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Relationship between Repeated Sprint Ability and Force–Velocity Profile in Elite and Subelite Female Field Hockey Players

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Featured Application: This study suggests that the force–velocity profile conceived by Bosco could be a useful, easy-to-apply assessment method of athletes' level of performance. Furthermore, the control of the step length and step frequency enables coaches and athletes to develop RSA training with a more specific focus based on the specific improvement needs (e.g., wicket run).

Abstract: This study aimed to compare two female field hockey teams of different competitive levels by analyzing kinematic variables in repeated sprint ability (RSA) tests and the force-velocity profile (FVP). Twenty-five female hockey players representing the elite and subelite levels from the same club volunteered to participate. The RSA protocol included six 30 m maximal sprints with a 30 s recovery. Kinematic variables, such as sprint time, step frequency, and step length, were analyzed for each sprint. Additionally, players performed counter-movement jumps (CMJs) and CMJs with 50% body weight (CMJ50s) to calculate the FV50 using the Bosco Index. The elite players showed better (≈2%; $p < 0.05$) fatigue indexes in sprint time (0–30 m and 0–10 m sections), step length (0–10 m, 10–20 m, and 20–30 m sections), and step frequency (20–30 m section) during the RSA test, as well as greater values (>10%; $p < 0.05$) in the CMJ50 and FV50 tests. In addition, these RSA (sprint time, step frequency, and step length) and jumping (CMJ, CMJ50, and FV50) variables showed a moderate, significant, or very significant relationship with each other. Therefore, it seems that both strength and speed capacities can be used either in conjunction or as a complementary approach to enhance the overall RSA performance.

Keywords: sport performance; monitoring and evaluation; team sports; fatigue index; sprint time; Bosco Index

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1. Introduction

Field hockey is a team sport characterized by the execution of high-intensity actions, like sprints, jumps, changes in direction, and shoots [1], which have a great influence on the match outcome [2]. For this reason, it is very important to enhance the ability to repeat high-intensity activities [3] and to avoid an impairment of performance in the course of a match due to the gradual development of fatigue [4].

Repeated sprint ability (RSA) tests have been frequently employed in team sports to assess the ability to repeat high-intensity actions in team sports [3]. These tests are composed of a series of repeated sprints, characterized by short efforts (e.g., 30–40 m sprints) and an incomplete recovery between them [3]. The mean time of the sprints, the overall sum of the time employed in all the repetitions, or the fatigue indexes comparing the fastest, mean, and slowest repetitions are used to assess the performance in the test. This can be complemented with the evaluation of running cyclic parameters such as the step frequency (SF) and the step length (SL), which provide further information on how fatigue can affect the running performance [5–8]. Fatigue indexes between 3% and 6% have been identified as reference values in different sports and performance levels [5,9–12]. In addition, the force–velocity profile (FVP) using counter-movement jumps (CMJs) has been identified as an indicator of neuromuscular capacities in both sprint [13] and RSA performance [14]. Recently, the calculation of the FVP with the use of two loads (20–70%, 1 repetition maximum; RM) has been proposed as a reliable procedure [15]. Specifically, the FVP50 (or Bosco test, 0–50% body weight loads) has shown a relationship with physical performance, both in individual [16] and team sports [5], thus facilitating easier assessment without requiring a 1 RM test. In addition to the relationships shown between jumping and sprint, plyometric training (based on CMJs and ankle jumps) has been found beneficial for improving RSA performance in athletes [17].

The differences in the metabolic and neuromuscular components of team sport players from diverse competitive standards have recently been addressed in the literature [18]. Soccer [19] and handball players [20] have shown greater performances in repeated sprinting and vertical jumping, whereas no statistical differences were observed in futsal players [21]. However, these studies have not complemented the analysis of RSA with running kinematics, nor used vertical jumps with external loads to calculate the FVP.

Therefore, the aim of this study was to analyze the kinematic differences between the RSA test and the FVP50 in two, elite vs. subelite, female field hockey athletes. Additionally, correlations between the analyzed kinematic variables (e.g., step length and step frequency) were also explored.

2. Materials and Methods

2.1. Participants

Twenty-five female field hockey players (age 24.92 ± 5.56 years; body height 1.67 ± 0.04 m; body weight 58.72 ± 3.71 kg) volunteered to take part in this study. Participants were both elite (n = 13; age 26.31 ± 4,97 years; body height 1.66 ± 0.04 m; body weight 59.00 ± 3.03 kg) and subelite (n = 12; age 23.42 ± 5.98 years; body height 1.67 ± 0.04 m; body weight 58.42 ± 4.46 kg) players from the first (national champion and European championship runner-up) and second (national second division) teams of the same club, respectively. This study received approval from the Local University Ethics Committee (CODE 35/2020), and all the participants provided their informed consent, in accordance with the principles of the Declaration of Helsinki. Additionally, all the participants were thoroughly briefed on the study's protocol.

2.2. Design

To ensure minimal disruption to their regular training routines, all coaching and support staff were informed and, in some cases, actively involved in the design of the study and its supervision. All the tests were conducted during the conditioning segment of the workouts at the beginning of the training session and after the completion of a standardized warm-up (Figure 1). The jumping tests were administered on Tuesday (regular resistance training session), while the repeated sprint ability (RSA) test was performed on Thursday (regular speed training workout), at the same time of day (8:00 p.m.) during a regular competition week in which they played against a lower-level team.

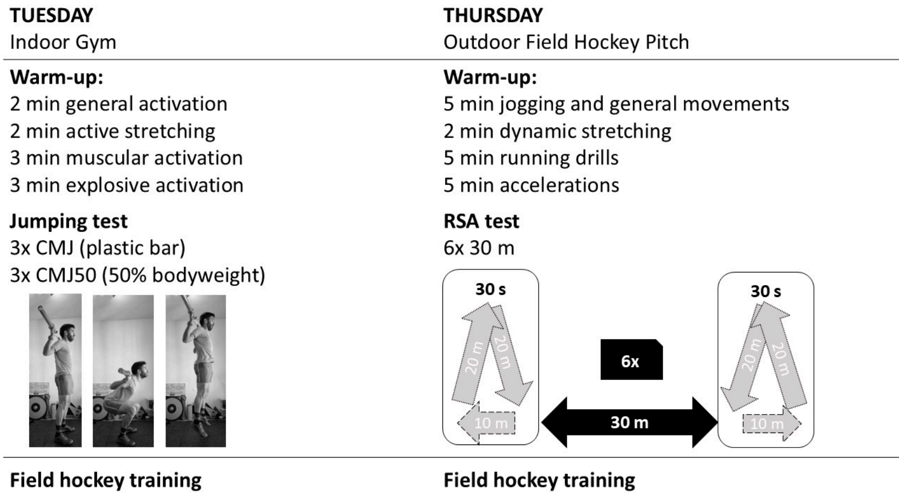

Figure 1. Jumping and RSA test protocols.

2.3. Repeated Sprint Ability Test

The repeated sprint ability (RSA) protocol involved six 30 m maximal sprints, with a 30 s active recovery period after each sprint being implemented [10]. Before the test, the players carried out a standardized and specific 15 min warm-up composed of 5 min of jogging and general movements, 2 min of dynamic stretching, 3 min of running drills, and 5 min of 5 to 10 m accelerations. During the recovery time, the participants decelerated for a maximum of 10 m and followed a triangle form circuit to return to the starting line [10]. Thereafter, they repeated the sprint for a total of six repetitions. Electronic photocells (Microgate, Bolzano, Italy) were used to measure sprinting times. The photocells were positioned at 0, 10, 20, and 30 m, with their heights adjusted in accordance with the participants' height. The starting position of the players was fixed, standing still 1 m behind the initial timing gates. An EX-ZR800 video-camera (Casio Computer Co., Tokyo, Japan) operating at 60 Hz with specific settings (shutter speed: 1/1000, resolution: 1920 × 1080 pixels) was used to record the 30 m sprints.

2.4. Estimation of the Step Frequency (SF) and Length (SL)

The SF was calculated by dividing the number of steps by the time it took to perform the sprint and the SL by dividing the sprint distance by the sprint time and SF in each section (0–10 m, 10–20 m, 20–30 m and 0–30 m) for the six sprints. In addition, to estimate the performance decrease, the following fatigue indexes were calculated: FImean = 100 − (mean/best × 100)) and worst (FIworst = 100 − (worst/best × 100)) repetition during the test [5].

2.5. Jump Test

All the players carried out CMJ and CMJ50 tests preceded by a 10 min warm-up composed of 2 min of general activation, 2 min of light active stretching focused primarily on the lower limbs, 3 min of basic bodyweight muscular activation (10 repetitions of lunges, squats, hip-thrusts, and single-leg Romanian deadlifts), and 3 min of explosive activation (involving six repetitions of squat jumps, CMJs, and Drop Jumps, with complete rest intervals between them).

All jumping tests were carried out on a contact platform (Chronojump—Bosco System, Barcelona, Spain), which allowed us to measure flight times, and the calculation of the jumping height was carried out using the Chronojump Sofware (Bosco System v 2.35, Barcelona, Spain). Each player performed three jumps for each test, and only the best score was considered for the analysis. From a standing position, all the participants performed a fast knee flexion to thereafter jump as high as possible while maintaining a vertical body position at take-off and landing with their knees fully extended and avoiding any lateral or frontal movements [22]. During the CMJ50 test, an additional load (bar) equivalent to 50%

of the body weight of each participant was used. To ensure consistency between the CMJs and CMJ50s, the players held a plastic barbell (with no overload) in the CMJs to mimic the execution of the CMJ50s. The FV50 proposed by Bosco was determined using the following equation: FV50 = CMJ50/CMJ × 100 [16].

2.6. Statistical Analysis

A descriptive analysis was performed, and subsequently, the Shapiro–Wilk test was applied to assess normality. A repeated measures analysis of variance (ANOVA) was employed to compare the variables (sprint time, step frequency, and step length) within the different sections (0–10 m, 10–20 m, and 20–30 m) of the six sprints. Post hoc tests were conducted using Bonferroni corrections, and effect sizes (np2) were employed to estimate the magnitude of difference, with 0.2, 0.5, and 0.8 indicating small, moderate, or large effect sizes, respectively [23]. Furthermore, to explore the relationship between the FV50 and the RSA kinematic parameters, Pearson correlation coefficients were utilized, with 0.1, 0.3, 0.5, 0.7, and 0.9 being used as thresholds for small, moderate, large, very large, or nearly perfect correlations [24]. Results are reported as mean ± standard deviation unless otherwise stated. All statistics were performed using the IBM Statistical Package for the Social Sciences (SPSS for Windows, version 27.0 (IBM Inc., Armonk, NY, USA) with alpha level set at $p < 0.05$.

3. Results

3.1. RSA Performance

Significant main time effects were observed for the kinematic variables measured during the 30 m RSA (Figure 2): sprint times (F3.65 = 11.55, $p < 0.001$, η2 = 0.33); SF (F4.60 = 14.05, $p < 0.001$, η2 = 0.38); and SL (F4.43 = 2.84, $p = 0.024$, η2 = 0.11).

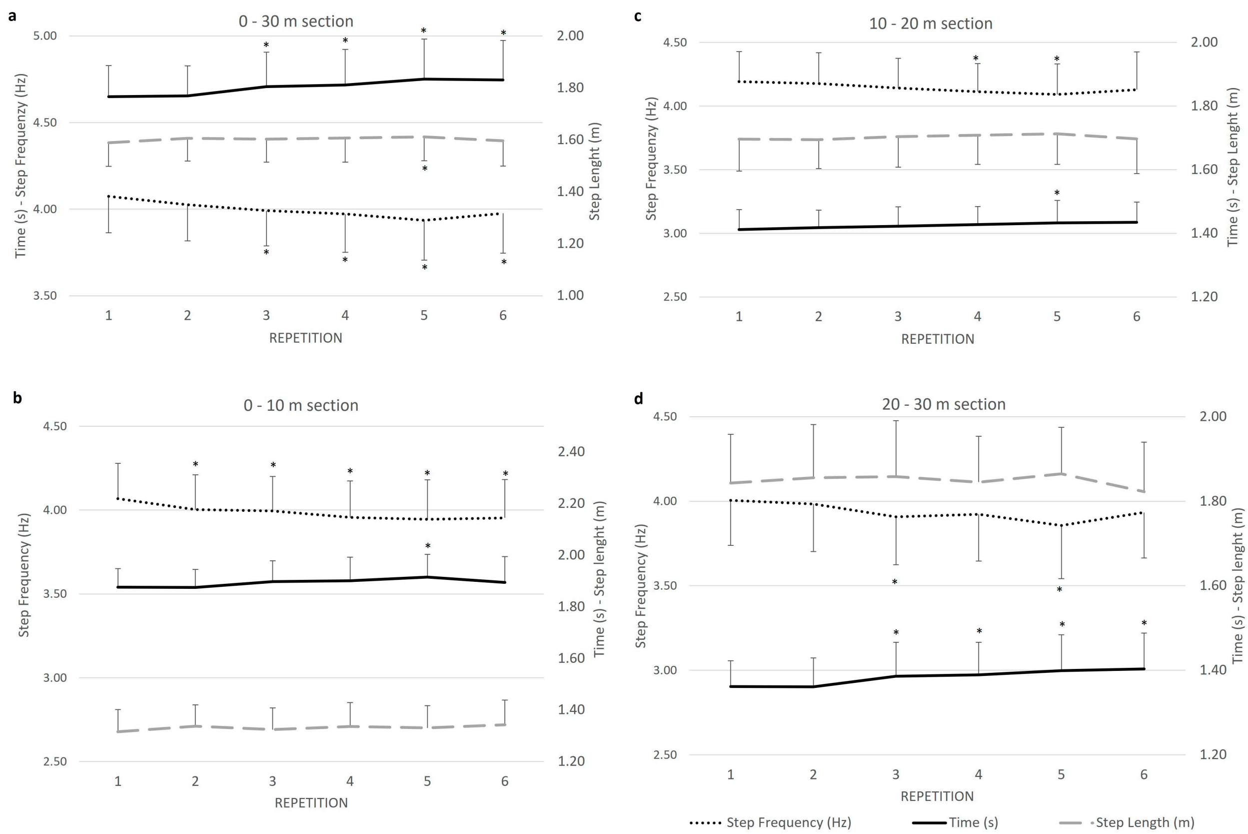

Figure 2. Evolution of step kinematics during the six repetitions in (**a**) 0–30 m, (**b**) 0–10 m, (**c**) 10–20 m, and (**d**) 20–30 m sections for all the players during the RSA test. (*) Different from the first repetition at $p < 0.05$.

When studying the 10 m intervals of the test (Figure 2b–d), a small effect of the repetitions was detected for the sprint times in the 20–30 m section (F4.44 = 12.49, $p < 0.001$, η2 = 0.35) and for the SF of the first (F5.00 = 12.85, $p < 0.001$, η2 = 0.36) and last (F4.53 = 5.70, $p < 0.001$, η2 = 0.20) 10 m sections. Trivial effects for SL were observed in all the sections (0–10 m: F4.38 = 2.84, $p = 0.024$, η2 = 0.11, 10–20 m: F3.44 = 0.96, $p = 0.43$, η2 = 0.04 and 20–30 m: F4.61 = 2.58, $p = 0.034$, η2 = 0.10).

Pairwise comparisons (Figure 2) revealed statistical differences in sprint times (p = 0.42–0.005) and SF (p = 0.005–0.001) between the first repetition and the third, fourth, fifth, and sixth repetitions during the 30 m sprint times. In the case of the SL, there were only differences ($p = 0.007$) between the first and fifth repetition of the 30 m sprint. When comparing the first and the last repetition of the 30 m test, the sprint time increased by 2.1% ($p = 0.017$), the SF decreased by 2.4% ($p = 0.004$), whereas there were no differences ($p > 0.05$) in the SL.

3.2. Jumping Performance

The mean values of CMJ (31.06 ± 0.65 cm) and CMJ50 (17.55 ± 0.48 cm) showed differences ($p < 0.001$) from each other.

3.3. Performance Level

Players from the subelite team (Table 1) exhibited higher (p < 0.05–0.01) fatigue indexes than those from the elite team in several cyclic running variables (sprint time, SF, and SL) throughout all the RSA sections (0–30 m, 0–10 m, 10–20 m, and 20–30 m). In addition, differences were found between both teams in the worst step frequency of the 20–30 m section ($p < 0.05$). However, no differences were observed for the best or average values of the RSA variables and sections.

Table 1. Comparison between an elite and subelite team in sprint time, step length, and step frequency for different parameters (best, mean, worst, and fatigue index mean and worst) during the RSA test sections (0–30 m, 0–10 m, 10–20 m, and 20–30 m). (*) Different between teams at $p < 0.05$.

	Team	Best	Mean	Worst	FImean	FIworst
0–30 m						
Sprint Time (s)	Elite	4.58 ± 0.22	4.67 ± 0.23	4.73 ± 0.25	1.87 ± 1.31	3.27 ± 1.97
	Subelite	4.64 ± 0.13	4.74 ± 0.16	4.87 ± 0.19	2.16 ± 0.95	4.92 ± 2.06 *
Step Frequency (Hz)	Elite	4.13 ± 0.23	4.02 ± 0.25	3.93 ± 0.26	−2.78 ± 1.45	−4.95 ± 1.96
	Subelite	4.07 ± 0.17	3.97 ± 0.16	3.87 ± 0.16	−2.31 ± 1.02	−4.68 ± 1.97
Step Length (m)	Elite	1.63 ± 0.11	1.61 ± 0.11	1.58 ± 0.10	−1.64 ± 0.74	−3.45 ± 0.97
	Subelite	1.63 ± 0.07	1.60 ± 0.07	1.56 ± 0.06	−2.07 ± 1.00	−4.45 ± 2.21
0–10 m						
Sprint Time (s)	Elite	1.85 ± 0.09	1.89 ± 0.09	1.92 ± 0.08	2.28 ± 1.44	4.13 ± 2.05
	Subelite	1.84 ± 0.07	1.90 ± 0.07	1.96 ± 0.09	3.39 ± 1.67	6.79 ± 2.20 *
Step Frequency (Hz)	Elite	4.13 ± 0.23	4.02 ± 0.25	3.93 ± 0.26	−2.78 ± 1.45	−4.95 ± 1.96
	Subelite	4.05 ± 0.17	3.95 ± 0.16	3.86 ± 0.16	−2.50 ± 0.84	−4.78 ± 1.04
Step Length (m)	Elite	1.36 ± 0.10	1.33 ± 0.09	1.30 ± 0.09	−2.13 ± 0.78	−4.37 ± 1.45
	Subelite	1.39 ± 0.07	1.34 ± 0.07	1.29 ± 0.08	−4.11 ± 2.24 *	−7.18 ± 2.95 *
10–20 m						
Sprint Time (s)	Elite	1.38 ± 0.07	1.41 ± 0.07	1.44 ± 0.08	2.02 ± 1.41	3.82 ± 2.13
	Subelite	1.41 ± 0.04	1.44 ± 0.04	1.47 ± 0.05	1.84 ± 0.94	3.88 ± 1.58
Step Frequency (Hz)	Elite	4.26 ± 0.27	4.17 ± 0.27	4.07 ± 0.29	−2.32 ± 1.37	−4.54 ± 1.99
	Subelite	4.25 ± 0.27	4.11 ± 0.17	4.01 ± 0.17	−3.02 ± 3.51	−5.52 ± 4.48
Step Length (m)	Elite	1.74 ± 0.11	1.71 ± 0.11	1.67 ± 0.12	−1.95 ± 0.65	−4.00 ± 1.45
	Subelite	1.74 ± 0.06	1.69 ± 0.06	1.64 ± 0.08	−2.79 ± 0.87 *	−6.14 ± 3.84
20–30 m						
Sprint Time (s)	Elite	1.34 ± 0.08	1.37 ± 0.08	1.40 ± 0.09	2.55 ± 1.08	4.91 ± 1.78
	Subelite	1.36 ± 0.05	1.40 ± 0.06	1.45 ± 0.06	3.05 ± 1.48	6.74 ± 3.60
Step Frequency (Hz)	Elite	4.11 ± 0.30	4.01 ± 0.29	3.90 ± 0.30	−2.48 ± 1.12	−5.15 ± 2.41
	Subelite	4.03 ± 0.20	3.85 ± 0.21	3.67 ± 0.24 *	−4.43 ± 1.87 *	−9.10 ± 4.21 *
Step Length (m)	Elite	1.88 ± 0.13	1.83 ± 0.12	1.79 ± 0.12	−2.54 ± 0.65	−4.92 ± 1.16
	Subelite	1.94 ± 0.13	1.86 ± 0.10	1.79 ± 0.08	−4.01 ± 1.91 *	−7.76 ± 3.57 *

The CMJ height did not show differences between the teams ($p = 0.54$). However, players from the elite team jumped 13.4% higher during the CMJ50 test (δ 2.21 cm; $p = 0.032$) and had a 10.7% greater FV50 (δ 5.72; $p = 0.002$) than those from the subelite team (Figure 3).

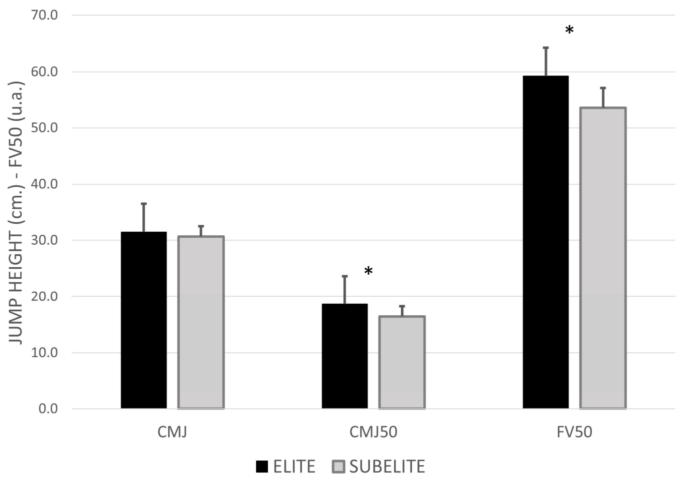

Figure 3. Comparison between the performance of players from two standards of competition in CMJ, CMJ50, and FV50. (*) Different between teams at $p < 0.05$.

3.4. Correlation Coefficients

CMJ50 and FV50 showed significant ($p < 0.001$) relationships with each other (Table 2). In addition, CMJ50 also showed moderate ($p < 0.05$) relationships with the worst fatigue index of the sprint time in the 0–30 m section and the worst step frequency in the 20–30 m section. FV50 showed moderate ($p < 0.05$) relationships with the worst fatigue index of the sprint time in the 0–10 m and 0–30 m sections and the worst value of SF in the 20–30 m section. Additionally, the worst fatigue indexes of the sprint time in the 0–30 m and 0–10 m section were significantly related ($p < 0.001$), and they were also related with the worst SF value in the 20–30 m section. Finally, the fatigue indexes of the 0–10 m and the 20–30 m sections had nearly perfect or moderate-to-very-large significant relationships ($p < 0.001$), respectively, within each section.

Table 2. Relationships (r) between the variables that showed significant differences between teams in RSA sections (0–30 m, 0–10 m, 10–20 m, and 20–30 m) and jumping tests (CMJ50 and FV50). (*) Statistical correlation at $p < 0.05$.

	Jump Test		**0–30 m**	**0–10 m**			**10–20 m**	**20–30 m**				
	CMJ50	**FV50**	**ST_ FIworst**	**ST_ FIworst**	**SL_ FImean**	**SL_ FIworst**	**SL_ FIworst**	**SF_ worst**	**SF_ FImean**	**SF_ FIworst**	**SL_ FImean**	**SL_ FIworst**
Jump Test												
CMJ50	1	0.697 *	−0.455 *	−0.292	0.141	0.062	0.104	0.448 *	0.188	0.255	0.125	0.151
FV50		1	−0.490 *	−0.488 *	0.312	0.257	0.095	0.464 *	0.335	0.353	0.342	0.362
0–30 m												
ST_FIworst			1	0.656 *	−0.296	−0.306	−0.144	−0.640 *	−0.252	−0.580 *	−0.551 *	−0.385
0–10 m												
ST_FIworst				1	−0.727 *	−0.641 *	0	−0.207	0.006	−0.243	−0.229	−0.086
SL_FImean					1	0.927 *	0.042	−0.017	0.142	0.238	0.213	0.162
SL_FIworst						1	0.003	0.098	0.266	0.321	0.318	0.247
10–20 m												
SL_FIworst							1	0.068	0.147	0.175	0.165	0.276
20–30 m												
SF_worst								1	0.513 *	0.591 *	0.509 *	0.482 *
SF_FImean									1	0.848 *	0.685 *	0.772 *
SF_FIworst										1	0.813 *	0.807 *
SL_FImean											1	0.877 *
SL_FIworst												1

ST_FIworst, sprint time fatigue index worst; SL_FImean, step length fatigue index mean; SL_FIworst, step length fatigue index worst; SF_worst, step frequency worst; SF_FIworst, step frequency fatigue index worst.

4. Discussion

The results of our study indicate that compared to subelite, the elite hockey team have better (≈2%) fatigue indexes (FIworst and FImean) in sprint time (0–30 m and 0–10 m sections), step length (0–10 m, 10–20 m, and 20–30 m sections), and step frequency (20–30 m section) when performing the RSA test. Additionally, the elite team achieved greater (>10%) values in the CMJ50 and FV50 jumping tests. In addition, these RSA and jumping variables showed a moderate-to-very-significant relationship.

4.1. Repeated Sprint Ability and Jumping Performance

The female field hockey players assessed in the present study showed better 30 m sprinting times (4.70 ± 0.19 s) than previously reported by female soccer (5.04 ± 0.23 s); [25] and field hockey players (5.29 ± 0.31 s) [26] and were slower (≈0.2 s) than male team players [27]. The time to complete the 30 m sprints increased during the RSA test, showing an inverse relation to the decrement in step frequency, whereas the step length remained largely unaffected [28]. This finding is consistent with previous studies [9,11,12]. Consequently, it is noteworthy that the fastest time in the current study is shorter than that observed in other studies, with differences ranging from 0.1 s [5,10] to more than 0.5 s [11].

When the RSA performance was assessed over 10 m sections (Figure 2b–d), the sprint times in the 20–30 m section increased, whereas the SF decreased in all the sections, particularly in the 0–10 m interval. This result suggests that coaches must focus on the SF to minimize the loss of speed [6]. Based on previous studies [5,11], it can be suggested that 4 Hz could be a reference SF value to be achieved during RSA tests.

The highest measured CMJ values in both teams (Figure 3) are similar to those previously observed in female elite field hockey players [5] and greater than those found in first-division female soccer players [10], as well as in female adolescent players from national handball leagues [17].

4.2. Level of Competition

As described in Table 1, both calculated fatigue indexes have proven to be the best criteria to distinguish RSA performance between both competition levels. This difference in performance is similar to the changes in relative distance at high speed by midfielders (2%) across halves of play [1]. Except for the worst SF in the 20–30 m, the subelite players presented lower values (lower differences between the highest and lowest SF in that section). Specifically, FIworst exhibited greater differences than FImean, although both indexes share similarities in several sections of the sprints and for different kinematic variables. Overall, oscillations greater than 4% could be considered a low level of performance. Even though the lower-level competitive players presented greater fatigue indexes, they were similar (3–6%) to those reported elsewhere [5,9–12,27].

Traditionally, RSA studies have focused on the decrements of performance during sprints. One of the most important findings of the current investigation is that kinematical parameters (SL and SF) provide qualitative information to further understand the change in performance during the test. The SL showed differences in all 10 m sections and, specifically, this difference could be up to 10 cm in the lower-level competitive team. The SL values determined in different sections of the test align with those observed in female soccer players [12] and field hockey players, [29] and exceed those recorded on a treadmill [9]. Additionally, the SF showed decrements in the 20–30 m section, with players from the subelite team displaying lower values in the worst index.

Regarding the jumping tests, there were differences in the CMJ50 and FV50 scores between players from the two competitive levels. Therefore, this may be a relevant area for improvement, given that in a sports environment, a 5% decrease in performance could be considered a significant decline [1]. This finding reinforces the idea that maximal strength is compromised in team sports [30]. Thus, it appears essential to emphasize maximal strength training for this population of athletes, suggesting that players should reach a reference value of 60% in the FV50, as proposed by Bosco in his strength–velocity index [16].

4.3. Correlations

The moderate-to-very-significant relationships between CMJ and FV50, the fatigue variables in the 30 m sprint, and the worst stride frequency in the 20–30 m section align with studies carried out in elite field hockey [5] and futsal players [31]. Therefore, improving strength (CMJ50 and FV50) could be associated with an enhancement in some of the RSA variables that discriminate competitive performance. The limited effects of explosive strength training are well known, as they might improve the maximal velocity but not in the RSA fatigue indexes. [32]. The relationship between the SF and SL within the 10 m sections highlights the interplay of these variables independently for the acceleration (0–10 m) and maximum velocity (20–30 m) phases [33]. Furthermore, fatigue in the 30 m sprint is related to several variables in the acceleration (0–10 m) and maximum velocity (20–30 m) phases, emphasizing the significance of tailoring training to short distances up to 10 m [34] or longer distances exceeding 20 m [29].

4.4. Practical Applications

This study suggests that the FVP50 conceived by Bosco [16] could be a useful, easy-to-apply assessment method of athletes' level of performance. Furthermore, the control of the SL and SF enables coaches and athletes to develop speed and RSA training with a more specific focus based on the specific improvement needs (e.g., wicket run). Moreover, customizing the focus on either step length or frequency can be adjusted based on the specific running section to be improved. This approach highlights the importance of utilizing simple techniques directly derived from the sport-specific motion, rather than crafting more intricate mathematical profiles [35]. The following reference values are proposed to control training progress in female elite team sports athletes: CMJ 30 cm and CMJ50 18 cm (about 60% of the FV50). Furthermore, regarding the RSA performance, they should complete a 30 m sprint in less than 4.6 s with a 3% in the FIworst.

Despite the new perspectives or references provided by this study, further studies are needed with a larger sample that includes different clubs, teams, and/or performance standards. In addition, it is necessary to analyze the evolution of the RSA and jumping variables over time, either at different times of the season or in different seasons. In this way, it would be possible to verify whether the relationships found imply causality.

5. Conclusions

The kinematic performance showed increases in time and decreases in SF throughout the RSA test, both in the overall analysis (0–30 m) and in the analyses of the 10 m sections. Differences in the fatigue indexes within every section of the RSA test and for the strength indicators (CMJ50 and PFV50) were observed between elite and subelite competition levels. The correlation analysis suggests that strength and speed training can be used either in conjunction or as complementary approaches to enhance the overall RSA performance (highlighting the CMJ50 and FV50 for improving sprint time fatigue index and step frequency).

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of Universidad Francisco de Vitoria (35/2020, 23/11/2020).

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Data Availability Statement: The data presented in this study are available on reasonable request from the corresponding author.

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