discussion

This study investigated the effects of 12-week athletics and multiactivity training programs on multiple dimensions of motor competence (MC) in children aged 6–10 years. The findings provide a valuable contribution to the growing literature on early MC development and offer nuanced insights into how distinct components of MC respond to structured physical interventions [31,51].

A central finding was the significant main effect of Time observed across all variables except JS. This result supports the well-established notion that children improve their MC over time, particularly when regularly exposed to structured physical stimulation [38,52,53]. However, only EHC, RS, and GMQ showed significant Group and Time × Group effects, indicating that performance evolved differently between the two groups across time.

As reported in the results section, in the EHC test, only IG_B demonstrated significant pre- to post-intervention improvement. Although IG_B already presented higher baseline performance, these differences between groups became more pronounced post-intervention. This aligns with previous findings showing that tasks requiring perceptual–motor integration benefit from diverse and cognitively engaging practice contexts [9,54]. The inclusion of manipulative tasks and games in the multiactivity group may have enhanced sensorimotor integration processes, consistent with evidence suggesting that cognitively demanding motor experiences can enhance MC [31]. Similar patterns were observed for the composite KTK3+ results (RS and GMQ), which confirmed the added value of diversified motor experiences for global motor proficiency [7,55]. IG_B displayed significant pre- to post-test improvements in both RS and GMQ, while between-group differences emerged only post-intervention, indicating comparable baseline performance.

These findings reinforce the hypothesis that multicomponent programs—especially those combining athletic elements (running, jumping, coordination tasks) with varied motor activities (object control, balance, spatial orientation)—may be particularly effective in promoting overall MC compared with traditional athletics programs or less structured physical education settings [19,56].

Conversely, both groups improved similarly in BB and MS performance, suggesting that the additional multiactivity content in IG_B neither enhanced nor impaired outcomes in these tests. A plausible explanation lies in the nature of these tasks, which were practiced in both intervention protocols.

The absence of significant effects for JS was somewhat unexpected, given that jumping and lateral movements are fundamental to both athletics and multiactivity sports. Nonetheless, this result is consistent with previous research indicating that gross motor tasks involving explosive power and rhythm may require longer or higher-intensity training to produce measurable improvements in children [8,34]. These skills may also be more sensitive to maturational changes or may demand task-specific reinforcement to elicit significant adaptations [30]. Supporting this view, Sortwell et al. [37,57] showed that plyometric-based games can effectively enhance jumping ability and muscular power in this age group—an approach that could complement multiactivity interventions to target power-dominant tasks like JS.

Recent studies [8,34] have also demonstrated that pedagogical strategies such as exergames [9] or cognitively engaging drills can promote skill-specific improvements by integrating coordination, rhythm [15], and perceptual challenges.

Another important aspect concerns the magnitude of the observed effects. The partial eta squared and Cohen's d values obtained for the significant interactions indicate that the intervention produced not only statistically significant but also practically meaningful improvements. This is particularly relevant in early childhood, when MC acts as a key foundation for physical activity participation, self-perception, and long-term health trajectories [5,58]. The differential impact of the intervention across variables reflects the principle of task specificity, which posits that motor skills adapt in distinct ways depending on training type, intensity, and structure [59]. The multiactivity intervention appeared especially effective in enhancing coordination and integrative aspects of MC, while exerting less influence on isolated locomotor or power-oriented skills. Future research should consider including targeted modules to address under-responsive domains such as explosive strength and agility.

From a pedagogical perspective, the findings support incorporating varied, developmentally appropriate, and engaging motor tasks into primary school curricula. Structured multiactivity programs may effectively complement traditional physical education by providing diverse and targeted experiences that optimize motor learning during the critical developmental period of early to middle childhood [60].

4.1. Lack of Specific Effects in Locomotor and Power Tasks

Interestingly, the intervention did not produce significant interaction effects for certain variables (BB, MS, and JS). Several factors may explain the absence of differential gains between groups: Training specificity: Improvements in motor tasks are greatest when the practiced skills closely resemble the assessed skills [61]. If the program did not include backward or lateral movement drills with sufficient frequency or intensity, substantial group differences were not expected. Moreover, skills such as sideways jumping may rely heavily on anaerobic power, rhythm, and reactive strength, which are less responsive to general motor programs and may require targeted plyometric or high-load training [62]; Ceiling effects**:** If participants already demonstrated high baseline proficiency in these simpler or gross-motor dominant tasks, there may have been limited room for observable improvement over a 12-week period; Measurement sensitivity**:** Although the standard tests used here (e.g., KTK3+, TGMD) are practical and widely validated, they may lack the granularity needed to detect small but meaningful improvements, particularly in dynamic or rhythm-based motor skills. Future studies could incorporate motion capture or wearable sensor-based kinematic assessments to enhance sensitivity and detect subtle changes in performance.

4.2. Limitations, Strengths, and Future Research

While the study's randomized controlled design and the use of validated motor assessment tools strengthen its internal validity, several limitations must be acknowledged.

The intervention duration (12 weeks) was relatively short to observe potential structural changes in some motor domains, particularly strength and balance, as reported by Sortwell et al. [57] and Nobre et al. [63].

Individual variability in prior motor experience, motivation, and cognitive engagement was not considered, although such factors are known to mediate motor learning outcomes [64,65].

In addition, this study did not consider variables such as gender, socioeconomic status, or psychological factors (e.g., enjoyment, self-efficacy), which could be included in future research. Future studies should explore longer interventions combining multiactivity with focused modules (e.g., plyometrics, dance, or exergames) to more precisely target locomotor and power domains [8,37], and integrate cognitive–motor tasks, as supported by recent exergaming studies [9]. Besides, as all IG_B group children followed the same program with identical complementary activities, it is not possible to determine whether the observed MC improvements were due to a specific activity or to the overall combination of tasks—an aspect that should be addressed in future research.

Finally, athletic skill performance was not assessed in the present study, as the main focus was to determine potential differences between programs in motor competence development. Nevertheless, this is an important aspect that future studies should consider, since athletic coaches aim to enhance motor competence without compromising sport-specific skills. Should future research confirm that athletic skills are not impaired by less specific training, it would support the inclusion of such complementary activities within athletics training programs.

5. Conclusions

In summary, this study provides compelling evidence that a 12-week athletics and multiactivity training program can significantly enhance motor competence (MC) in children aged 6–10 years, particularly in coordination-driven tasks and overall motor proficiency. The IG_B intervention produced meaningful gains in EHC, GMQ, and total RS, exceeding those observed in the IG_A group. While some locomotor skills improved generally over time, these results highlight the importance of targeted, varied, and engaging physical activity interventions during the critical developmental window for MC.

Future research should investigate the longitudinal effects of such programs and examine the interplay between cognitive, motivational, and physical domains to further optimize children's motor development trajectories.

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Institutional Review Board Statement: The current protocol has been reviewed and approved by the Scientific Ethics Committee of the Faculdad de Ciencias e del Deport de la Universidad da Extremadura, Spain (approval number: N°244/2024, 3 October 2024), and was developed following the Declaration of Helsinki for work with humans.

Informed Consent Statement: Informed consent was obtained from the participants to publish this paper.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon request (nataniellopes@gmail.com).

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Abbreviations

The following abbreviations are used in this manuscript:

BB	Balancing Backwards
EHC	Eye-hand Coordination
FMS	Fundamental Motor Skills
GMQ	Global Motor Quotient
IG_A	Athletics training group
IG_B	Athletics training + complementary activities group
JS	Jumping Sideways
KTK3	Körperkoordinationstest für Kinder + EHC
MABC	Movement Assessment Battery for Children
MC	Motor Competence
MS	Moving Sideways
N	Number
PA	Physical Activity

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RS	Raw Score

Appendix A

Table A1. Intervention Group (IG_A) Program.

Week	Sports	Training Objective	Exercises Prescription	Volume
1	Athletics	Technic and Speed	Main part: Running technics (Skipping's) and Speed: various starts: sitting, lying down…	60 min
	Athletics	Speed and Strength	Main part: Agility and coordination circuit and General physical condition circuit	60 min
	Athletics	Strength and Resistance	Main part: General physical condition circuit and Varied games to stimulate resistance	60 min
2	Athletics	Technics and Speed	Main part: Hurdles training technic and running high speed with 4, 5 and 6 low hurdles	60 min
	Athletics	Speed and Strength	Main part: Agility and coordination circuit and multi-throw with medicine ball (1-2kg)	60 min
	Athletics	Strength and Resistance	Main part: General physical condition circuit and aerobic running (10-15 minutes)	60 min
3	Athletics	Technics and Speed	Main part: Running technique training with cones and pins and Speed: Speed games	60 min
	Athletics	Speed and Strength	Main part: Fast running over short distances and multi-jumps to the sandpit	60 min
	Athletics	Strength and Resistance	Main part: Strength training on the stairs and Resistance games (Example: Formula 1)	60 min
4	Athletics	Technics and Speed	Main part: Race Modelling (pins at different distances) Speed: Short-duration speed.	60 min
	Athletics	Speed and Strength	Main part: Pursuit race and Hurdles races; General physical condition circuit	60 min
	Athletics	Strength and Resistance	Main part: General physical condition circuit and Resistance games (Example: Suicide)	60 min
5	Athletics	Technics and Speed	Main part: Long Jump technics training and Speed: Short-duration speed (15 to 20 meters)	60 min
	Athletics	Speed and Strength	Main part: Block star training and strength training oh hill (fast running on short hills)	60 min
	Athletics	Strength and endurance	Main part: General physical condition circuit and aerobic running (10-15 minutes)	60 min
6	Athletics	Technics and Speed	Main part: Block start training and race modelling; Speed: various starts: sitting, lying…	60 min
	Athletics	Speed and Strength	Main part: Agility and coordination circuit and General physical condition circuit	60 min
	Athletics	Strength and endurance	Main part: Agility and coordination circuit and long jump and Resistance games (Relay)	60 min
7	Athletics	Technics and Speed	Main part: Relay training technics and circuit of agility and coordination (slalom)	60 min
	Athletics	Speed and Strength	Main part: Various starts (sitting, lying down) and Strength training on the stairs	60 min
	Athletics	Strength and endurance	Main part: Strength training using only body weight and aerobic running (10-15 minutes)	60 min
8	Athletics	Technics and Speed	Main part: High jump training and Speed: Short-duration speed (15 to 20 meters)	60 min
	Athletics	Speed and Strength	Main part: Race Modelling (pins 3-or4-meter distance) Strength training - body weight	60 min

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	Athletics	Strength and endurance	Main part: General physical condition circuit and Resistance games (Ex: Relay 4x400m)	60 min
9	Athletics	Technics and Speed	Main part: Running technics (Skipping's) and Speed: Speed Games (Ex: Divisions Game)	60 min
	Athletics	Speed and Strength	Main part: Short-duration speed (15-20 meters) and Strength training with medicine balls	60 min
	Athletics	Strength and endurance	Main part: Multi-jumps to the sandpit and aerobic running (10-15 minutes)	60 min
10	Athletics	Technics and Speed	Main part: Running technique training with cones and Agility and coordination circuit	60 min
	Athletics	Speed and Strength	Main part: Speed Games (Slalom and relay 4x40m) Multi throwing with medicine balls	60 min
	Athletics	Strength and endurance	Main part: Strength training using only body weight and aerobic running (15-20 minutes)	60 min
11	Athletics	Technics and Speed	Main part: High jump training and Speed: Short-duration speed (30 to 40 meters)	60 min
	Athletics	Speed and Strength	Main part: Speed (Relay 4x40m) Strength Multi-jumps (boxes, ropes, stair, hurdles, etc)	60 min
	Athletics	Strength and endurance	Main part: General physical condition circuit and Resistance games (Ex: Formula 1	60 min
12	Athletics	Technics and Speed	Main part: Hurdles training technic and running high speed with 4, 5 and 6 low hurdles	60 min
	Athletics	Speed and Strength	Main part: Agility and coordination circuit and General physical condition circuit	60 min
	Athletics	Strength and endurance	Main part: Strength training using only body weight and aerobic running (15-20 minutes)	60 min

Appendix B

Table A2. Intervention Group (IG_B) Program.

Week	Sports	Training Objective	Exercises Prescription	Volume
1	Athletics	Technic and Speed	Main part: Running technics (Skipping's) and Speed: various starts: sitting, lying down…)	60 min
	Gymnastic	Technic and initiation	Main part: Basic fundamentals of Gymnastics (Learning basic posture exercises)	60 min
	Athletics	Strength and Resistance	Main part: General physical condition circuit and Varied games to stimulate resistance	60 min
2	Athletics	Technics and Speed	Main part: Hurdles training technic and running high speed with 4, 5 and 6 low hurdles	60 min
	Handball	Technic and initiation	Main Part: Relationship with the ball and fundamental (passing, receiving and shooting)	60 min
	Athletics	Strength and Resistance	Main part: General physical condition circuit and aerobic running (10-15 minutes)	60 min
3	Athletics	Technics and Speed	Main part: Running technique training with cones and pins and Speed: Speed games	60 min
	M. Games	Technic and initiation	Main Part: Games to develop general MC (rhythm and co-operation games)	60 min
	Athletics	Strength and Resistance	Main part: Strength training on the stairs and Resistance games (Example: Formula 1)	60 min
4	Athletics	Technics and Speed	Main part: Race Modelling (pins at different distances) Speed: Short-duration speed.	60 min

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	Swimming	Technic and training	Main part: Learning basic aquatic motor skills (Free Games) and basic fundamentals of swimming.	60 min
	Athletics	Strength and Resistance	Main part: General physical condition circuit and Resistance games (Example: Suicide)	60 min
5	Athletics	Technics and Speed	Main part: Long Jump technics training and Speed: Short-duration speed (15 to 20 meters)	60 min
	Handball	Technic and training	Main Part: Relationship with the ball (dribbling and feinting)	60 min
	Athletics	Strength and endurance	Main part: General physical condition circuit and aerobic running (10-15 minutes)	60 min
6	Athletics	Technics and Speed	Main part: Block start training and race modelling; Speed: various starts: sitting, lying…	60 min
	M. Games	Technic and training	Main Part: Games with varied movements (Station: hopping, running, jumping, throwing)	60 min
	Athletics	Strength and endurance	Main part: Agility and coordination circuit and Long jump and Resistance games (Relay)	60 min
7	Athletics	Technics and Speed	Main part: Relay training technics and circuit of agility and coordination (slalom)	60 min
	Handball	Technic and training	Main Part: Relationship with the ball (dribbling and feinting)	60 min
	Athletics	Strength and endurance	Main part: Strength training using only body weight and aerobic running (10-15 minutes)	60 min
8	Athletics	Technics and Speed	Main part: High jump training and Speed: Short-duration speed (15 to 20 meters)	60 min
	Gymnastic	Technic and training	Main part: Basic fundamentals of gymnastics (Improving Jumping and rolling exercises)	60 min
	Athletics	Strength and endurance	Main part: General physical condition circuit and Resistance games (Ex: Relay 4x400m)	60 min
9	Athletics	Technics and Speed	Main part: Running technics (Skipping's) and Speed: Speed Games (Ex: Divisions Game)	60 min
	M. Games	Technic and training	Main part: Object manipulation games and balance challenges with balls, hoops, ropes.	60 min
	Athletics	Strength and endurance	Main part: Multi-jumps to the sandpit and aerobic running (10-15 minutes).	60 min
10	Athletics	Technics and Speed	Main part: Running technique training with cones and Agility and coordination circuit	60 min
	Swimming	Technic and training	Main Part: Learning basic aquatic motor skills (Propulsion and manipulation exercises)	60 min
	Athletics	Strength and endurance	Main part: Strength training using only body weight and aerobic running (15-20 minutes)	60 min
11	Athletics	Technics and Speed	Main part: High jump training and Speed: Short-duration speed (30 to 40 meters)	60 min
	Handball	Technic and training	Relationship with the ball and fundamental technical and tactical notions in game.	60 min
	Athletics	Strength and endurance	Main part: General physical condition circuit and Resistance games (Ex: Formula 1)	60 min
12	Athletics	Technics and Speed	Main part: Hurdles training technic and running high speed with 4, 5 and 6 low hurdles	60 min
	M. Games	Technic and training	Main part: Circuit of games for cooperation, manipulation, locomotion and coordination.	60 min
	Athletics	Strength and endurance	Main part: Strength training using only body weight and aerobic running (15-20 minutes)	60 min

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