



# One Minute Aerobics

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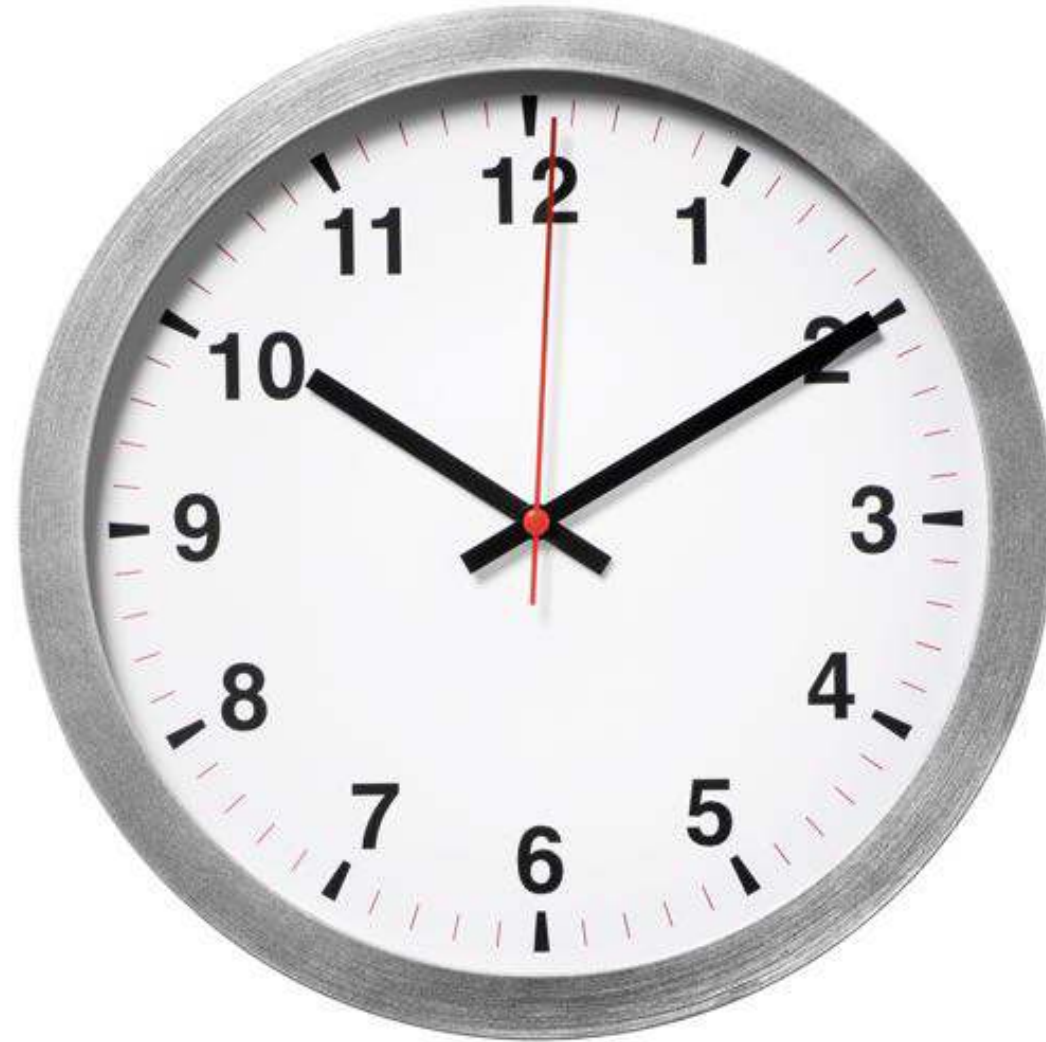
## Why improve cardiorespiratory fitness?

- Increase in cardiorespiratory fitness (1-MET, 3.5 ml/kg/min)
  - 7 cm decrease in waist circumference
  - 5 mmHg decrease in systolic blood pressure
  - 1 mmol/L reduction in fasting plasma glucose

## Cardiorespiratory Exercise

- Adults should get at least 150 minutes of moderate-intensity exercise per week.
- Exercise recommendations can be met through 30-60 minutes of moderate-intensity exercise (five days per week) or 20-60 minutes of vigorous-intensity exercise (three days per week).
- One continuous session and multiple shorter sessions (of at least 10 minutes) are both acceptable to accumulate desired amount of daily exercise.
- Gradual progression of exercise time, frequency and intensity is recommended for best adherence and least injury risk.
- People unable to meet these minimums can still benefit from some activity.

Barrier = Time



# High Intensity Interval Training (HIIT)

- Maximal Oxygen Consumption =  $VO2_{max}$
- Maximal Heart Rate =  $HR_{max}$
- Moderate Intensity Exercise
  - 46% - 63%  $VO2_{max}$
  - 64% – 76%  $HR_{max}$
- Vigorous Intensity Exercise
  - 64% - 90%  $VO2_{max}$
  - 77% – 95%  $HR_{max}$

**Table 1.** Summary of adaptations following 2, 6 and 12-15 weeks of low-volume high-intensity interval training (HIIT).

Protocol	Time/session	2 wk	6 wk
Wingate HIIT (four to six 30-s sprints; 4-min recovery)	~20 min	<ul style="list-style-type: none"> <li>↑ <math>\dot{V}O_{2max}</math> (Whyte et al. 2010; Hazell et al. 2010; Astorino et al. 2012)</li> <li>↑ 250, 750 kJ and 5 km TT performance (Burgomaster et al. 2005; Gibala et al. 2006; Hazell et al. 2010)</li> <li>↑ Wingate PPO and MPO (Burgomaster et al. 2005; Whyte et al. 2010; Hazell et al. 2010)</li> <li>↑ Resting muscle glycogen content (Burgomaster et al. 2005)</li> <li>↑ Maximal activity of CS and COX (Burgomaster et al. 2005, 2006; Gibala et al. 2006)</li> <li>↑ COXII and COXIV protein content (Gibala et al. 2006)</li> <li>↑ IS (Cederholm Index and GIR) (Babraj et al. 2009; Richards et al. 2010)</li> <li>↓ OGTT glucose and insulin AUC (Babraj et al. 2009; Richards et al. 2010)</li> <li>↑ Resting fat oxidation 24 h post-training (Whyte et al. 2010)</li> <li>↓ SBP 24-h post-training (Whyte et al. 2010)</li> </ul>	<ul style="list-style-type: none"> <li>↑ <math>\dot{V}O_{2max}</math> (Burgomaster et al. 2007, 2008; Astorino et al. 2012)</li> <li>↑ 250 kJ TT performance (Burgomaster et al. 2007)</li> <li>↑ Wingate PPO and MPO (Burgomaster et al. 2008)</li> <li>↑ Resting muscle glycogen content and ↓ glycogen utilization during exercise (Burgomaster et al. 2008)</li> <li>↑ Maximal activity of CS and <math>\beta</math>-HAD (Burgomaster et al. 2008)</li> <li>↑ GLUT4, PDH and COXIV protein content (Burgomaster et al. 2007, 2008)</li> <li>↑ Whole-body fat oxidation and ↓ CHO oxidation during exercise (Burgomaster et al. 2008)</li> <li>↑ Peripheral arterial compliance (Rakobowchuck et al. 2008)</li> <li>↑ Endothelial function (Rakobowchuck et al. 2008)</li> </ul>



May not be  
feasible for all



# **The 1-minute workout: How to get fit in 60 seconds**



Twelve Weeks of Sprint Interval Training Improves Indices of Cardiometabolic Health Similar to Traditional Endurance Training despite a Five-Fold Lower Exercise Volume and Time Commitment.

- 12 Week Intervention, 3 x week
  - Sedentary Males
- Moderate Intensity Continuous Training (MICT)
  - 45 min continuous cycling at 70% HR<sub>max</sub>
  - Total Time = 50 mins
- Sprint Interval Training (SIT)
  - 3 x 20 second all out sprints
  - 2 minutes recovery
  - Total Time = 10 mins

Table 2. Descriptive Characteristics and Markers of Glycemic Control.

VARIABLE	MCT (n=8)		SIT (8)		CTL (8)		STATISTICS		
	PRE	POST	PRE	POST	PRE	POST	Time	Group	T x G
Weight (kg)	84 ± 20	82 ± 20	84 ± 23	83 ± 22	78 ± 25	78 ± 23	0.111	0.875	0.364
BMI (kg/m <sup>2</sup> )	26 ± 6	26 ± 6	27 ± 5	26 ± 5	25 ± 7	25 ± 7	0.125	0.609	0.304
Percent Fat (%)	27 ± 10	25 ± 10*	30 ± 7	28 ± 8*	24 ± 6	25 ± 8	0.098	0.546	0.042
VO <sub>2peak</sub> (L/min)	2.7 ± 0.6	3.2 ± 0.6*	2.6 ± 0.8	3.0 ± 0.7*	2.5 ± 0.7	2.5 ± 0.7	<0.0001	0.338	<0.0001
Max Workload (W)	249 ± 30	271 ± 30*	243 ± 38	275 ± 30*	219 ± 30	213 ± 32	<0.0001	0.141	<0.0001
CSL	5.0 ± 3.2	6.7 ± 5.0*	4.9 ± 2.3	7.3 ± 4.7*	7.4 ± 5.8	7.0 ± 4.9	0.006	0.841	0.008
K <sub>it</sub> (1/min)	2.0 ± 0.9	2.1 ± 0.7	2.1 ± 0.9	2.4 ± 0.8	2.1 ± 0.6	2.1 ± 0.7	0.119	0.822	0.176
ΔAUC <sub>0-30</sub> (μM/min)	1171 ± 281	1007 ± 240	1231 ± 703	1148 ± 344	1090 ± 343	1158 ± 308	0.238	0.958	0.363
ΔInsulin AUC (μM/min)	1423 ± 712	1223 ± 640	1515 ± 817	1454 ± 1065	1317 ± 348	1425 ± 1025	0.463	0.923	0.209
ΔGlucose AUC (mmol/L)	301 ± 144	257 ± 100*	300 ± 93	295 ± 75*	291 ± 52	292 ± 54	0.001	0.235	0.004
FPG (mmol/L)	5.3 ± 0.6	5.2 ± 0.8	5.0 ± 1.2	5.4 ± 0.8	5.5 ± 1.8	5.4 ± 0.8	0.164	0.641	0.284
FPI (μM/min)	10.1 ± 5.3	8.4 ± 5.9	9.5 ± 5.3	7.8 ± 4.1	7.5 ± 6.4	13.8 ± 13.2	0.454	0.982	0.135
HOMA-IR	2.4 ± 1.6	2.3 ± 2.1	2.1 ± 1.3	1.8 ± 1.8	2.0 ± 2.2	2.7 ± 3.7	0.465	0.92	0.348
GLUT4 Protein Content	1.0 ± 0.6	1.3 ± 0.6*	1.0 ± 0.8	1.8 ± 0.6*	1.0 ± 0.4	0.8 ± 0.4	0.003	0.403	0.021

Values are means ± S.D. VO<sub>2peak</sub>, maximal oxygen uptake; CSL, insulin sensitivity index from IVGTT; K<sub>it</sub>, glucose rate of disappearance during 10–50 min of IVGTT; ΔAUC<sub>0-30</sub>, insulin area under the curve from 10–30 min of IVGTT; ΔInsulin AUC, insulin area under the curve from 0–30 min of IVGTT; ΔGlucose AUC, glucose area under the curve from 0–30 min of IVGTT; FPG, fasting plasma glucose; FPI, fasting plasma insulin.

\*Significantly different vs. pre-training (p<0.05), as determined by post-hoc analyses following a significant Time x Group interaction (T x G).

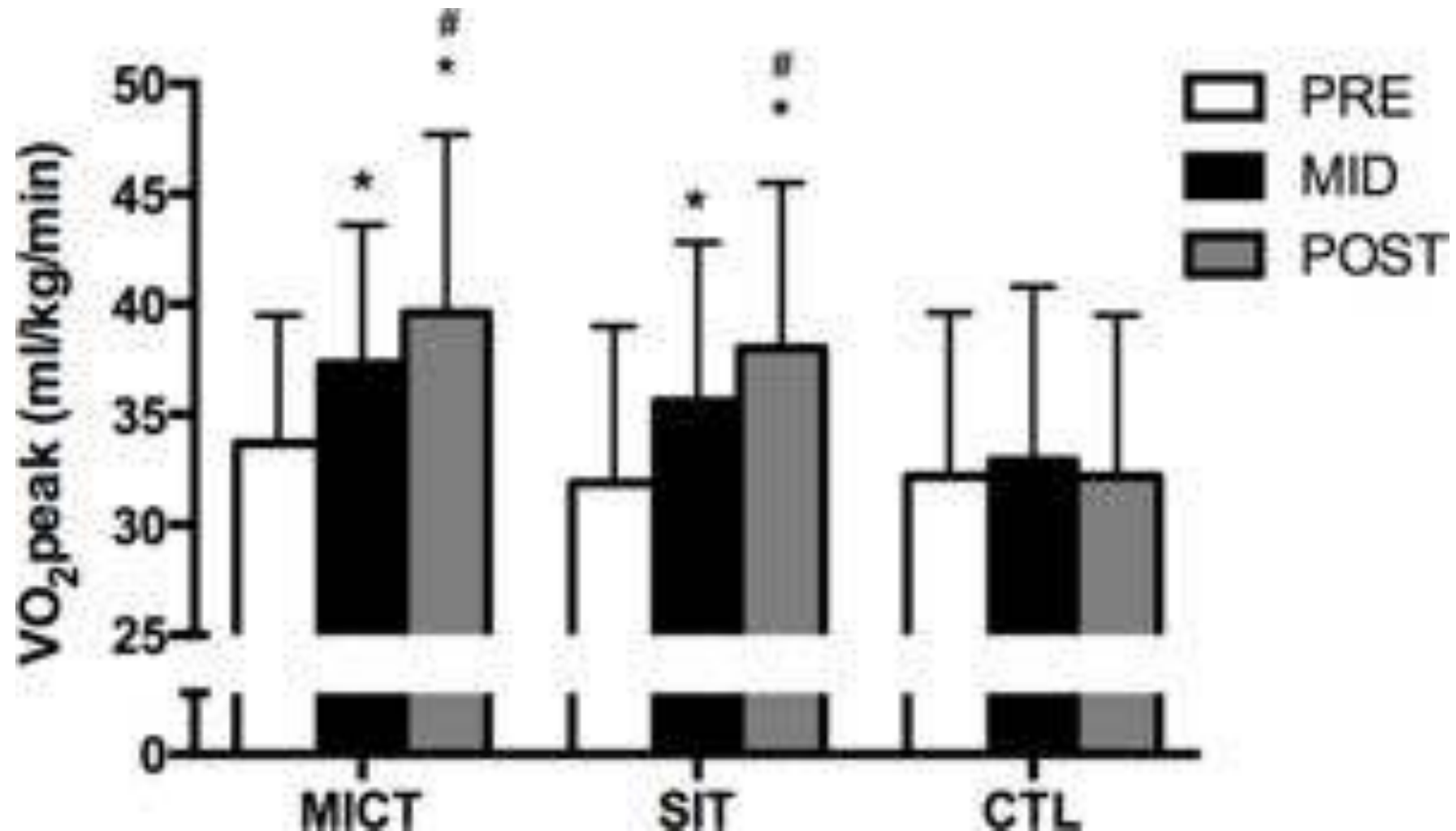
doi:10.1371/journal.pone.0154075.t002

Gillen JB, Martin BJ, MacInnis MJ, Skelly LE, Tarnopolsky MA, et al. (2016) Twelve Weeks of Sprint Interval Training Improves Indices of Cardiometabolic Health Similar to Traditional Endurance Training despite a Five-Fold Lower Exercise Volume and Time Commitment. PLOS ONE 11(4): e0154075.

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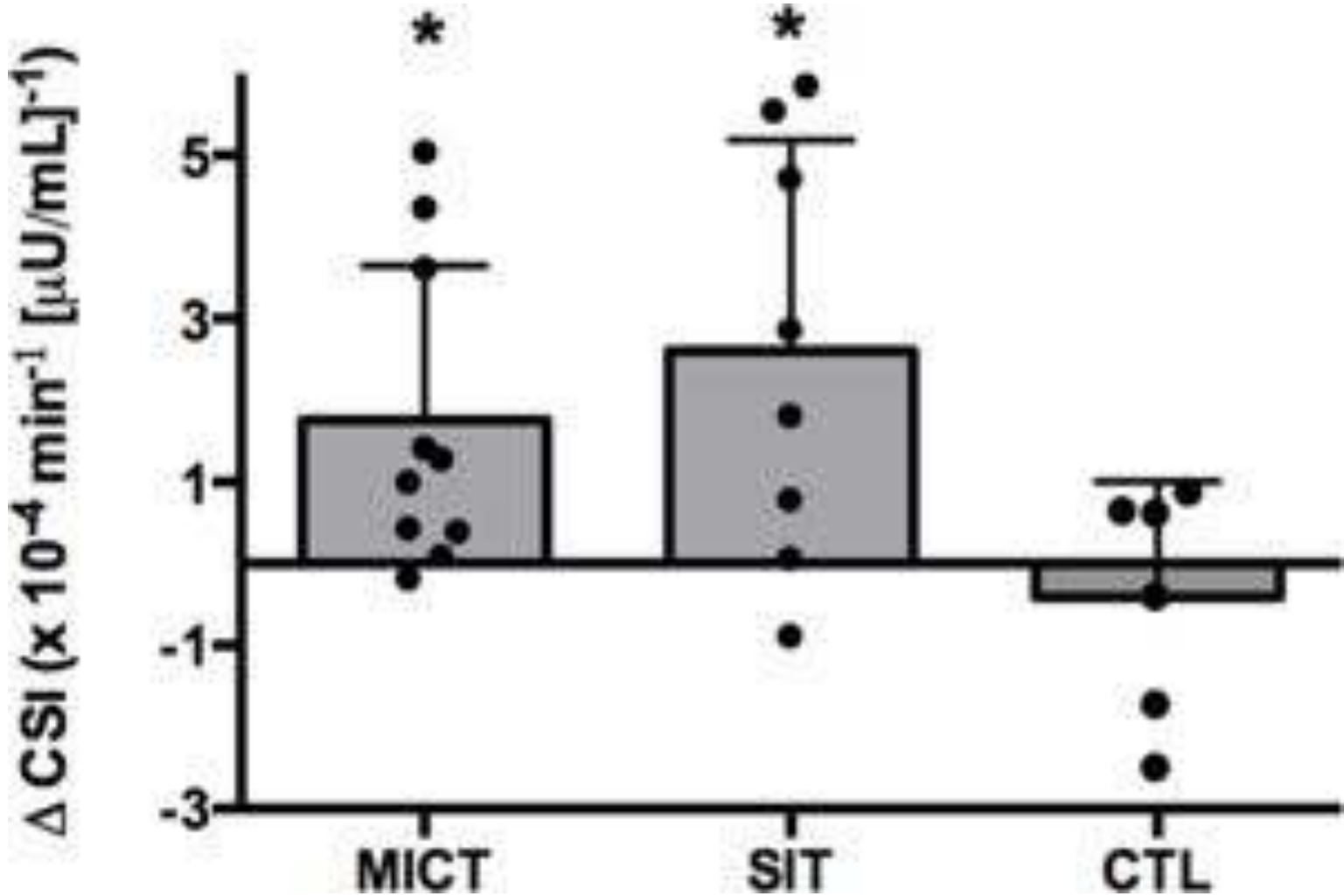
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Fig 1. Effect of SIT and MICT on VO<sub>2</sub>peak.



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Fig 2. Effect of SIT and MICT on insulin sensitivity.



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# Practical Considerations

- HIIT is still 10 – 30 minutes total
  - Warm up, cool down, stretch
- Must be willing to work at a high intensity
- Most studies utilized cycling, however, other activities are likely to be beneficial
  - Stair walking, running, swimming
- Those just starting an exercise program should begin with moderate continuous activity
- HIIT should be used as part of a complete exercise training regimen

## Resistance Exercise

- Adults should train each major muscle group two or three days each week using a variety of exercises and equipment.
- Very light or light intensity is best for older persons or previously sedentary adults starting exercise.
- Two to four sets of each exercise will help adults improve strength and power.
- For each exercise, 8-12 repetitions improve strength and power, 10-15 repetitions improve strength in middle-age and older persons starting exercise, and 15-20 repetitions improve muscular endurance.
- Adults should wait at least 48 hours between resistance training sessions.



## **Neuromotor Exercise**

- Neuromotor exercise (sometimes called “functional fitness training”) is recommended for two or three days per week.
- Exercises should involve motor skills (balance, agility, coordination and gait), proprioceptive exercise training and multifaceted activities (tai ji and yoga) to improve physical function and prevent falls in older adults.
- 20-30 minutes per day is appropriate for neuromotor exercise.

## Flexibility Exercise

- Adults should do flexibility exercises at least two or three days each week to improve range of motion.
- Each stretch should be held for 10-30 seconds to the point of tightness or slight discomfort.
- Repeat each stretch two to four times, accumulating 60 seconds per stretch.
- Static, dynamic, ballistic and PNF stretches are all effective.
- Flexibility exercise is most effective when the muscle is warm. Try light aerobic activity or a hot bath to warm the muscles before stretching.

# Conclusions

- Some exercise is better than none
- Make exercise work for the patient and their lifestyle



# Thank You & Questions?

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