Managing your MS symptoms when things heat up



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Todays Journey...



- What happens when you get hot
- What is the latest evidence on heat management
- Practical heat management tips



What is heat sensitivity

- Increase in body temperature of 0.5°C
- 60-80% of PwMS are heat sensitive
- Transient temporary worsening
- Uhthoff's phenomenon
- Ambient temp, exercise, infection & psychological stress
- Increase weather temperatures can increase visits to GP





Frohman et al 2011 Chacko et al 2021

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Physiologically what is happening

- Demyelination = changes in axonal physiology
- Reduced sweating capacity
- MS severity = greater risk of developing conduction block
- Lesions within hypothalamus impair the homeostatic control



Frohman et al 2011 Davis et al 2010

Consequences of Heat Sensitivity

- Exercise = increase Core temperature
- Decrease in physically active lifestyle
- Inactivity = muscle weakness, atrophy
- Key factor leading to a decrease in the capacity of PwMS to exercise and lead the lifestyle they desire

Skjerbaek et al 2013 Bilgin et al 2022





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Research on current best management

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• Active body cooling is associated with restoration and even improvement of physical and cognitive function

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- Pre-cooling = reduce body temp by 0.5-1.0 degree C
- Immersion (16-17°C for 30min)
- Ambient temperature
- Affects lasted for 2 -8 hours
- Improved QoL

Poyraz et al 2021, Skjerbaek et al 2013 Kaltsatou and Flouris 2019, Bilgin et al 2022 Nilsagard et al 2006, Grahn et al 2008





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	h	nterventio	on		Control					
	Mean	SD	Total	Mean	SD	Total	SMD (95% CI)	Weight		
White et al. (2000)	6.6	0.8	6	8.0	2.0	6	-0.919 (-2.120, 0.282)	8.13		+-
NASA Cooling Group (2003)	7.4	0.13	36	7.5	0.11	39	-0.833 (-1.306, -0.361)	52.50		
Meyer-Heim et al. (2007)	14.2	10.8	20	18	17.3	20	-0.264 (-0.886, 0.359)	30.26		
Reynolds et al. (2011)	5.80	1.54	6	6.1	1.53	6	-0.195 (-1.330, 0.939)	9.11		
Overall							-0.610 (-0.952, -0.267)	100.00		
Test for overall effect: Z-Value =	3.49, p vali	ue <0.001								
Heterogeneity: Tau2=0.000, I2= 0	0.0%, df=3	3, Chi2=2	.81, p-Valu	ue=0.421					Environmentaria (Environmentaria)	(Fayour the control group)
						Six-minu	to walk test (6MWT)		[ravou us unevendon group]	fraven ar conner@reak1
	Mean	SD	Total	Mean	SD	Total	SMD (95% CD	Weight		
Reynolds et al. (2011)	459.1	116.5	6	414.3	96.4	6	0.419 (-0.727, 1.565)	52.14		1 · · ·
Gonzales et al. (2017)	255.0	31.0	9	165.0	14.0	9	3 485 (1 794 5 177)	47.86		
Overall	200.0	51.0		105.0	14.0		1 887 (-1 116 4 889)	100.00		
Overan	1.22	alua =0.	10				1.007 (-1.110, 4.007)	100.00	1	
Test for evenall offert. 7 Value -	Test for overall effect: Z-Value = 1.23, p-value = 0.218									0 5.
Test for overall effect: Z-Value =	=1.23, p-vc	16-1 CL	2-0 65 -	V-10	002					
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>I</i> ²	= 1.23, p-va = 88.4%, o	df=1, Ch	i ² =8.65, p	-Value=0	.003				[Favour the control group]	[Favour the intervention group]
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 I ²	= 88.4%,	df=1, Ch	i ² =8.65, p	o-Value=0	.003	Exe	rcise Duration		[Favour the control group]	[Favour the intervention group]
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>l</i> ²	= 1.25, p-va = 88.4%, o Mean	df=1, Ch	i ² =8.65, p	-Value=0	.003	Exe	rcise Duration	Weight	[Favour the control group]	[Favour the intervention group]
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>I</i> ² Grahn et al. (2008)	=1.25, p-ve = 88.4%, e <u>Mean</u> 42.8	df=1, Ch	i ² =8.65, p	Mean	.003 SD 9.8	Exe Total	rcise Duration SMD (95% CI) 0.822 (-0.095, 1.738)	Weight	[Favour the control group]	[Favour the intervention group]
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>l</i> ² Grahn et al. (2008) Chaseline et al. (2017)	Mean 42.8 46.6	df=1, Ch SD 16.4 14.2	Total	Mean 31.7 32.7	.003 SD 9.8 11.5	Exe Total 10 10	rcise Duration SMD (95% CI) 0.822 (-0.095, 1.738) 1.076 (0.131, 2.020)	Weight 51.49 48.51	[Favour the control group]	[Favour the intervention group]
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>l</i> ² Grahn et al. (2008) Chaseling et al. (2017) Overall	$\frac{Mean}{42.8}$	sp 16.4 14.2	Total 10 10	Mean 31.7 32.7	.003 SD 9.8 11.5	Exe Total 10 10	rcise Duration SMD (95% CI) 0.822 (-0.095, 1.738) 1.076 (0.131, 2.020) 0.945 (0.287, 1.603)	Weight 51.49 48.51	[Favour the control group]	[Favour the intervention group]
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>l</i> ² Grahn et al. (2008) Chaseling et al. (2017) Overall	$= 1.23, p-v_{d} = 88.4\%, o$ $= 88.4\%, o$ $= 42.8$ $= 46.6$	sp 16.4 14.2	Total 10 10	Mean 31.7 32.7	.003 SD 9.8 11.5	Exe Total 10 10	rcise Duration SMD (95% CI) 0.822 (-0.095, 1.738) 1.076 (0.131, 2.020) 0.945 (0.287, 1.603)	Weight 51.49 48.51 100.00	[Favour the control group]	[Favour the intervention group]
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>l</i> ² Grahn et al. (2008) Chaseling et al. (2017) Overall Test for overall effect: Z-Value =	$= 1.23, p-v_0$ $= 88.4\%, 0$ $Mean$ 42.8 46.6 $= 2.82, p-v_0$	df=1, Ch SD 16.4 14.2 due = 0.0	Total 10 10	Mean 31.7 32.7	.003 SD 9.8 11.5	Exe Total 10 10	rcise Duration SMD (95% CI) 0.822 (-0.095, 1.738) 1.076 (0.131, 2.020) 0.945 (0.287, 1.603)	Weight 51.49 48.51 100.00	[Favour the control group]	[Favour the intervention group]
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>I</i> ² Grahn et al. (2008) Chaseling et al. (2017) Overall Test for overall effect: Z-Value = Heterogeneity: Tau ² =0.000 <i>I</i> ² =	$\frac{Mean}{42.8}$ $\frac{42.8}{46.6}$ $=2.82, p-w$ $0.0\%, df=$	df=1, Ch sp 16.4 14.2 alue = 0.0 $1. Chi^2=$	Total 10 10 05 0.14, p-V	-Value=0 Mean 31.7 32.7 Yalue=0.70	.003 <u>SD</u> 9.8 11.5	Exe Total 10 10	rcise Duration SMD (95% CI) 0.822 (-0.095, 1.738) 1.076 (0.131, 2.020) 0.945 (0.287, 1.603)	Weight 51.49 48.51 100.00	[Favour the control group]	[Favour the intervention group]
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>l</i> ² Grahn et al. (2008) Chaseling et al. (2017) Overall Test for overall effect: Z-Value = Heterogeneity: Tau ² =0.000 <i>l</i> ² =	Mean 42.8 46.6 =2.82, <i>p</i> - <i>v</i> ₀ 0.0%, df=	df=1, Ch <u>SD</u> 16.4 14.2 <i>alue</i> =0.0 -1, Chi ² = <u>Sclerosis</u>	Total 10 10 10 10 10 10 10 10 10 10	-Value=0 Mean 31.7 32.7 Yalue=0.7(mal Comp	.003 <u>SD</u> 9.8 11.5 05 05	Exe Total 10 10	rcise Duration SMD (95% CI) 0.822 (-0.095, 1.738) 1.076 (0.131, 2.020) 0.945 (0.287, 1.603)	Weight 51.49 48.51 100.00	[Favour the control group]	[Favour the intervention group]
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>l</i> ² Grahn et al. (2008) Chaseling et al. (2017) Overall Test for overall effect: Z-Value = Heterogeneity: Tau ² =0.000 <i>l</i> ² = ($= 1.23, p-v_d$ $= 88.4\%, q$ $= 88.4\%, q$ $= 42.8$ $= 46.6$ $= 2.82, p-v_d$ $= 00.0\%, df = 000\%, df = 000\%$	df=1, Ch <u>SD</u> 16.4 14.2 alue =0.0 -1, Chi ² = <u>SClerosis</u> <u>SD</u>	12=8.65, p Total 10 10 10 0.05 0.14, p-V Function Total	Mean 31.7 32.7 alue=0.70 mal Comp	.003 SD 9.8 11.5 05 osite (M SD	Exe Total 10 10	rcise Duration SMD (95% CI) 0.822 (-0.095, 1.738) 1.076 (0.131, 2.020) 0.945 (0.287, 1.603) SMD (95% CD)	Weight 51.49 48.51 100.00 Weight	[Favour the control group] -2.02 Favour the control group	[Favour the intervention group]
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Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>l</i> ² Grahn et al. (2008) Chaseling et al. (2017) Overall Test for overall effect: Z-Value = Heterogeneity: Tau ² =0.000 <i>l</i> ² = (NASA Cooling Group (2003) Meyer-Heim et al. (2007)	1.2.5, p-vd = 88.4%, o Mean 42.8 46.6 =2.82, p-vd 00.0%, df= Mean 0.08 0.952	SD 16.4 16.4 14.2 alue =0.0 1, Chi ² = Sclerosis SD 0.03 0.88	Total 10 10 10 10 10 10 10 10 10 10	Mean 31.7 32.7 'alue=0.70 mal Comp Mean 0.05 0.723	.003 SD 9.8 11.5 05 osite (N SD 0.03 1.11	Exe Total 10 10 10 ISFC) Total 39 20	rcise Duration SMD (95% CI) 0.822 (-0.095, 1.738) 1.076 (0.131, 2.020) 0.945 (0.287, 1.603) SMD (95% CI) 1.000 (0.519, 1.481) 0.229 (-0.393, 0.851)	Weight 51.49 48.51 100.00 Weight 53.40 46.60	[Favour the control group]	[Favour the intervention group]
Test for overall effect: Z-Value = Heterogeneity: Tau ² =4.1579 <i>I</i> ² Grahn et al. (2008) Chaseling et al. (2017) Overall Test for overall effect: Z-Value = Heterogeneity: Tau ² =0.000 <i>I</i> ² = (NASA Cooling Group (2003) Meyer-Heim et al. (2007) Overall	1.23, p-w = 88.4%, v Mean 42.8 46.6 = 2.82, p-w 00.0%, df= Mean 0.08 0.952	SD 16.4 14.2 14.2 alue =0.0 -1, Chi ² = Sclerosis SD 0.03 0.88	12=8.65, p Total 10 10 10 10 10 10 10 10 10 10	Mean 31.7 32.7 'alue=0.7(nal Comp Mean 0.05 0.723	.003 SD 9.8 11.5 05 osite (N SD 0.03 1.11	Exe Total 10 10 10 10 10 10 10 10 10 10	rcise Duration SMD (95% CI) 0.822 (-0.095, 1.738) 1.076 (0.0131, 2.020) 0.945 (0.287, 1.603) SMD (95% CI) 1.000 (0.519, 1.481) 0.229 (-0.393, 0.851) 0.641 (-0.114, 1.395)	Weight 51.49 48.51 100.00 Weight 53.40 46.60 100.00	[Favour the control group] -2.02 Favour the control group	[Favour the intervention group]
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Reducing Fatigue

- 90% of PwMS report fatigue
- Cryotherapy over long-term use may decrease fatigue
- Limiting the severity of fatigue will allow for higher exercise work loads to be achieved = better results



Get a Head Start

Campbell et al 2019



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Exercise & Heat Sensitivity

- Intervals
- Resistant training over cardio training
- Exercise duration was increased by 33% with precooling

Kaltsatou and Flouris 2019 Grahn et al 2008



Figure 2. Core temperature before, during and after 30 min of resistance exercise and endurance exercise in heat sensitivity (HS) persons with multiple sclerosis (MS). Core temperature increased more during endurance exercise than during resistance exercise.





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