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Review Article

Individualizing Strength Training Using the Vertical Force-Velocity Profile in Vertical Jumping and its Effect on Athletic Performance: A Systematic Review

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Abstract

Background. The individualization of strength training represents a promising strategy for enhancing performance in high-speed actions, such as jumping and sprinting. The vertical force-velocity (F-v) profile allows for the identification of individual imbalances between force and velocity in vertical jumping.

Objectives. This systematic review aimed to analyze the effects of individualized strength training programs based on the vertical F-v profile on jump and sprint performance.

Materials and methods. A comprehensive search was conducted in scientific databases following PRISMA guidelines, analyzing eight studies that met the inclusion criteria. The study involved a total of 353 subjects over 18 years of age participated, including athletes, students, and professional dancers. The training protocols encompassed two weekly sessions over a period of 7 to 12 weeks, using exercises such as squats and vertical jumps, tailored to each individual's F-v profile.

Results. The main results indicated significant improvements in countermovement jump (CMJ), squat jump (SJ), and sprint performance, with greater gains observed in groups that received optimized training based on the F-v profile. The findings were consistent with previous research highlighting the effectiveness of the F-v profile for planning more specific and effective training programs. However, methodological differences were identified among studies, particularly in exercise selection and training volume.

Conclusions. It is concluded that individualized training based on the vertical force-velocity profile is effective in enhancing performance in disciplines requiring explosive actions. This tool allows for optimized strength training programming.

Keywords: force-velocity, individualization, jumping performance, sprinting, strength training.

Introduction

Improving athletic performance requires an individualized approach to training. Each athlete has unique biomechanical, anatomical, and physiological characteristics that affect how they respond to training stimuli (Halson, 2014). In many sports, actions such as jumping, sprinting, and changing direction are critical (Pleša et al., 2021; Ramirez-Campillo et al., 2020). These movements demand rapid mobilization of body mass or its segments, relying heavily on lower limb (LL) strength.

Neuromuscular capacity of the LL is commonly assessed through jumping tests, which provide relevant, reliable, and specific information (Jiménez-Reyes et al., 2011). However, measuring only jump height may not offer a complete picture of an athlete's performance. Factors such as body weight, push-off distance (influenced by leg length), and center of mass height (distance from the ground to the greater trochanter with flexed knees) also play key roles, as highlighted by Samozino et al. (2008). These authors proposed a method based on Newton's laws to estimate force, power, and velocity with greater accuracy.

Subsequent studies using force plates (Jiménez-Reyes et al., 2017a) and linear position transducers (Giroux et al., 2014) have confirmed the validity and reliability of Samozino's method. This led to the development of the vertical force-velocity (F-v) profile (Samozino et al., 2012), a practical and reliable tool for field use. It involves performing five vertical jumps with varying loads to assess the balance between an athlete's ability to produce force, velocity, and power. The data are represented on a Cartesian graph, with force on the Y-axis and velocity on the X-axis. The resulting linear relationship enables theoretical determination of maximum force and velocity.

The slope of the graph indicates the athlete's profile: a steeper slope suggests a force-oriented profile with a velocity deficit, while a flatter slope indicates a velocity-oriented profile with a force deficit. This information is essential for tailoring training programs to the individual needs of each athlete.

Although many LL strength training programs have shown positive effects (Díez et al., 2021), the wide variation in loading methods—such as differences in 1RM percentages or use of bodyweight—raises questions about which approaches are most effective for each athlete. The F-v profile offers a solution by helping identify specific individual deficits in force or velocity production.

Therefore, the objective of this study was to systematically review scientific literature to analyze the effects of training programs individualized according to each athlete's vertical F-v profile, specifically on vertical jumping and sprinting performance. Although the F-v profile was originally designed for vertical movements, previous studies have identified a meaningful relationship between jumping and sprinting (Loturco et al., 2015; Loturco et al., 2017), supporting the relevance of examining its effects on both.

Materials and Methods

Protocol and Registration

This study implemented the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) as defined by the EQUATOR Network in 2018, using a pre-established protocol for reviews (Page et al., 2021). The study also optimized basic methodology in the stages of problem formulation, literature search, evaluation, analysis, and presentation of findings to systematize the review process and enhance scientific robustness, following the latest recommendations of the Joanna Briggs Institute (JBI) for scoping reviews (Peters et al., 2020). The aim is to summarize the available literature on the effect of individualized strength training using the vertical force-velocity profile on sprint and jump performance through a mixed analysis of studies. Since this review is not eligible for PROSPERO registration, summarized information and methodology will be made publicly available on Figshare to avoid unnecessary duplications, with the following DOI: https://doi.org/10.6084/m9.figshare.25332145.

Eligibility Criteria

Inclusion criteria for this review include:

- Experimental articles.
- Peer-reviewed articles published between 2010 and 2023.
- Publications written in English.
- Full texts available.
- Articles reporting changes in performance through individualized strength training using the vertical force-velocity profile in sprints and jumps.

Studies that do not correspond to original research (e.g., editorials, notes, dissertations, etc.), that involve populations with underlying pathology, and/or that present methodological limitations will be excluded.

Information Sources

PubMed/MEDLINE, Ebsco and Web of Science were selected for the literature review. Additionally, more articles were manually searched in Google Scholar.

Search Strategy

The search strategy was guided by the PRISMA extension for reporting literature searches in systematic reviews (PRISMA-S) (Rethlefsen et al., 2021). Initially, the PICO framework defined the following question: "Does the Individualization of Strength Training Using the Vertical Force-Velocity Profile Affect Sprint and Jump Performance?"

Table 1. PICO Search Strategy

P	I	C	O
Healthy subjects aged 18 years or older	Clinical studies of 6-8 weeks	Individualized training using the force-velocity profile	Changes in sprint and vertical jump performance

Search algorithms were employed in the selected databases to capture relevant articles for the review. The database searches were conducted during the last week of September 2023. The search algorithms used across all databases included: "force-velocity profile," "velocity-force profile performance," "Force velocity profile AND performance," and "force-velocity profile horizontal performance."

Study Selection and Data Collection Process

Two authors (A.R.J. and S.L.B.) independently searched for articles in the selected databases. Publications meeting the inclusion criteria were selected for further analysis and synthesis phases. A table was designed to report results and compare key findings, including citation/country, study type, study design, participant characteristics, objectives, methodology, results, and conclusions. Discrepancies were identified and re-solved through discussion with a third and fourth author (C.A.G. and D.L.).

Results

After employing search algorithms in the databases (PubMed, Ebsco, and Web of Science), 493 results were obtained. Following an initial filter to eliminate duplicates, 242 potentially eligible articles remained. Evaluating the year, title, and abstracts excluded 225 articles, resulting in 17 studies, of which 10 were excluded due to research design or training programs not meeting criteria. A manual search in Google Scholar found 1 study (Jiménez-Reyes et al., 2019), adding to the 7 studies (Barrera-Domínguez et al., 2023; Escobar Álvarez et al., 2020; Jiménez-Reyes et al., 2017b; Lindberg et al., 2021; Simpson et al., 2021; Zabaloy et al., 2020; Zubčić & Vučetić, 2022) that met all inclusion criteria, resulting in a total of 8 studies. A systematic review was then conducted following PRISMA guidelines, as shown in Figure 1 depicting the literature search flowchart.

Risk of Bias of Included Studies

The risk of bias of included studies was assessed using the modified Cochrane tool RoB-2 for randomized controlled trials (RCTs) (Sterne et al., 2019). The risk of bias analysis was performed independently by two authors (A.R.J. and S.L.B.), and consensus was reached through discussions with the other two authors (C.A.G. and D.L.). The analysis identified that five of the studies exhibited a moderate risk of bias, while three showed a low risk of bias.

Result Tables

The following tables summarize the characteristics of the studies included in this systematic review, detailing the programs and outcomes observed.

Discussion

This systematic review aimed to analyze the effects of individualized strength training based on the vertical force-velocity (F-v) profile on jumping and sprint performance. The findings support the hypothesis that individualized training interventions based on this profile are more effective than generalized programs, particularly for explosive actions such as the countermovement jump (CMJ), squat jump (SJ), and sprinting.

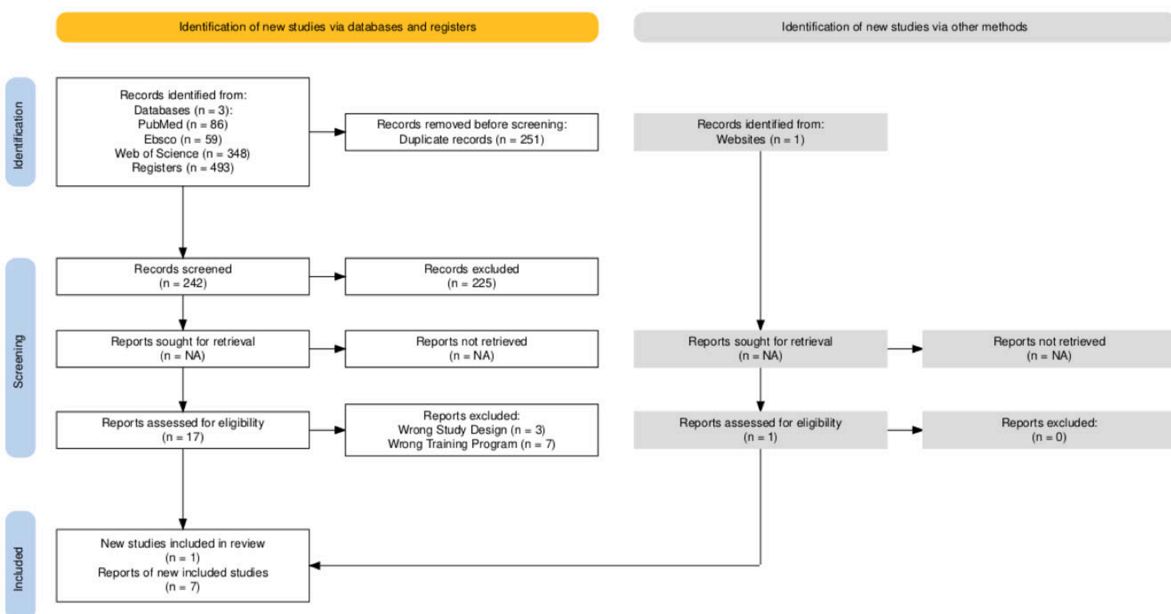

Fig. 1. PRISMA Flow Diagram (Haddaway et al., 2022)

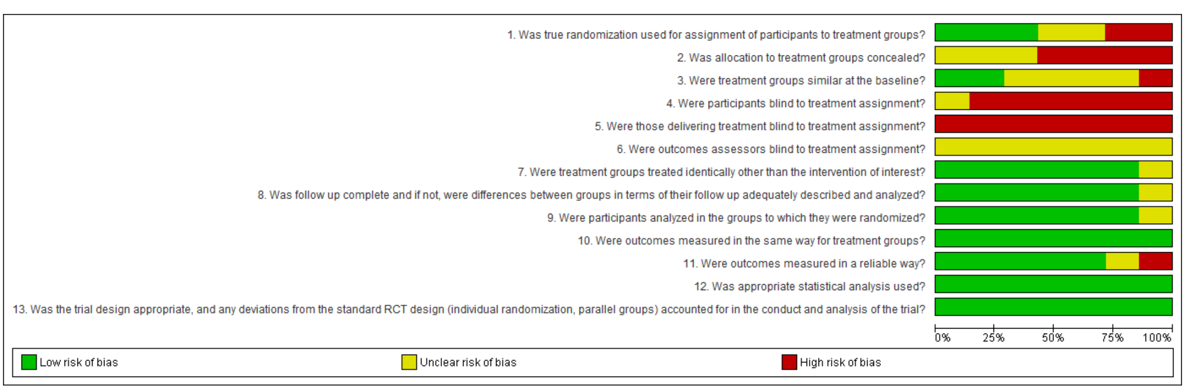

Fig. 2. Risk of Bias Analysis for Selected Studies

Table 2. Summary of Program Characteristics by different studies

Authors	N (M:F)	Age	Exercise (s)	Frequency (days/week)	Intensity (%1RM or VMP $m\cdot s^{-1}$)	Volume (sets x reps)	Duration (weeks)	Analyzed Variable	% Change
Barrera-	30	22,9 ± 6,52	**High Force Deficit**	2			8	F0 (N/kg)	G_{CON}: -0,94
Domínguez	30:0	years	**Program:**						G_{INT}: 16,1
et al, 2023.	G_{CON} (n=15)		Back Squat		0,68-0,51$m\cdot s^{-1}$ 80%-	3 sets with 10% VL		V0 (m/s)	G_{CON}: 13,5
	G_{INT} (n=15)		Deadlift Trap Bar		90%1RM	3 sets with 10% VL			G_{INT}: -18,1
			Single leg CMJ		0,71-0,58 $m\cdot s^{-1}$	3 sets x 4 reps.		P_{max} (W/kg)	G_{CON}: 10,8
			Deadlift Barbell		70%-80%1RM	3 sets with 10% VL		CMJ	G_{INT}: -1,00
			Clean Pull		10%BW	3 sets with 5% VL			G_{CON}: -0,59
			CMJ Trap Bar		0.52-0.39 $m\cdot s^{-1}$	3 sets x 3 reps.		DjuR	G_{INT}: 21,2
			Low Force Deficit		>1,11 $m\cdot s^{-1}$ 80% 1RM				G_{CON}: -6,43
			Program:		80% BW	3 sets with 10% VL		DJuL	G_{INT}: 25,2
			Back squat			3 sets x 3 reps.			G_{CON}: -3,50
			CMJ trap bar			3 sets x 4 reps.		RSI R	G_{INT}: 24,8
			Single leg CMJ		0,68-0.51 $m\cdot s^{-1}$	3 sets with 10% VL			G_{CON}: -12,6
			Deadlift barbell		80%-90%1RM	3 sets with 5% VL		RSI L	G_{INT}: 23,1
			Clean pull		80%BW	3 sets x 4 reps			G_{CON}: -14,4
			Single leg SJ		10%BW			THT R	G_{INT}: 19,1
			Balanced Program:		0.52-0.39 $m\cdot s^{-1}$	3 sets with 10% VL			G_{CON}: -2,88
			Back squat		85%-95%1RM	3 sets x 5 reps.		THT L	G_{INT}: 6,80
			Depth jump		>1.11 $m\cdot s^{-1}$ 80%1RM	3 sets x 4 reps.			G_{CON}: -2,78
			Single leg CMJ		BW	3 sets with 10% VL		Sprint (10m)	G_{INT}: 4,63
			Deadlift trap bar			3 sets x 5 reps.		COD45 R	G_{CON}: 0,09
			Clean pull jump		0,68-0.51 $m\cdot s^{-1}$	3 sets x 5 reps.			G_{INT}: -5,91
			Abalakov Jump		80%-90%1RM			COD45 L	G_{CON}: -1,03
			Low Velocity		30cm BW	3 sets x 3 reps.			G_{INT}: -7,54
			Deficit Program:		10%BW	3 sets x 3 reps.		COD90 R	G_{CON}: -1,57
			Depth jump		0,71-0,58 $m\cdot s^{-1}$	3 sets x 5 reps.			G_{INT}: -5,64
			Single Leg SJ		70%-80%1RM	3 sets x 3 reps.		COD90 L	G_{CON}: 3,51
			Band Assisted CMJ		65% 1RM	3 sets x 3 reps.			G_{INT}: -2,99
			Clean pull jump		BW	3 sets x 5 reps.		COD180 R	G_{CON}: 1,30
			SJ					COD180 L	G_{INT}: -3,00
			Abalakov Jump			3 sets x 5 reps.			G_{CON}: 2,15
			High Velocity		30cm BW	3 sets x 3 reps.			G_{INT}: -5,71
			Deficit Program:		BW	3 sets x 3 reps.			G_{CON}: 1,08
			Band assisted CMJ		<BW	3 sets x 5 reps.			G_{INT}: -5,30
			Box jump		65% 1RM	3 sets x 3 reps.			
			Single leg CMJ		BW	3 sets x 3 reps.			
			Abalakov jump		BW				
			CMJ						
			Clean pull jump						
					<BW				
					30cm BW				
					BW				
					BW				
					BW				
					50% 1RM				
Zubčić &	30	21,97 ± 2,25	Force Program:	2			7	SJ	G_{FOR}: 12,43
Vučetić,	30:0	years	Half Back Squat		0.68-0.59 $m\cdot s^{-1}$ (80% y	4 a 5 sets x 5 reps.			G_{VEL}: 2,02
2022.	Force (n=15)		Velocity Program:		85% 1RM)			SFV%	G_{FOR}: 31,53
	Velocity		Squat Jump			7 a 9 sets x 6 reps.			G_{VEL}: 2,20
	(n=15)				-25%BW			Pmax	G_{FOR}: 2,67
								(W/kg)	G_{VEL}: 16,07
Lindberg et	40	20±4 years	Force Program:	2			10	1 RM Squat	G_{TOW}: 2,9
al, 2021.	40:0		Deadlift, Hip-		1-6 RIR	14 set por semana x			G_{AW}: 4,6
	Tow (n=9)		thrust, Front squat,			3 a 10 reps.		Sprint (10m)	G_{BAL}: 6,5
	Awa (n=20)		Squat, Stiff-leg dead						G_{TOW}: 1,0
	Bal (n=11)		lift, Bulgarian split					Sprint (30m)	G_{AW}: -0,9
			squat, Trap Bar,						G_{BAL}: -1,7
			Calf-raises.		50 a 70% 1RM	4 sets por semana x		SJ	G_{TOW}: 0,9
			Trap bar			5 reps.			G_{AW}: -0,6
								CMJ	G_{BAL}: -0,4
			Balanced Program:		1-6 RIR	13 sets por semana			G_{TOW}: 4,8
			Deadlift, Front			x 3 a 10 reps.		Leg-press	G_{AW}: 3,7
			squat, Bulgarian					power	G_{BAL}: 5,7
			split Squat, Hip		-50% 1RM	15 sets por semana		SJ-RFD max	G_{TOW}: 4,3
			thrust.			x 5 a 10 reps.			G_{AW}: 3,1

Table 2 (continued)

Authors	N (M:F)	Age	Exercise (s)	Frequency (days/week)	Intensity (%1RM or VMP m·s⁻¹)	Volume (sets x reps)	Duration (weeks)	Analyzed Variable	% Change
			Box jumps, Stair jumps, Single leg stair jumps, Squat jump w/rubber band, Stair jumps, Trap bar jumps Velocity Program: Half squat, Hip thrust. Squat jumps, Trapbar jumps, Step up, Squat jump w/rubber band, Countermovement jumps, Box jumps, Clean pull, Stair jumps, Single leg stair jumps.		1-2 RIR -50% 1RM	6 sets por semana x 3 a 8 reps. 22 sets pos semana x 5 a 10 reps.			G_{BAL}: 5,7 G_{TOW}: 6,7 G_{AW}: 4,2 G_{BAL}: 2,9 G_{TOW}: -9,3 G_{AW}: -7,3 G_{BAL}: 8,4
Simpson et al, 2021.	29 29:0 Con (n=14) Int (n=15)	24±3 years	High Force Deficit Program: Squat Box squat Trapbar deadlift Clean pull Squat jump Jump shrug Low Force Deficit Program: Squat Box squat Clean pull Squat jump Jump shrug Squat jump Balanced Program: Squat Clean pull Jump shrug Squat jump CMJ Depth jump Low Velocity Deficit Program: Jump shrug Squat jump CMJ Deph jump Accelerated band jump High Deficit Velocity Program: Jump shrug CMJ Squat jump CMJ Deph jump Accelerated band jump	2	> 80% 1 RM > 80% 1 RM > 80% 1 RM 80, 70, y 65 % 1 RM > 80% > 80% 1 RM 80% 1 RM 70% 1 RM 20-30-65 % 1 RM > 80% 1 RM 80% 1 RM 65% 1 RM 20-30% 1RM 1 RM BW y 10% BW 65% 1 RM 20-30% 1 RM BW <BW-BW 65% 1 RM 10% BW BW BW BW <BW	3 sets x 3 a 8 reps.	8	SJ Sprint (10m) Sprint (20m) F0 (N/kg) V0 (m/s) SFV% 3 RM Pmax	G_{CON}: 2,33 G_{INT}: 6,98 G_{CON}: -1,74 G_{INT}: -1,75 G_{CON}: -1,26 G_{INT}: -1,27 G_{CON}: -0,09 G_{INT}: 0,81 G_{CON}: 9,39 G_{INT}: 2,90 G_{CON}: -6,35 G_{INT}: -4,80 G_{CON}: -0,09 G_{INT}: 0,81 G_{CON}: 2,86 G_{INT}: 8,57
Escobar Álvarez et al, 2020.	46 0:46 Con (n=10) GINT (n=36) [GLFD n=16 GHFD n=20]	18±9 years	High Force Deficit Program: Leg press Deadlift SJ Back squat	2	90% 1 RM 90% 1 RM 80% BW 80% 1 RM	3 sets x 6 reps. 3 sets x 6 reps. 3 sets x 6 reps. 3 sets x 6 reps.	9	CMJ F0 (N/kg) V0 (m/s) SFV%	G_{CON}: 0,73 G_{INT}: 12,54 G_{CON}: 0,004 G_{INT}: 0,19 G_{CON}: 0,02 G_{INT}: -0,25

Table 2 (continued)

Authors	N (M:F)	Age	Exercise (s)	Frequency (days/week)	Intensity (%1RM or VMP m·s⁻¹)	Volume (sets x reps)	Duration (weeks)	Analyzed Variable	% Change
			CMJ		85% BW	3 sets x 6 reps.			G_{CON}: 0,004
			Single leg CMJ		10%BW	3 sets x 6 reps.		Pmax	G_{INT}: -0,76
			Low Force Deficit						G_{CON}: 0,04
			Program:			3 sets x 6 reps.			G_{INT}: 0,00
			Leg press		90% 1RM	3 sets x 6 reps.			
			SJ		80% 1RM	3 sets x 6 reps.			
			Single leg CMJ		10% BW	3 sets x 6 reps.			
			Back squat		80% 1RM	3 sets x 6 reps.			
			CMJ		85%BW	3 sets x 6 reps.			
			Single leg SJ		BW				
Zabaloy et	34	$G_{VElOCITY1}$:	Velocity Deficit	2	40%-60% 1RM	2 a 4 sets x 2 a 6	7	F0 (N/kg)	G_{VEL}: -0,16
al 2020.	34:0	21,5 ± 4	Program:		40%-60% BW	reps.			G_{FOR}: 0,10
	$G_{VELOCITY}$ (n=6)	years	Squat		BW	2 a 4 sets x 2 a 6		V0 (m/s)	G_{BAL}: 0,03
	G_{FORCE} (n=11)	G_{FORCE}: 23,7	SJ			reps.			G_{CON}: -0,01
	$G_{BALANCED}$	± 3 years	Sprint		75%-85% 1RM	3 a 6 sets x 10 a 30m			G_{VEL}: 0,17
	(n=9)	$G_{BALANCED}$:	Force Deficit		75%-85% BW			SFV%	G_{FOR}: -0,17
	G_{CON} (n=7)	22 ± 4 years	Program:		BW	2 a 4 sets x 2 a 6			G_{BAL}: -0,06
		G_{CON}: 21,4 ±	Squat			reps.			G_{CON}: 0,01
		3 years	SJ		60%-75% 1RM	2 a 4 sets x 2 a 6		Pmax	G_{VEL}: -0,40
			Sprint		60%-75% BW	reps.			G_{FOR}: 0,21
			Balanced Program:		BW	3 a 6 sets x 10 a 30m			G_{BAL}: 0,02
			Squat					CMJ	G_{CON}: 0,00
			SJ			2 a 4 sets x 2 a 6			G_{VEL}: 0,04
			Sprint			reps.			G_{FOR}: -0,06
						2 a 4 sets x 2 a 6		SJ	G_{BAL}: -0,03
						reps.			G_{CON}: -0,004
						3 a 6 sets x 10 a 30m			G_{VEL}: -0,016
								Sprint (5m)	G_{FOR}: 0,010
									G_{BAL}: 0,02
								Sprint (10m)	G_{CON}: -0,01
									G_{VEL}: 0,05
								Sprint (20m)	G_{FOR}: -0,02
									G_{BAL}: -0,03
								Sprint (30m)	G_{CON}: -0,002
									G_{VEL}: -0,02
									G_{FOR}: -0,01
									G_{BAL}: -0,02
									G_{CON}: -0,02
									G_{VEL}: -0,02
									G_{FOR}: -0,01
									G_{BAL}: -0,03
									G_{CON}: -0,006
									G_{VEL}: -0,01
									G_{FOR}: -0,01
									G_{BAL}: -0,02
									G_{CON}: -0,003
									G_{VEL}: -0,01
									G_{FOR}: -0,01
									G_{BAL}: -0,01
									G_{CON}: -0,007
Jiménez-	60	23,1±4	Strength				12,6	F0 (N/kg)	G_{FOR}: 30,3
Reyes et al,	60:0	years	Back squat			3 a 6 sets x 2 a 6		V0 (m/s)	G_{VEL}: -6,77
2019.	GVELOCITY		Leg press			reps			G_{FOR}: -21,4
	(n=24)		Deadlift					SFV%	G_{VEL}: 15,8
	GFORCE		Strength-power						G_{FOR}: 74,3
	(n=36)		Clean pull					Pmax	G_{VEL}: -19,2
	GBALANCED		Deadlift			3 a 6 sets x 2 a 6			G_{FOR}: 0,44
	(n=6)		SJ			reps		SJ	G_{VEL}: 7,79
	GNON (n=18)		CMJ						G_{FOR}: 12,5
	GCON (n=20)		Power			3 a 6 sets x 2 a 6			G_{VEL}: 10,1
			SJ			reps			
			CMJ						
			Single leg SJ						
			Single leg CMJ						
			Clean pull jump			3 a 6 sets x 2 a 6			
			Power-speed			reps			
						3 a 6 sets x 2 a 6			
						reps			

Table 2 (continued)

Authors	N (M:F)	Age	Exercise (s)	Frequency (days/week)	Intensity (%1RM or VMP m·s⁻¹)	Volume (sets x reps)	Duration (weeks)	Analyzed Variable	% Change
			Depth jumps SJ CMJ Maximal vertical box jump Speed Maximal roller push off CMJ with arms High Force Deficit Program: 3 Strength 2 Strength-power 1 Power Low Force Deficit Program: 2 Strength 2 Strength-power 2 Power Balanced Program: 1 Strength 1 Strength-power 2 Power 1 Power-speed 1 Speed Low Velocity Deficit Program: 2 Speed 2 Power-speed 2 Power High Velocity Deficit Program: 3 Speed 2 Power-speed 1 Power						
Jiménez-Reyes et al, 2017.	84 84:0 GVELOCITY (n=18) GFORCE (n=22) GBALANCED (n=6) GNON (n=18) GCON (n=20)	23,1±4 years	Strength Back squat Leg press Deadlift Strength-power Clean pull Deadlift SJ CMJ Power SJ CMJ Single leg SJ Single leg CMJ Clean pull jump Power-speed Depth jumps SJ CMJ Maximal vertical box jump Speed Maximal roller push off CMJ with arms High Force Deficit Program: 3 Strength 2 Strength-power 1 Power Low Force Deficit Program: 2 Strength 2 Strength-power 2 Power			3 a 6 sets x 2 a 6 reps 3 a 6 sets x 2 a 6 reps 3 a 6 sets x 2 a 6 reps 3 a 6 sets x 2 a 6 reps 3 a 6 sets x 2 a 6 reps	9	F0 (N/kg) V0 (m/s) SFV% Pmax SJ	G_{FOR}: 24,0 G_{VEL}: -6,16 G_{BAL}: 1,76 GNON: -2,32 G_{CON}: 0,21 G_{VEL}: -18,9 G_{FOR}: 17,9 G_{BAL}: 3,70 GNON: 5,57 G_{CON}: 0,21 G_{VEL}: 57,9 G_{FOR}: -20,1 G_{BAL}: -0,50 GNON: -5,54 G_{CON}: 1,91 G_{VEL}: -0,40 G_{FOR}: 10,5 G_{BAL}: 5,53 GNON: 2,42 G_{CON}: 0,61 G_{VEL}: 14,2 G_{FOR}: 12,7 G_{BAL}: 7,22 GNON: 2,33 G_{CON}: -1,43

Table 2 (continued)

Authors	N (M:F)	Age	Exercise (s)	Frequency (days/week)	Intensity (%1RM or VMP m·s⁻¹)	Volume (sets x reps)	Duration (weeks)	Analyzed Variable	% Change
			Balanced Program: 1 Strength 1 Strength-power 2 Power 1 Power-speed 1 Speed Low Velocity Deficit Program: 2 Speed 2 Power-speed 2 Power High Velocity Deficit Program: 3 Speed 2 Power-speed 1 Power						

Note: The following abbreviations and symbols are used throughout Table 2:
Intervention Groups:
GCON = Control group; GINT = Intervention group; GFOR / GFORCE = Force-oriented group; GVEL / GVELOCITY = Velocity-oriented group; GBAL / GBALANCED = Balanced group; GNON = Non-optimized training group; GTOW / GAW = Group Tow / Group Away.
Exercises and Programs:
SJ = Squat Jump; CMJ = Countermovement Jump; DJuR / DJuL = Drop Jump Right / Left; RSI R / L = Reactive Strength Index Right / Left; THT R / L = Triple Hop Test Right / Left; SJ-RFD max = Maximum Rate of Force Development in Squat Jump; Clean Pull = High pull from floor; Jump Shrug = Explosive pull with shoulder shrug; Depth Jump = Jump from elevated platform; Box Jump = Jump onto a box; Band Assisted Jump = Jump with elastic band assistance.
Mechanical Variables:
F_0 (N/kg) = Maximum theoretical force (relative to body mass); V_0 (m/s) = Maximum theoretical velocity; Pmax (W/kg) = Maximum power (relative to body mass); SFV% = Slope of the force-velocity profile; 1RM = One-repetition maximum; BW = Body weight; <BW = Load less than body weight; VL = Velocity loss during exercise; VMP ($m·s^{-1}$) = Mean propulsive velocity.
Sprint and Change of Direction Tests:
Sprint (5m, 10m, 20m, 30m) = Sprint tests over designated distances; COD45 / COD90 / COD180 = Change of direction at 45°, 90°, and 180°.
Volume and Intensity:
Sets × Reps = Number of sets and repetitions; RIR = Repetitions in reserve.

Across the eight included studies, five reported significant improvements in both CMJ and SJ, and three reported enhancements in sprint performance. These findings align with the theoretical foundation of the F-v profile proposed by Samozino et al. (2012), which emphasizes the importance of tailoring training loads to address individual force or velocity deficits. In studies by Barrera-Domínguez et al. (2023) and Zabaloy et al. (2020), individualized interventions produced greater improvements compared to non-optimized or control groups. This supports the rationale for individualized programming in athletic development.

The predominance of strength deficits in the evaluated populations is notable. This suggests that, in adult athletes—even those engaged in regular sport practice—maximum force output is often a limiting factor in vertical or horizontal explosive performance. It may reflect a broader tendency in sports environments to prioritize technical or tactical training over maximal strength development (Jiménez-Reyes et al., 2017). Consequently, the individualized F-v approach offers a corrective strategy by directing training efforts toward the athlete's specific imbalance.

However, the results were not uniformly positive across all studies or outcome variables. For example, in Barrera-Domínguez et al. (2023), although the program was based on F-v profiling, no improvements were observed in maximum power output (Pmax); yet, the reduction in performance was smaller than in the control group. This may suggest that while the F-v approach minimizes performance decline during intense training periods, it does not guarantee improvement unless programming variables—such as intensity, exercise selection, and progression—are optimized.

Interestingly, some studies (e.g., Simpson et al., 2021) reported partial improvements depending on the deficit group, indicating that the effectiveness of individualized training may vary based on the accuracy of deficit diagnosis or the athletes' baseline characteristics. It is possible that in populations with minimal imbalance or already well-developed strength/power capacities, the marginal gains of optimization are reduced. Conversely, those with more pronounced imbalances may benefit more from individualized plans.

The duration and structure of the interventions also deserve discussion. While all studies included at least two weekly training sessions, the total length ranged from 7 to 12.6 weeks. Shorter interventions may not allow enough time to resolve neuromuscular deficits, particularly in strength-oriented programs. Longer or auto-regulated protocols, such as in Jiménez-Reyes et al. (2019), where training ended when profiles became balanced, may be more effective and athlete-friendly.

Exercise selection varied across studies. Although all included squats and vertical jumps, only one study (Jiménez-Reyes et al., 2019) strictly adhered to the original categorization of exercises proposed by Jiménez-Reyes et al. (2017): strength, strength-power, power, power-speed, and speed. Most deviations involved combining exercise types or modifying set/rep schemes. This raises the question of how much deviation from the original model affects outcomes, and whether hybrid or context-adapted versions of the F-v framework might be equally effective under certain conditions.

Regarding sprint performance, positive outcomes were reported in three of the four studies measuring it. This supports the association between vertical power and horizontal speed described in previous research (Loturco et al., 2015; 2017). However, one study (Jiménez-Reyes et al., 2019) showed improvements that were not superior to the optimized group, suggesting that sprint-specific adaptations may depend on more than vertical F-v training alone, possibly requiring additional horizontal force development or technical sprint work.

In summary, the current evidence confirms that the vertical F-v profile is a useful tool for individualizing training in athletes. While not all interventions led to performance improvements, the general trend supports its application for enhancing vertical and horizontal explosive tasks. Nevertheless, methodological heterogeneity, varying training compliance, and population differences limit the generalizability of the results. Future studies should compare individualized F-v training against other individualized methods and consider combining vertical and horizontal profiling for a more complete picture of athletic needs.

Conclusion

The study concluded that strength training programs optimized according to the vertical F-v profile produced significant and superior improvements in vertical jump and sprint performance compared to non-optimized programs. Individualization of training based on the F-v profile proved to be an effective strategy for enhancing performance in explosive activities such as jumping and sprinting.

Practical Applications

The application of the F-v profile in strength training programs provides a framework for more effective and individualized athlete development. Coaches and trainers can utilize this tool to identify specific deficits in force or velocity and tailor training programs accordingly. This approach not only optimizes performance gains but also minimizes the risk of injury by addressing individual weaknesses. The integration of F-v profiling into regular training assessments can lead to more strategic and informed training decisions, ultimately enhancing athletic performance.

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Індивідуалізація силового тренування із використанням профілю вертикальної сили-швидкості у вертикальному стрибку та його вплив на спортивну результативність: Систематичний огляд

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 11 с., 2 табл., 2 рис., 24 джерела.

Історія питання. Індивідуалізація силових тренувань є перспективною стратегією для підвищення результативності під час виконанні швидкісних дій, як-от стрибки та спринт. Профіль вертикальної сили-швидкості (F-v) дозволяє виявити індивідуальні дисбаланси між силою та швидкістю у вертикальних стрибках.

Мета дослідження. Цей систематичний огляд мав на меті проаналізувати вплив індивідуалізованих програм силових тренувань, розроблених на основі вертикального профілю F-v, на результативність стрибків та спринту.

Матеріали та методи. Проведено комплексний пошук у наукометричних базах даних згідно з рекомендаціями PRISMA, під час якого було проаналізовано вісім досліджень, які відповідали критеріям включення. У дослідженні взяли участь 353 особи віком старше 18 років, включаючи спортсменів, студентів та професійних танцюристів. Протоколи тренувань передбачали проведення двох щотижневих занять протягом періоду від 7 до 12 тижнів із використанням таких вправ, як присідання та вертикальні стрибки, адаптованих до індивідуального профілю F-v кожної особи.

Результати. Основні результати показали значне поліпшення результативності у стрибках з контррухом (КРС), стрибках із присіду (ПС) та спринті, причому більші досягнення спостерігалися в групах, які отримували оптимізоване тренування на основі профілю F-v. Отримані дані відповідали результатам попередніх досліджень, які підкреслюють ефективність застосування профілю F-v для планування більш конкретних і дієвих програм тренувань. Однак між дослідженнями встановлено методологічні відмінності, зокрема у виборі вправ та обсязі тренувань.

Висновки. Зроблено висновок про ефективність проведення індивідуалізованого тренування на основі вертикального профілю сили-швидкості щодо підвищення результативності в дисциплінах, що вимагають вибухових дій. Зазначений інструмент дозволяє скласти оптимізовану програму силового тренування.

Ключові слова: сила-швидкість, індивідуалізація, результативність стрибків, спринт, силові тренування.

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