Recommended Protocol Durations For Testing VO_2max

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History

- In the beginning, intermittent protocol, distributed over several days
- Early researching comparing protocols was more for VO_2max prediction than protocol development
- Buchfuhrer et al. (1983) was the first study designed to assess protocol duration (*8 – 17 min, 5 subjects/group*)
- Astorino (2004) – 26 subjects; 6, 10, 14 min treadmill protocols

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Current Recommendations

10 – 12 min, regardless of gender, age, fitness, health

Current Practice

5 – >25 min, regardless of gender, age, fitness, health

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Methods

- 16 subjects (8 male, 8 female); cyclists, triathletes, moderate to high VO_2max
- males > 45 mL/kg/min; females > 40 mL/kg/min: *cycle ergometry*
- Familiarization test to determine VO_2max, peak Watts, Watts increment and protocol duration

5 min protocol: MPOF (Watts) / 5 (min) x 1.2

8 min protocol: MPOF (Watts) / 8 (min) x 1.1

12 min protocol: MPOF (Watts) /12 (min) x 1.0

16 min protocol: MPOF (Watts) /16 (min) x 0.9

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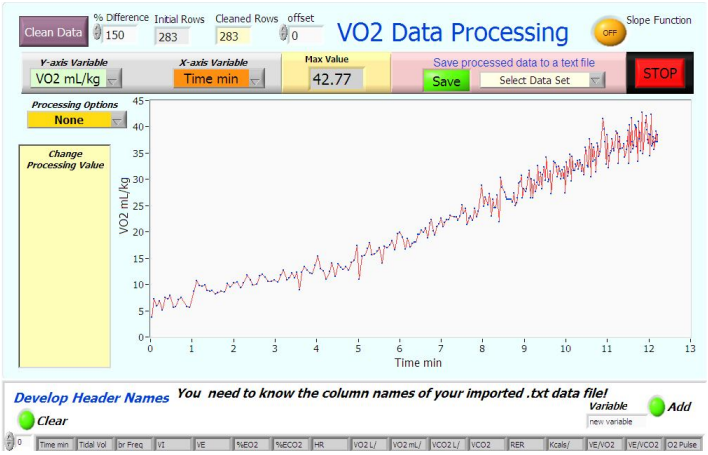
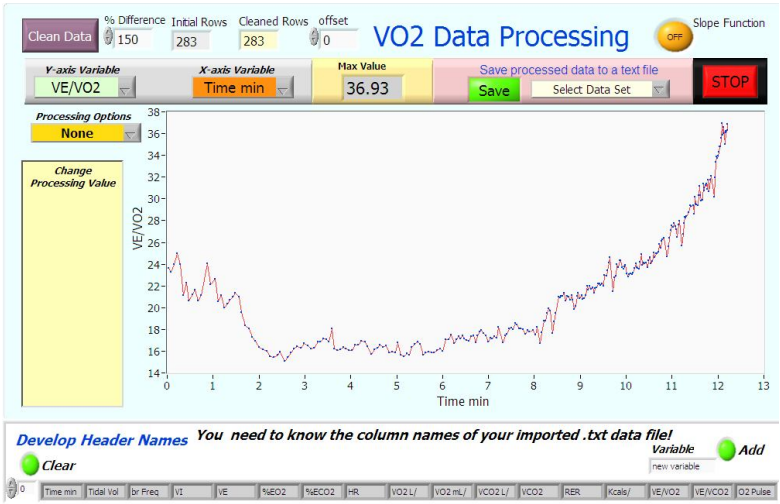
- Exercise tests completed in balanced Latin-squares order; 2 tests each day, separated by 45 min on two different days.
- automated breath-by-breath indirect calorimetry.
- Data processed to determine VO_2max and the VT.



- VO_2 plateau was defined as VO_2 time slope < 50 mL/min during last 30 s of test.
- VT detected using VE/VO_2 method.



Results

	Mean ± SD	Males	Females
Age (years)	24.9 ± 6.6	23.8 ± 3.2	26.0 ± 8.9
Height (cm)	171.9 ± 10.6	180.7 ± 6.0	163.1 ± 5.4
Weight (kg)	66.8 ± 11.1	75.7 ± 6.9	57.8 ± 5.6
Fat (%)	16.4 ± 5.8	11.6 ± 2.4	21.2 ± 3.6
VO_2max (L/min)	3.66 ± 0.88	4.44 ± 0.39	2.87 ± 0.36

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Protocol durations (min)

Variable	Mean ± SD	Males	Females
5 min	5.05 ± 0.17	5.12 ± 0.18	4.98 ± 0.13
8 min	7.77 ± 0.23	7.84 ± 0.20	7.69 ± 0.26
12 min	11.53 ± 0.42	11.49 ± 0.45	11.58 ± 0.40
16 min	16.25 ± 0.42	16.02 ± 0.37	16.49 ± 0.31

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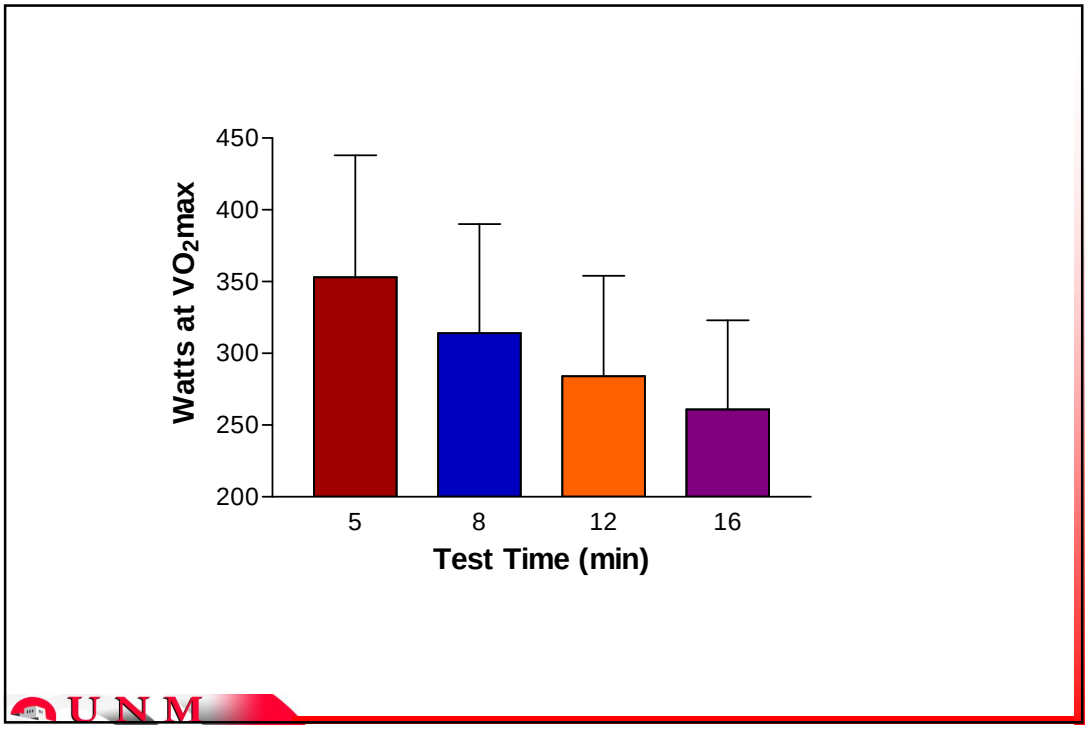
Watts at VO2max
450
400
350
300
250
200
5
8
12
16
Test Time (min)
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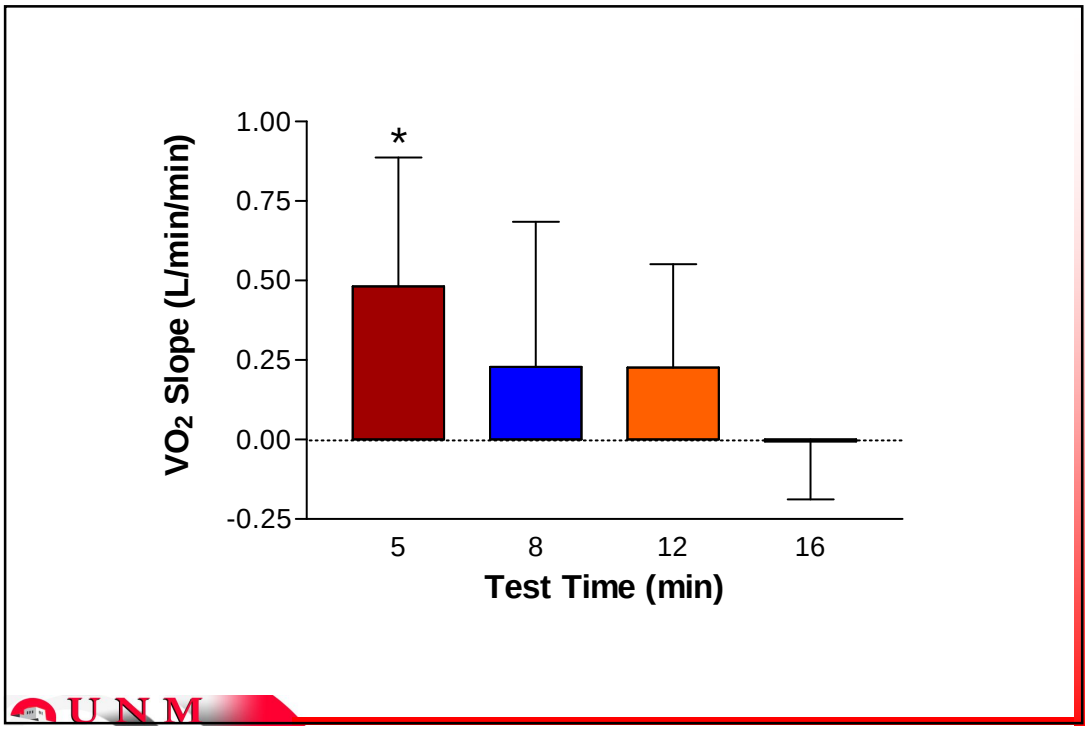
VO2 Slope (L/min/min)
1.00
0.75
0.50
0.25
0.00
-0.25
*
5
8
12
16
Test Time (min)
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VO_2 Plateau

	Incidence	
Protocol	**Males**	**Females**
5 min	1	1
8 min	3	6
12 min	2	4
16 min	5	4

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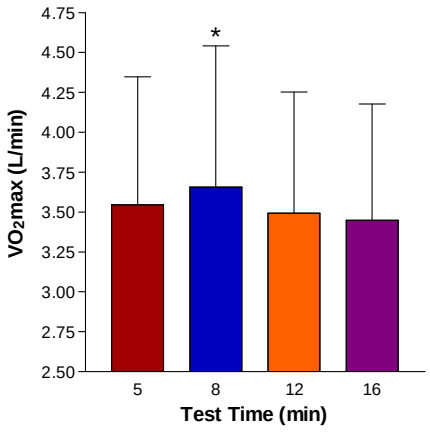

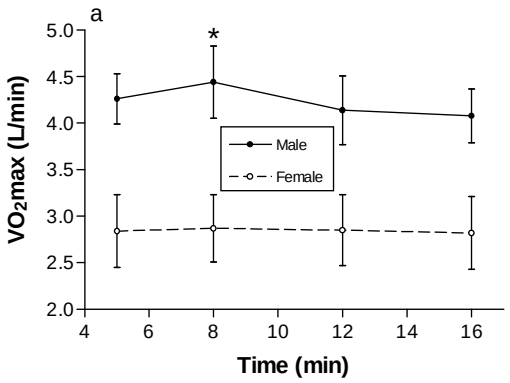

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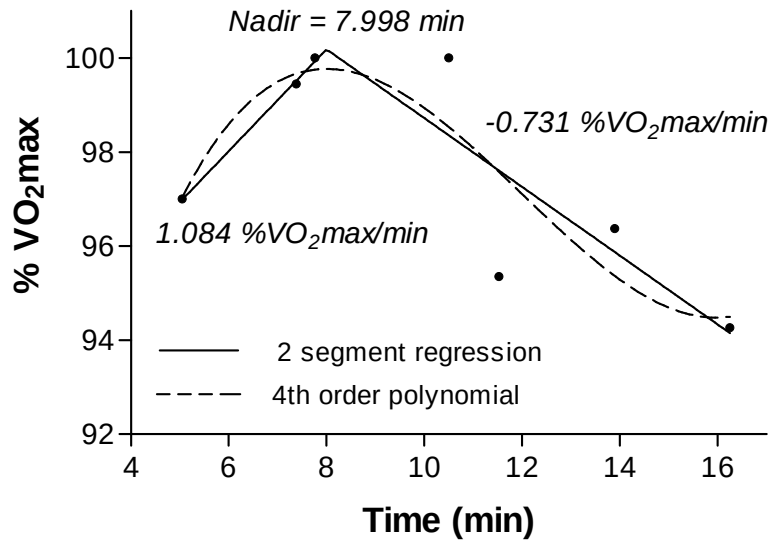

Conclusions

- VO_2max testing requires protocol durations between 6-10 min.
- More important for trained than untrained individuals.
- Exercise physiology needs to re-explore the science of protocol development.