I Congreso de Monitores de Fútbol Base ACGFútbol

Santiago de Compostela 22 de diciembre

Las fases sensibles del entrenamiento en el fútbol base

Ezequiel Rey





Etapas Sensibles: margen de tiempo durante el cual el aprendizaje de una habilidad o el desarrollo de una capacidad es particularmente efectivo (Gallahue & Donnelly, 2003).

Figure 10: The Sensitive Periods of Accelerated Adaptation to Training (Balyi and Way, 2005)



During the sensitive periods the windows of trainability are fully open. Outside of the sensitive periods the windows are still open, though only partially.

Todas las capacidades son entrenables a todas edades, sin embargo los mecanismos responsables de las adaptaciones alcanzadas difieren en función del estado madurativo (Lloyd et al., 2015).

Lloyd, R. S., Oliver, J. L., Faigenbaum, A. D., Howard, R., De Ste Croix, M. B. A., Williams, C. A., et al. (2015). Long-term athletic development- part 1: a pathway for all youth. *Journal of Strength and Conditioning Research*, 29(5), 1439–1450.

Especialización

Temprana

Tardía









EDAD CRONOLÓGICA





HMB Técnica Flexibilidad Velocidad



Canadian Sport For Life

BOYS PEAK STRENGTH VELOCITY GROWTH SPURT 6 HEIGHT (cm/yr) ONSET OF GROWTH SPURT 0 16 18 4 10 14 AGE PENIS TESTES

PUBIC HAIR



Age under 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20+

ACA





EDAD RELATIVA

 Table II. Birth-date distributions of the U 15, U 16, U 17 and U-18 selections per country.

 Month of birth

 1
 2
 3
 4
 5
 6
 7
 8
 9
 10
 11
 12
 Ko

Team	1	2	3	4	5	6	7	8	9	10	11	12	Kolmogorov- Smirnov test
Belgium	15	10	12	13	9	10	9	6	5	3	3	4	P < 0.01
	N =	37 (37.	37%)							N =	10 (10.	10%)	
Denmark	14	10	9	4	15	10	7	7	6	6	0	2	P < 0.01
	N =	33 (36.	67%)							N =	= 8 (8.8)	9%)	
England	21	15	11	5	5	3	4	6	8	8	5	3	P < 0.01
	N =	47 (50.	00%)							N =	16 (17.	02%)	
France ^a	9	3	6	5	5	3	4	0	0	4	1	1	P < 0.01
	N =	18 (43.	90%)							N =	6 (14.6	53%)	
Germany	18	17	17	6	13	7	9	7	5	2	2	0	P < 0.01
	N =	52 (50.	49%)							N =	= 4 (3.8	9%)	
Italy	14	12	10	7	6	5	6	9	5	1	0	2	P < 0.01
	N =	36 (46.	75%)							N =	= 3 (3.9	0%)	
The Netherlands	14	15	11	6	8	7	1	12	14	6	5	2	P < 0.05
	N =	14 (36.	84%)							N =	6 (15.7	79%)	
Portugal	8	15	10	13	9	3	1	5	3	2	3	0	P < 0.01
	N =	33 (45.	83%)							N =	= 5 (6.9	4%)	
Spain ^a	8	4	6	11	7	4	4	1	0	2	2	1	P < 0.01
	N =	18 (36.	00%)							N =	5 (10.0	0%)	
Sweden ^a	6	8	3	5	3	3	1	3	3	1	0	0	P < 0.05
	N =	17 (47.	22%)							N =	= 1 (2.7)	8%)	
TOTAL	N =	331 (43	.38%)							N =	71 (9.3	81%)	P < 0.01

Helsen, W. F., van Winckel, J., & Williams, A. M. (2005). The relative age effect in youth soccer across Europe. *Journal of Sports Sciences*, *23*(6), 629–636.

EDAD DE ENTRENAMIENTO



Helsen, W. F., van Winckel, J., & Williams, A. M. (2005). The relative age effect in youth soccer across Europe. *Journal of Sports Sciences*, *23*(6), 629–636.

10.000 horas o 10 años

			Men's Sports			
	Basketball	Football	Baseball	Ice Hockey	Soccer	Women's Basketball
High school athletes						
Total	549,500	983,600	455,300	29,900	321,400	456,900
Seniors	157,000	281,000	130,100	8500	91,800	130,500
College freshman athletes	4500	16,200	7300	1100	5200	4100
High school to college, %	2.9	5.8	5.6	12.9	5.7	3.1
College athletes						
Total	15,700	56,500	25,700	3700	18,200	14,400
Seniors	3500	12,600	5700	800	4100	3200
Athletes drafted	44	250	600	33	76	32
College to professional, %	1.3	2.0	10.5	4.1	1.9	1.0
High school to professional, %	0.03	0.09	0.46	0.39	0.08	0.02

TABLE 2. Estimated percentages of athletes moving from high school to college, high school to professional, and college to professional in several sports in the United States.^a

^{*a*}Adapted from the National Collegiate Athletic Association (47), percentages are based on estimated data and thus are approximations. Estimates for the professional level are based on athletes drafted; there is no guarantee that they qualified for the playing roster.



Hornig, M., Aust, F., & Güllich, A. (2014). Practice and play in the development of German top-level professional football players. *European Journal of Sport Science*, 1–10. http://doi.org/10.1080/17461391.2014.982204

Table II. The number of other sports engaged in and the number of players who engaged in them during childhood and adolescence in each country.

	Childho	od	Adolescence						
	No of other sports	No. of players	No. of other sports	No. of players					
Brazil	1.40 ± 0.69	45	1.32 ± 0.67	19					
England	4.40 ± 1.55	43	4.16 ± 1.70	43					
France	1.72 ± 1.27	18	2 ± 0	2					
Ghana	1.91 ± 1.13	23	1.72 ± 0.90	18					
Mexico	1.73 ± 1.47	30	2.25 ± 1.77	12					
Portugal	1.66 ± 0.72	29	1.33 ± 0.71	9					
Sweden	2.54 ± 1.61	41	1.86 ± 1.22	29					
Combined	$2.32~\pm~1.63$	229	$2.52~\pm~1.76$	132					

Table III. The type of other sports engaged in and the number of players who engaged in them.

Type of sport	No. of players
Athletics	80
Swimming	62
Basketball	44
Table tennis	37
Tennis	33
Handball	32
Volleyball	28
Judo/karate	29
Golf	28
Snooker/pool	23
Cycling	22



Ford, P. R., Carling, C., Garces, M., Marques, M., Miguel, C., Farrant, A., et al. (2012). The developmental activities of elite soccer players aged under-16 years from Brazil, England, France, Ghana, Mexico, Portugal and Sweden. *Journal of Sports Sciences*, 1–11. http://doi.org/10.1080/02640414.2012.701762

Odds Ratio vs Exposure Hours Per Week



Approximate Exposure Hours Per Week

Figure 1. Relationship of injury to exposure hours in high school athletes.⁴¹

Jayanthi, N., Pinkham, C., Dugas, L., Patrick, B., & LaBella, C. (2013). Sports Specialization in Young Athletes: Evidence-Based Recommendations. *Sports Health: a Multidisciplinary Approach*, *5*(3), 251–257. http://doi.org/10.1177/1941738112464626

Conclusion

Combining moderate volumes of organised childhood soccer practice/training with variable engagement in non-organised soccer play and organised practice/training in diverse sports was associated with greater improvement of skilled matchplay performance in German youth elite players.

Operation of the second state of the second

Güllich, A., Kovar, P., Zart, S., & Reimann, A. (2016). Sport activities differentiating match-play improvement in elite youth footballers – a 2-year longitudinal study. *Journal of Sports Sciences*, 1–9. http://doi.org/10.1080/02640414.2016.1161206



Las curvas de crecimiento del desarrollo de la cabeza/encéfalo y del cuerpo en general tienen un transcurso muy diferente.

 El encéfalo a los 6 años alcanza el 90-95 % del tamaño adulto.

FIGURE 8.2

Growth of three different organ systems and tissues contrasted with the body's general growth. Growth is plotted in terms of percentage of change from birth to 20 years. Note that the growth of lymph tissue rises to nearly twice its adult level by the end of childhood. Then it declines. (Reprinted by permission of the publisher from J. M. Tanner, 1990, *Foetus into Man,* 2nd ed., Cambridge, MA: Harvard University Press, p. 16. Copyright © 1990 by J. M. Tanner. All rights reserved.)



Las células nerviosas del SNC experimentan ya en el transcurso de los primeros años de vida una reticulación creciente. Esta germinación de nuevas fibras es especialmente intensa hasta el tercer año de vida



Helsen, W. F., van Winckel, J., & Williams, A. M. (2005). The relative age effect in youth soccer across Europe. *Journal of Sports Sciences*, 23(6), 629–636.

				YOU	ТН РІ	HYSIC	AL DI	EVELO	OPME	NT (Y	'PD) N	/ODE	l fof	R MAI	.ES					
CHRONOLOGICAL AGE (YEARS)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21+
AGE PERIODS	сні		OD		м	IDDLE	сни	DHO	OD					ADO	LESC	ENCE				ADULTHOOD
GROWTH RATE	RAPI	D GRC	WTH	~	>	STEAD	DY GR	owti	Η ◀	\leftrightarrow	AD	OLESC	ENT S	PURT	4	→	DECL	INE IN	I GRO	WTH RATE
MATURATIONAL STATUS						YEAR	S PRI	E-PHV	′ <	-		_	PHV	-			→	YEAR	S POS	ST-PHV
TRAINING ADAPTATION	PREI	ооми	NANT	LY NE	URAL	(AGE-	RELAT	ED)	~	→	COM	BINA	ION	OF NE	URAL	AND I	HORM	IONAL	. (MAT	URITY-RELATED)
	F	FMS	5		FN	٨S			FMS							FN	٨S			
		SSS			S	SSS			SSS			SSS								
	N	1obili	ty			м	obil	ity			Mobility									
	,	Agility	/			Α	gili	ty			Agility						Agility			
PHYSICAL QUALITIES	:	Speed	i			S	pee	ed			Speed Speed						d			
	1	Powe	r			Ρ	ow	er			Power							Ρ	owe	er
	Str	en	gth			Str	en	gth				Str	en	gth				Str	eng	gth
					Hyper	trophy					Hyper	trophy		Н	ype	ertr	opł	ıy		Hypertrophy
	Endu	rance	& MC			E	ndurar	nce & M	ис				Endu	irance	& MC			Endu	uran	ce & MC
TRAINING STRUCTURE	UN	ISTRU	CTUF	ED LOW STRUCTURE MODE							MODERATE STRUCTURE HIGH STRUCTURE VERY HIGH STRUCTURE						SH STRUCTURE			

			,	YOUT	Н РН	YSICA	L DE\	/ELOF	PMEN	T (YP	D) M	ODEL	FOR	FEMA	LES					
CHRONOLOGICAL AGE (YEARS)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21+
AGE PERIODS	СНІ	EARL	Y DOD	м	DDLE	CHIL	DHO	OD				A	DOLE	SCEN	CE				A	DULTHOOD
GROWTH RATE	RAPI	D GR	оwтн	←	→ s	TEAD	y gro	оwтн	←	→	ADOL	ESCEN	IT SPL	JRT	←	▶ □	ECLIN	e in g	ROW	TH RATE
MATURATIONAL STATUS				YEAR	S PRE	-PHV					PHV	-			→	YEAR	S PO	ST-PH	v	
TRAINING ADAPTATION	PRE	PREDOMINANTLY NEURAL (AGE-RELATED)										JRITY-RELATED)								
	FMS FMS FMS																			
			SSS SSS																	
	N	lobil	ity		м	obil	ity		Mobility											
		Agilit	ÿ		Α	gili	ty			l)	Agi	lity	'		Agility					
PHYSICAL QUALITIES		Spee	d		S	pee	d				Spe	eed						Spe	eed	
	1	Powe	r		P	ow	er				Ρον	ver	•					Ρον	ver	
	Str	rength Strength Strength Strength								h										
				Hyper	trophy				Hyper	trophy			Hy	per	tro	phy	'		ŀ	lypertrophy
	Endu	rance	& MC		Er	nduran	ce & N	ис				Endu	irance	& MC				Endu	ıran	ce & MC
TRAINING STRUCTURE	UN	STRU	JCTUF	CTURED LOW STRUCTURE MODERATE STRUCTURE HIGH STRUCTURE VERY HIGH STRUCTUR									SH STRUCTURE							

				YOU	тн рн	IYSIC	AL DE	EVELC	OPME	NT (Y	PD)	MODE	l for	MAL	.ES							
CHRONOLOGICAL AGE (YEARS)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21+		
AGE PERIODS	сні	EARL LDH(Y DOD		М	IDDLE	СНІ	.DHO	OD					ADO	LESC	ENCE				ADULTHOOD		
GROWTH RATE	RAPI	D GR	оwтн	~	> '	STEAD	Y GR	OWT	- ▲	\leftrightarrow		OLESC	ENT S	PURT	4	→	DECL	INE IN	I GRO	WTH RATE		
MATURATIONAL STATUS						YEAR	S PRE	E-PHV	′ ◄	(РΗV	-			→	YEAR	S PO	ST-PHV		
TRAINING ADAPTATION	PREI	оомі	NANT	LY NEI	JRAL	(AGE-	RELAT	ED)	<	→	cor	ABINA	TION	OF NE	URAL	AND I	HORM	IONAL	. (MA	(URITY-RELATED)		
	F	-M	S		FN	٨S			FMS							FN	٨S					
		SSS		SSS SSS						SSS												
	Mobility															Mobility Mobility						
	N	1obili	ity			М	obil	ity								Mol	oility					
	N	1obili Agilit	ity Y			M A	obil gili	ity ty				Α	gili	ty		Mol	oility	A	gilit	:y		
PHYSICAL QUALITIES		1obili Agilit Spee	ity Y d			M A S	obil gili pee	ity ty ed				A	gili pee	ty ed		Mol	oility	A	gilit pee	ty d		
PHYSICAL QUALITIES		1obili Agilit Spee Powe	ity y d			M A S P	obil gili pee owe	^{ity} ty ed er				A S P	gili pee ow	ty ed er		Mol	bility	A S P(gilit pee OW	ty d e r		
PHYSICAL QUALITIES	× Str	1obili Agilit Spee Powe	ity y d er g th			M A S P Str	obil gili pee owe	ity ty ed er gth				A S P Sti	gili pee ow ren	ty ed er gth		Mol	oility	A S P(Str	gilit pee ow	ay d er gth		
PHYSICAL QUALITIES	× Str	1obili Agilit Spee Powe	ity y d er gth		Hyper	M A S P Str	obil gili pee owe	ity ty ed er gth			Нуре	A S P Sti	gili pee owo ren;	ty ed er gth H	уре		opł	A S P Str	gilit pee ow en	ty d er gth Hypertrophy		
PHYSICAL QUALITIES	N Str Endu	1obili Agilit Spee Powe Cen	ity y d er gth & MC		Hyper	M A S(P(Str trophy Er	obil gili pee owo eng	ity ty ed er gth	ис		Нуре	A S P Sti	gili pee owo ren; Endu	ty ed er gth H	уре & мс	ertr	oility opł	A S P Str Ny Endu	gilit pee ow en	ty d er gth Hypertrophy ce & MC		



Agility



Balance



Co-ordination



Speed



Jumping



Climbing



Walking



Skating



Hopping



Swimming



Skipping



Balance



Throwing



Dribbling



Kicking



Throwing



Hitting



Catching

HMB y HM específicas













	Sports														
Skill Themes	Aerobics	Basketball	Football	Dance	Golf	Hockey	Martial Arts	Rock Climbing	Soccer	Softball	Tennis	Track and Field	Tumbling	Ultimate Frisbee	Volleyball
Traveling	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Chasing, fleeing, dodging		\times	×			×	\times		×	×				×	
Jumping, landing	×	\times	\times	\times			\times	×	X	×	\times	\times	\times	\times	X
Balancing	×	\times	\times	\times	\times	\times	\times	×	X	×	\times	\times	\times	\times	X
Transferring weight	×	\times	\times	\times	\times	\times	\times	×	X	×	\times	\times	\times	\times	X
Rolling			\times	\times			\times						\times		X
Kicking	×		\times	\times			\times		×						
Punting			\times						×						
Throwing		\times	\times						×	×	×	\times		\times	\times
Catching		\times	\times						X	×				×	
Volleying									×						\times
Dribbling		×				\times			×						
Striking with rackets											×				
Striking with golf clubs					×										
Striking with bats										×					
Striking with hockey sticks						×									

Table 3.1 Skill Themes Used in Sports*

*This table is intended only to suggest how various skill themes are applied in sports contexts.



				YOU	ТН РІ	HYSIC	AL DI	EVELC	OPME	NT (Y	PD) N	NODE	L FOF	MAI	.ES					
CHRONOLOGICAL AGE (YEARS)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21+
AGE PERIODS	сні	EARL	Y DOD		м	IDDLE	сни	DHO	OD					ADO	LESC	ENCE				ADULTHOOD
GROWTH RATE	RAPI	D GRO	оwтн	~	>	STEAD	OY GR	OWT	- ▲	\leftrightarrow	AD	OLESC	ENT S	PURT	4	→	DECL	INE IN	I GRO	WTH RATE
MATURATIONAL STATUS						YEAR	S PRI	E-PHV	′ ◄	(PHV	-			→	YEAR	S PO	ST-PHV
TRAINING ADAPTATION	PREI	оомі	NANT	LY NE	URAL	(AGE-	RELAT	ED)	<	>	COM	IBINA	TION	OF NE	URAL	AND I	HORM	IONAL	. (MAT	URITY-RELATED)
	1	FM:	S		FN	٨S			FMS							F	vis			
		555				sss SSS					SSS									
	N	1obili	ty	Mobility											Mol	bility				
		Agilit	У			Α	gili	ty			Agility					Agility				
PHYSICAL QUALITIES		Spee	d			S	pee	ed				S	pee	d				S	pee	d
	1	Powe	r			P	ow	er			Power							Ρ	ow	er
	Str	en	gth			Str	en	gth				Str	en	gth				Str	en	gth
					Hyper	trophy					Hyper	trophy		Н	ype	ertr	opł	۱y		Hypertrophy
	Endu	rance	& MC			Er	ndurar	nce & M	ис				Endu	rance	& MC			Endu	uran	ce & MC
TRAINING STRUCTURE	UN	ISTRUCTURED LOW STRUCTURE MODERATE STRUCTURE HIGH STRUCTURE VERY HIGH STRUCTURE									SH STRUCTURE									



Early childhood	Late childhood	Adolescents	Adulthood
CHRONOLOGICAL AGE			
Female: 6–8 years	Female: 9–11 years	Female: 12–18 years	Female: >18 years
Male: 6–9 years	Male: 10–13 years	Male: 14–18 years	Male: >18 years
BIOLOGICAL AGE			
Tanner stage I	Tanner stage I–II	Tanner stage III–IV	Tanner stage V
MATURITY			
Pre-pubertal (pre PHV)	Pre-pubertal (pre PHV)	Pubertal (mid PHV)	Post-pubertal (post PHV)
STAGE OF LONG-TERM ATHLETE	DEVELOPMENT		
FUNdamentals	Learning to train	Training to train	Training to compete
LONG-TERM DEVELOPMENT OF N	IUSCULAR FITNESS (STRENGTH, PO)	WER, ENDURANCE)	
low	resistance trainin	ng skill competency	high
 Coordination training Agility training Balance training Muscular endurance training with own body mass/training tools (e.g., medicine ball) with a focus on exercise technique 	 Balance training Plyometric training as part of deliberate play (e.g., rope skipping) with a focus on correct jumping and landing mechanics Core strength training Muscular endurance training with own body mass/training tools (e.g., medicine ball) Free weight training with a focus on exercise technique 	 Balance training Plyometric training (depth jumps from low drop heights) Core strength training Free weight training at light to moderate loads Heavy resistance strength training (hypertrophy) Eccentric resistance training Sport-specific resistance training 	 Balance training Plyometric training (depth jumps from moderate drop heights) Core strength training Free weight training at moderate to high loads Heavy resistance strength training (neuromuscular activation + hypertrophy) Sport-specific resistance training
TRAINING-INDUCED ADAPTATION	S		
Neurona	l adaptations	Hormonal/Neuronal/M	uscular/Tendinous adaptations

Granacher, U., Lesinski, M., Büsch, D., Muehlbauer, T., Prieske, O., Puta, C., et al. (2016). Effects of Resistance Training in Youth Athletes on Muscular Fitness and Athletic Performance: A Conceptual Model for Long-Term Athlete Development. *Frontiers in Physiology*, 7, 4. http:// doi.org/10.1519/JSC.00000000001101

FUERZA				
Edad (años)	6-9	9-12	12-16	+16
Volumen (rep)	36-24	30-24	24-15	18-6
Series	6-10	3-6	3-6	2-5
Intensidad (%1RM)	PC	30-50	50-85	85-100
Frecuencia	1-2 días	1-2 días	2-4 días	2-5 días
Recuperación	72 h	72-48 h	48 h	48-24 h

Granacher, U., Lesinski, M., Büsch, D., Muehlbauer, T., Prieske, O., Puta, C., et al. (2016). Effects of Resistance Training in Youth Athletes on Muscular Fitness and Athletic Performance: A Conceptual Model for Long-Term Athlete Development. *Frontiers in Physiology*, 7, 4. http:// doi.org/10.1519/JSC.00000000001101





Figura 2. Escala de esfuerzo percibido OMNI-RES de fuerza para niños.

Fuente: Robertson et al.⁶³

Granacher, U., Lesinski, M., Büsch, D., Muehlbauer, T., Prieske, O., Puta, C., et al. (2016). Effects of Resistance Training in Youth Athletes on Muscular Fitness and Athletic Performance: A Conceptual Model for Long-Term Athlete Development. *Frontiers in Physiology*, 7, 4. http:// doi.org/10.1519/JSC.00000000001101



Figure 1. Children should learn proper exercise tec hnique from a qualified instructor.





Figure 2. Medicine ball partner twist exercise



Figure 3. Medicine ball chest push exercise

Low-Box Jump



Figure 2. Landing errors: Knee valgus "knock-knee" motion, landing on toes rather than on the ball of foot, feet are not shoulder width apart, and feet are not symmetrical.



Figure 4. Landing errors: Knee valgus "knock-knee" motion and feet are not shoulder width apart.

Squat



Split



Movilidad escápula





Single Leg Squat





Figure 2. Medicine-ball lunge



Figure 3. Exercise-band lateral raise

44 04 DX

by [Mc





Figure 6. Punch-balloon knee tap



Figure 8. Superman raise



Figure 7. ABC push-up



Figure 9. BOSU squat balance



Figure 5. BOSU mountain climber











Intensidad







Volumen

- 1 serie de 6-10 repeticiones.
- 2-3 series de 6-10 repeticiones.

Table 8.1Number of Foot Contacts by Season for JumpTraining

	LEVEL												
	Beginning	Intermediate	Advanced	Intensity									
Off-season	60-100	100-150	150-250	Low-moderate									
Preseason	100-250	150-300	150-450	Moderate-high									
In-season		Depends on sport		Moderate									
Championship season		Recovery only		Moderate-high									



Frecuencia

- 2 sesiones/semana.
- Al menos 72 h de recuperación entre ambas.

Recuperación entre series

• Entre 60-180 segundos.

				YOU	ТН РІ	IYSIC	AL DI	EVELO	OPME	NT (Y	PD) N	IODE	l fof	MAI	ES					
CHRONOLOGICAL AGE (YEARS)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21+
AGE PERIODS	EARLY CHILDHOOD MIDDLE CHILDHOOD						ADOLESCENCE ADULTHOOD													
GROWTH RATE	RAPID GROWTH						ADOLESCENT SPURT													
MATURATIONAL STATUS	YEARS PRE-PHV							YEAR	S PO	ST-PHV										
TRAINING ADAPTATION	PREDOMINANTLY NEURAL (AGE-RELATED)																			
PHYSICAL QUALITIES	FMS				FMS			FMS		FMS										
	SSS			SSS			SSS		SSS											
	Mobility			Mobility					Mobility											
	Agility				Agility					Agility				Agility						
	:	Speed	i			Speed				Speed					Speed					
		Powe	r			Ρ	Power				Power				Power					
	Str	eng	gth	Stren				gth			Strength			Strength						
	Hypertrophy								Hyper	trophy		Hypertrophy Hyper			Hypertrophy					
	Endu	rance	& MC	Enduran				ice & MC			Endurance & MC				Endurance & MC					
TRAINING STRUCTURE	UN	ISTRU	CTUR	RED	I	low	STRU	CTUR	E		MODERATE STRUCTURE HIGH STRUCTURE VERY HIGH STR			SH STRUCTURE						



Sports Med DOI 10.1007/s40279-015-0330-y

REVIEW ARTICLE

Development of Aerobic Fitness in Young Team Sport Athletes

Craig B. Harrison¹ · Nicholas D. Gill¹ · Taisuke Kinugasa² · Andrew E. Kilding¹

Abstract The importance of a high level of aerobic fitness for team sport players is well known. Previous research suggests that aerobic fitness can be effectively increased in adults using traditional aerobic conditioning methods, including high-intensity interval and moderateintensity continuous training, or more recent game-based conditioning that involves movement and skill-specific tasks, e.g. small-sided games. However, aerobic fitness training for youth team sport players has received limited attention and is likely to differ from that for adults due to changes in maturation. Given young athletes experience different rates of maturation and technical skill development, the most appropriate aerobic fitness training modes and loading parameters are likely to be specific to the developmental stage of a player. Therefore, we analysed studies that investigated exercise protocols to enhance aerobic fitness in young athletes, relative to growth and maturation, to determine current best practice and limitations. Findings were subsequently used to guide an evidence-based model for aerobic fitness development. During the sampling stage (exploration of multiple sports), regular participation in moderate-intensity aerobic fitness training, integrated into sport-specific drills, activities and skillbased games, is recommended. During the specialisation stage (increased commitment to a chosen sport), high-intensity small-sided games should be prioritised to provide

🖂 Craig B. Harrison

hbcraig@gmail.com

- ¹ Sports Performance Research Institute New Zealand, AUT University, AUT Millennium Campus, 17 Antares Place, Auckland 0632, New Zealand
- ² Japan Institute of Sports Sciences, Japan Sports Council, Tokyo, Japan

the simultaneous development of aerobic fitness and technical skills. Once players enter the investment stage (pursuit of proficiency in a chosen sport), a combination of small-sided games and high-intensity interval training is recommended.

Key Points

Aerobic fitness should be actively developed in team sport players throughout their development, rather than aligning exercise to specific periods of maturation.

Sport-specific training programmes should be prioritised throughout development to increase the opportunity for concurrent physical and technical development.

Training must be accurately prescribed using specific game variables to ensure the desired aerobic fitness adaptations are achieved.

1 Introduction

An important component contributing to successful performance in many invasion team sports is a player's physical ability to repeatedly produce high-intensity intermittent bouts of exercise during games that typically last 60–120 min [1–3]. The aerobic fitness status of an individual largely determines this ability due to its substantial role durine recovery, which assists with delaying



Mode: Repeated sprint

Duration: 4-6 x sprints

Yes

Frequency: 1-2 x per week for 10 weeks

Work intensity: 95-100% max speed

Recovery: 20-120 s / 4-10 min passive

Yes

VO_{2peak}/ ISRP

Fig. 1 A proposed evidence-based model for aerobic fitness development in young team sport players. HR_{peak} peak heart rate, *ISRP* intermittent shuttle running performance, max maximum, min minutes, *SSGs* small-sided games, VO_{2peak} peak volume of oxygen uptake

Aerobic Fitness in Young Team Sport Athletes

stage

Mode: 3 vs. 3 to 5 vs. 5 SSGs

Frequency: 2 x per week

Pre-PHV / < 13 años





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>45 min 50-60 % FC_{máx}





PHV / 13-16 años

<u>SSG</u>

Formato: 3vs3 / 4vs4 Frecuencia: 2-3 días semana Volumen total: 8-28 min Repeticiones: 4-8 min Intensidad: 90-95% Fc_{máx} Recuperación: 1/1 Campo: 25x30 m / 30x40m >8 semanas

<u>HIIT</u>

Frecuencia: 2 días semana Volumen total: 8-28 min Intervalos: 30s-4 min Intensidad: 90-95% Fc_{máx} 0 30-15IFT Recuperación: 1/1 Campo: 25x30 m / 30x40m Ciclos de 5-10 semanas

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Juegos reducidos

Tipo de entrenamiento	Ir	ntensid	ad					
	%FC _{máx}	RPE	Tiempo recuper	Trabajo total, min	Duración de las rep	Rep	Recup	Tareas
								8x8
Capacidad		Un poco duro	24-48h	30-60	6-30 min	1-8	< 1 min	7x7
Aeróbica	80-90							6x6
								5x5
Potencia	00.05	Muy	. 701	40.05	0.0	4.0	0.5-1	4x4
Aeróbica	90-95	duro	>72h	12-35	3-6 min	4-8	ratio	3x3



Table 3

Pitch sizes considered small, medium, and large for various soccer drills, reported by Rampinini et al. (25) and Owen et al. (22)

Soccer drill	Small	Medium	Large
3-a-side	$12 imes 20 ext{ m}$	15 imes 25 m	18 imes30 m
4-a-side	16 $ imes$ 24 m	20 imes30 m	24 $ imes$ 36 m
5-a-side	20 imes28 m	25 imes35 m	30 imes 42 m
6-a-side	24 imes32 m	30 imes 40~m	36 imes48 m
1-a-side possession	5 imes 10 m	10 imes15 m	$15 imes 20~{ m m}$
2-a-side possession	10 imes15 m	15 imes 20~m	20 imes25 m
3-a-side possession	15 imes 20 m	20 imes25 m	25 imes30 m
4-a-side possession	20 imes25 m	25 imes30 m	30 imes35 m
5-a-side possession	25 imes30 m	30 imes35 m	35 imes40 m

Post- PHV / >16 años

<u>SSG</u>

Formato: 3vs3 a 5vs5 Frecuencia: 2 días semana Volumen total: 8-28 min Repeticiones: 4-8 min Intensidad: 90-95% Fc_{máx} Recuperación: 1/1 Campo: grande (L) >8 semanas

<u>HIIT</u>

Frecuencia: 2-3 días semana Volumen total: 8-28 min Intervalos: 15s-4 min Intensidad: 90-95% Fc_{máx} o 30-15IFT Recuperación: 1/1 Campo: 25x30 m / 30x40m Ciclos de 4-12 semanas

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Post- PHV / >16 años

<u>RSA</u>

Frecuencia: 1-2 días semana Repeticiones: 4-6 Distancia: 40 m Series: 2-5 Intensidad: 100% máximo esfuerzo Recuperación: 205 – 2 min Pausa: 4-10 min 10-12 semanas

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Proceso de enseñanza-

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¡Muchas gracias por vuestra atención!