$Physical \ demands \ of tennis \ across \ the \ different \ court \ surfaces, \ performance \ levels, \ and \ sexes: \ a \ systematic \ review \ with \ meta-analysis$

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Supplementary File 7. Stroke speeds

7 1	Dogle	Same	Sanad	(km/h)

7.1 Peak Serve Speed (km/h)					Charles and	distant.				
Group	Author (Year)	Study re			Study condition				Meta-analysis	
		Mean		N (Matches		Sex	Playing Level	Comment	Included in MA	Reason for exclusion from MA
	Cui et al. (2020a)	208.9	11.0	269	Hard	Men	International	Australian Open 2015-2017 Seeded	No	Only two studies for analysis
	Cui et al. (2020a)	204.6	11.0	223	Hard	Men	International	Australian Open 2015-2017 Non-seeded	No	Only two studies for analysis
	Cui et al. (2020a)	209.2	11.0	157	Hard	Men	International	US Open 2015-2017 Seeded	No	Only two studies for analysis
	Cui et al. (2020a)	204.4	10.0	105	Hard	Men	International	US Open 2015-2017 Non-seeded	No	Only two studies for analysis
	Reid et al. (2016)	206.3	11.8	88	Hard	Men	International	Australian Open 2012-2014 - peak serve speed	No	Only two studies for analysis
Men International Hard	Smith et al. (2018b)	202.7	13.7	NR	Hard	Men	International	Australian Open 2014-2016 <22.2°C	No	ELO-adjusted matches, nr of matches not reported
Vici incernational rial o	Smith et al. (2018b)	203.4	13.0	NR	Hard	Men	International	Australian Open 2014-2016 22.3-27.9°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al. (2018b)	206.5	11.5	NR	Hard	Men	International	Australian Open 2014-2016 27.9-30°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al. (2018b)	206.3	16.4	NR	Hard	Men	International	Australian Open 2014-2016 30.1-32.2°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al. (2018b)	206.2	9.9	NR	Hard	Men	International	Australian Open 2014-2016 >32.3°C	No	ELO-adjusted matches, nr of matches not reported
	Whiteside et al. (2015)	201.2	9.3	40	Hard	Men	International	Top ranked: Australian Open 2012-2014 - peak serve speed	No	Subgroup analysis (Reid et al 2016)
	Whiteside et al. (2015)	196.5	11.6	40	Hard	Men	International	Lower ranked: Australian Open 2012-2014 -peak serve speed	No	Subgroup analysis (Reid et al 2016)
Ven International Clav	Cui et al. (2020a)	205.2	10.0	106	Clay	Men	International	French Open 2015-2017 Seeded	No	Only one study for analysis
neri incernacional ciay	Cui et al. (2020a)	199.7	9.0	48	Clay	Men	International	French Open 2015-2017 Non-seeded	No	Only one study for analysis
Men International Grass	Cui et al. (2020a)	210.2	10.0	162	Grass	Men	International	Wimbledon 2015-2017 Seeded	No	Only one study for analysis
	Cui et al. (2020a)	203.4	9.0	118	Grass	Men	International	Wimbledon 2015-2017 Non-seeded	No	Only one study for analysis
	Reid et al. (2016)	171.8	10.5	82	Hard	Women	International	Australian Open 2012-2014	No	Only on study for analysis
	Smith et al. (2018	166.7	10.9	NR	Hard	Women	International	Australian Open 2014-2016 <22.2°C	No	ELO-adjusted matches, nr of matches not reported
Jomen International Hard	Smith et al. (2018a)	166.6	10.8	NR	Hard	Women	International	Australian Open 2014-2016 22.3-27.9°C	No	ELO-adjusted matches, nr of matches not reported
TOTAL TIME CONTROL TIME	Smith et al. (2018a)	170.9	19.0	NR	Hard	Women	International	Australian Open 2014-2016 27.9-30°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al.(2018a)	168.0	21.7	NR	Hard	Women	International	Australian Open 2014-2016 30.1-32.2°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al. (2018a)	168.3	22.3	NR	Hard	Women	International	Australian Onen 2014-2016 >32 3°C	No	FLO-adjusted matches or of matches not reported

7.2 First Serve Speed (km/h)						r.c.					
Group	Author (Year)	Study r			Study conditions				Meta-analysis		
		Mean 186.9	SD 10.0	N (Matches) 269	Surtace Hard	Sex	Playing Level	Comment		A Reason for exclusion from MA	
	Cui et al. (2020a)						International	Australian Open 2015-2017 Seeded Deuce court	Yes		
	Cui et al. (2020a)	183.6	10.0	223 269	Hard	Men	International	Australian Open 2015-2017 Non-seeded Deuce court	Yes		
	Cui et al. (2020a)	187.8	11.0		Hard	Men	International	Australian Open 2015-2017 Seeded AD court	Yes		
	Cui et al. (2020a)	184.1	10.0	223	Hard	Men	International	Australian Open 2015-2017 Non-seeded AD court	Yes		
	Cui et al. (2020a)	185.9	10.0	157	Hard	Men	International	US Open 2015-2017 Seeded Deuce court	Yes		
	Cui et al. (2020a)	181.8	10.0	105	Hard	Men	International	US Open 2015-2017 Non-seeded Deuce court	Yes		
	Cui et al. (2020a)	185.2	11.0	157	Hard	Men	International	US Open 2015-2017 Seeded AD court	Yes		
	Cui et al. (2020a)	180.9	10.0	105	Hard	Men	International	US Open 2015-2017 Non-seeded Ad court	Yes		
ten International Hard	Hornery et al. (2007)	178.0	9.0	17	Hard	Men	International	ATP (21.4 y)	Yes		
	Kovalchik and Reid (2017)	179^	NR	21	Hard	Men	International	Australian Open 2012-2017	Yes		
	Reid et al. (2016)	184.3	9.3	88	Hard	Men	International	Australian Open 2012-2014 - mean first serve speed	Yes		
	Smith et al. (2018b)	181.8	7.9	NR	Hard	Men	International	Australian Open 2014-2016 <22.2°C	No	ELO-adjusted matches, nr of matches not reported	
	Smith et al. (2018b)	182.0	8.0	NR	Hard	Men	International	Australian Open 2014-2016 22.3-27.9°C	No	ELO-adjusted matches, nr of matches not reported	
	Smith et al. (2018b)	183.7	11.4	NR	Hard	Men	International	Australian Open 2014-2016 27.9-30°C	No	ELO-adjusted matches, nr of matches not reported	
	Smith et al. (2018b)	182.3	9.4	NR	Hard	Men	International	Australian Open 2014-2016 30.1-32.2°C	No	ELO-adjusted matches, nr of matches not reported	
	Smith et al. (2018b)	181.9	9.1	NR	Hard	Men	International	Australian Open 2014-2016 >32.3°C	No	ELO-adjusted matches, nr of matches not reported	
	Whiteside et al. (2015)	175.0	9.9	40	Hard	Men	International	Top ranked: Australian Open 2012-2014 - mean first serve	No	Subgroup analysis (Reid et al 2016)	
	Whiteside et al. (2015)	171.9	8.7	40	Hard	Men	International	Lower ranked: Australian Open 2012-2014 - mean first serve	No	Subgroup analysis (Reid et al 2016)	
	Cui et al. (2020a)	186.3	9.0	106	Clay	Men	International	French Open 2015-2017 Seeded Deuce court	Yes		
	Cui et al. (2020a)	182.6	9.0	48	Clay	Men	International	French Open 2015-2017 Non-seeded Deuce court	Yes		
	Cui et al. (2020a)	181.7	9.0	106	Clay	Men	International	French Open 2015-2017 Seeded AD court	Yes		
en International Clay	Cui et al. (2020a)	180.9	10.0	48	Clay	Men	International	French Open 2015-2017 Non-seeded AD court	Yes		
	Fitzpatrick et al. (2019)	181.8	9.7	244	Clay	Men	International	Roland Garros 2016, 2017 - winning players	Yes		
	Fitzpatrick et al. (2019)	180.9	10.7	244	Clay	Men	International	Roland Garros 2016, 2017 - losing players	Yes		
	Hornery et al. (2007)	172.0	14.0	20	Clav	Men	International	ATP (21.4 v)	Yes		
	Brown et al. (2021)	188.0	14.9	1140	Grass	Men	International	Wimbledon 2004 -2019	Yes		
	Cui et al. (2020a)	189.2	9.0	162	Grass	Men	International	Wimbledon 2015-2017 Seeded Deuce court	Yes		
	Cui et al. (2020a)	184.9	9.0	118	Grass	Men	International	Wimbledon 2015-2017 Non-seeded Deuce court	Yes		
	Cui et al. (2020a)	192.1	10.0	10.0	Grass	Men	International	Wimbledon 2015-2017 Seeded AD court	Yes		
Ien International Grass	Cui et al. (2020a)	185.3	9.0	118	Grass	Men	International	Wimbledon 2015-2017 Non-seeded AD court	Yes		
	Fitzpatrick et al. (2019)	188.6	8.8	241	Grass	Men	International	Wimbledon 2016, 2017 - winning players	Yes		
	Fitzpatrick et al. (2019)	185.2	10.2	241	Grass	Men	International	Wimbledon 2016, 2017 - Willing players Wimbledon 2016, 2017 - losing players	Yes		
	Maguirriain et al. (2016)	187.9	9.4	15	Grass	Men	International	Wimbledon 2015	Yes		
nior Men International Hard	Kovalchik and Reid (2017)	158^	NR.	12	Hard	Men	International	Australian Open 2012-2017 (juniors)	No.	Only one study for analysis	
mor men international raid	Kovalchik and Reid (2017)	153^	NR	21	Hard	Women	International	Australian Open 2012-2017 (Juliois)	Yes	Only one study for unarysis	
	Reid et al. (2016)	155.5	9.8	82	Hard	Women	International	Australian Open 2012-2017 Australian Open 2012-2014	Yes		
	Smith et al. (2018a)	151.9	10.9	NR	Hard	Women	International	Australian Open 2012-2014 Australian Open 2014-2016 <22.2°C	Yes No	ELO adjusted matches, as of matches and consisted	
/omen International Hard	Smith et al. (2018a) Smith et al. (2018a)	151.9	10.9	NR NR	Hard	Women	International		No No	ELO-adjusted matches, nr of matches not reported	
		155.2	9.7	NR.	Hard			Australian Open 2014-2016 22.3-27.9°C	No No	ELO-adjusted matches, nr of matches not reported	
	Smith et al. (2018a)	150.3	19.7	NR NR		Women	International	Australian Open 2014-2016 27.9-30°C		ELO-adjusted matches, nr of matches not reported	
	Smith et al. (2018a) Smith et al. (2018a)	150.3	20.0	NR NR	Hard	Women	International	Australian Open 2014-2016 30.1-32.2°C	No No	ELO-adjusted matches, nr of matches not reported ELO-adjusted matches, nr of matches not reported	
		150.2	10.5	250	Hard	Women	International	Australian Open 2014-2016 >32.3°C			
omen International Clay	Fitzpatrick et al. (2019)				Clay	Women	International	Roland Garros 2016, 2017 - winning players	Yes	Only one study for analysis	
	Fitzpatrick et al. (2019)	154.7	9.9	250	Clay	Women	International	Roland Garros 2016, 2017 - losing players	Yes	Only one study for analysis	
	Brown et al. (2021)	160.0	13.1	1070	Grass	Women	International	Wimbledon 2004-2019	Yes		
omen International Grass	Fitzpatrick et al. (2019)	159.4	9.5	249	Grass	Women	International	Wimbledon 2016, 2017 - winning players	Yes		
	Fitzpatrick et al. (2019)	158.4	8.4	249	Grass	Women	International	Wimbledon 2016, 2017 - losing players	Yes		
unior Women International Hard	Kovalchik and Reid (2017)	146^	NR	6	Hard	Women	International	Australian Open 2012-2017 (juniors)	No	Only one study for analysis	

Group	Author (Year)	Study re	esults		Study cond	ditions			Meta-analy	sis
	,	Mean	SD	N (Matches)	Surface	Sex	Playing Level	Comment	Included in	MA Reason for exclusion from MA
	Cui et al. (2020a)	155.5	11.0	269	Hard	Men	International	Australian Open 2015-2017 Seeded Deuce court	Yes	
	Cui et al. (2020a)	153.3	10.0	223	Hard	Men	International	Australian Open 2015-2017 Non-seeded Deuce court	Yes	
	Cui et al. (2020a)	150.9	12.0	269	Hard	Men	International	Australian Open 2015-2017 Seeded AD court	Yes	
	Cui et al. (2020a)	149.2	11.0	223	Hard	Men	International	Australian Open 2015-2017 Non-seeded AD court	Yes	
	Cui et al. (2020a)	153.6	11.0	157	Hard	Men	International	US Open 2015-2017 Seeded Deuce court	Yes	
	Cui et al. (2020a)	149.7	10.0	105	Hard	Men	International	US Open 2015-2017 Non-seeded Deuce court	Yes	
	Cui et al. (2020a)	149.4	12.0	157	Hard	Men	International	US Open 2015-2017 Seeded AD court	Yes	
	Cui et al. (2020a)	146.0	11.0	105	Hard	Men	International	US Open 2015-2017 Non-seeded Ad court	Yes	
en International Hard	Hornery et al. (2007)	135.0	10.0	17	Hard	Men	International	ATP (21.4 y)	Yes	
	Reid et al. (2016)	152.1	9.6	88	Hard	Men	International	Australian Open 2012-2014 - mean second serve speed	Yes	
	Smith et al. (2018b)	147.5	8.8	NR	Hard	Men	International	Australian Open 2014-2016 <22.2°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al. (2018b)	147.6	9.1	NR	Hard	Men	International	Australian Open 2014-2016 22.3-27.9°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al. (2018b)	150.0	11.8	NR	Hard	Men	International	Australian Open 2014-2016 27.9-30°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al. (2018b)	148.7	10.1	NR	Hard	Men	International	Australian Open 2014-2016 30.1-32.2°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al. (2018b)	148.6	10.2	NR	Hard	Men	International	Australian Open 2014-2016 >32.3°C	No	ELO-adjusted matches, nr of matches not reported
	Whiteside et al. (2015)	145.7	9.3	40	Hard	Men	International	Top ranked: Australian Open 2012-2014 - mean second serve	No	Subgroup analysis (Reid et al 2016)
	Whiteside et al. (2015)	144.4	10.3	40	Hard	Men	International	Lower ranked: Australian Open 2012-2014 - mean second serve	No	Subgroup analysis (Reid et al 2016)
	Cui et al. (2020a)	152.7	9.0	106	Clay	Men	International	French Open 2015-2017 Seeded Deuce court	No	Only two studies for analysis
en International Clay	Cui et al. (2020a)	150.8	10.0	48	Clay	Men	International	French Open 2015-2017 Non-seeded Deuce court	No	Only two studies for analysis
	Cui et al. (2020a)	145.9	10.0	106	Clay	Men	International	French Open 2015-2017 Seeded AD court	No	Only two studies for analysis
	Cui et al. (2020a)	144.5	10.0	48	Clay	Men	International	French Open 2015-2017 Non-seeded AD court	No	Only two studies for analysis
	Hornery et al. (2007)	134.0	12.0	20	Clay	Men	International	ATP (21.4 y)	No	Only two studies for analysis
	Brown et al. (2021)	157.0	15.3	1140	Grass	Men	International	Wimbledon 2004 - 2019	Yes	
	Cui et al. (2020a)	161.5	12.0	162	Grass	Men	International	Wimbledon 2015-2017 Seeded Deuce court	Yes	
en International Grass	Cui et al. (2020a)	157.0	11.0	118	Grass	Men	International	Wimbledon 2015-2017 Non-seeded Deuce court	Yes	
en memberoral orazi	Cui et al. (2020a)	159.0	13.0	10.0	Grass	Men	International	Wimbledon 2015-2017 Seeded AD court	Yes	
	Cui et al. (2020a)	155.3	11.0	118	Grass	Men	International	Wimbledon 2015-2017 Non-seeded AD court	Yes	
	Maquirriain et al. (2016)	155.9	13.6	15	Grass	Men	International	Wimbledon 2015	Yes	
	Reid et al. (2016)	131.2	8.5	82	Hard	Women	International	Australian Open 2012-2014	No	Only two studies for analysis
	Smith et al. (2018a)	127.3	8.7	NR	Hard	Women	International	Australian Open 2014-2016 <22.2°C	No	ELO-adjusted matches, nr of matches not reported
omen International Hard	Smith et al. (2018a)	126.7	8.7	NR	Hard	Women	International	Australian Open 2014-2016 22.3-27.9°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al. (2018a)	130.1	9.8	NR	Hard	Women	International	Australian Open 2014-2016 27.9-30°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al.(2018a)	126.4	17.3	NR	Hard	Women	International	Australian Open 2014-2016 30.1-32.2°C	No	ELO-adjusted matches, nr of matches not reported
	Smith et al. (2018a)	126.5	17.3	NR	Hard	Women	International	Australian Open 2014-2016 >32.3°C	No	ELO-adjusted matches, nr of matches not reported
omen International Grass	Brown et al. (2021)	136.0	12.2	1070	Grass	Women	International	Wimbledon 2004-2019	No	Only two studies for analysis

Group	Author (Year)	Study r	Study results		Study conditions			Meta-analysis		
	,	Mean	SD	N (Matches) Surface	Sex	Playing Level	Comment	Included in MA	Reason for exclusion from MA
	Reid et al. (2016)	111.3	5.5	88	Hard	Men	International	Australian Open 2012-2014 - groundstroke	No	Only two studies for analysis
Men International Hard	Whiteside et al. (2015)	95.6	6.6	40	Hard	Men	International	Top ranked: Australian Open 2012-2014	No	Subgroup analysis (Reid et al 2016)
	Whiteside et al. (2015)	94.3	6.3	40	Hard	Men	International	Lower ranked: Australian Open 2012-2014	No	Subgroup analysis (Reid et al 2016)
Women International Hard	Reid et al. (2016)	106.1	5.8	82	Hard	Women	International	Australian Onen 2012-2014	No	Only one study for analysis

7.5 Forehand Speed (km/h)

Group Author (Year)		Study results			Study conditions				Meta-analysis		
Стобр	Addisor (Tear)	Mean	SD	N (Matches)	Surface	Sex	Playing Level	Comment	Included in MA	Reason for exclusion from MA	
Men International Hard	Kovalchik and Reid (2017)	119^	NR	21	Hard	Men	International	Australian Open 2012-2017	No	Only one study for analysis, SD missing	
Junior Men International Hard	Kovalchik and Reid (2017)	113^	NR	12	Hard	Men	International	Australian Open 2012-2017	No	Only one study for analysis, SD missing	
Women International Hard	Kovalchik and Reid (2017)	111^	NR	21	Hard	Women	International	Australian Open 2012-2017	No	Only one study for analysis, SD missing	
Junior Women International Hard	Kovalchik and Reid (2017)	110^	NR	6	Hard	Women	International	Australian Open 2012-2017	No	Only one study for analysis, SD missing	
Notes: ^Median, NR = Not Reported											

7.6 Backhand Speed (km/h)									
Group	Author (Year)	Study re	Study results		Study con	ditions			Meta-analysis
		Mean	SD	N (Matches	Surface	Sex	Playing Level	Comment	Included in MA Reason for exclusion from MA
Men International Hard	Kovalchik and Reid (2017)	108^	NR	21	Hard	Men	International	Australian Open 2012-2017	No Only one study for analysis, SD missing
Junior Men International Hard	Kovalchik and Reid (2017)	105^	NR	12	Hard	Men	International	Australian Open 2012-2017	No Only one study for analysis, SD missing
Women International Hard	Kovalchik and Reid (2017)	106^	NR	21	Hard	Women	International	Australian Open 2012-2017	No Only one study for analysis, SD missing
Junior Women International Hard	Variability and Baid (2017)	1020	ND	6	Marri	Women	International	Australian Open 2012 2017	No. Only one study for analysis SD mission