

Tissue Gas Exchange during Hyperbaric Exposures Athletes vs. Non-athletes

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Objectives: In this study we investigate whether or not differences exist in human skeletal muscle (MM) and subcutaneous (SC) tissue gas tensions between athletes and non-athletes measured under room air and hyperbaric conditions.

Athletes Met the Following Criteria

Aerobic Exercise: An activity raising the body's demand for oxygen resulting in a temporary increase in rate of respiration & heart rate, performed at least three times per wk for at least 90 min on each occasion

Activities of the Athlete Subjects: Running, bicycling, swimming

Non-athlete "Exercise" Activity Included:

Hospital parking lot to hospital and return after shift and/or work week ends/holidays: Spectator at sports & entertainment events. Golf using a golf cart

Anthropomorphic Characteristics of subjects

	ATHLETE PROTOCOL A	NONATHLETE	TOTAL
Number (%)	13(36)	23(64)	36(100)
Mean Age/Yrs (+/-)	34.2Yrs +/-12.8	34.4Yrs +/-9	34.5 Yrs +/-10.9
Mean Height/Centimeters (+/-SD)	169.77 +/-10.2	169.72 +/-6.3	169.67 +/-9.44
Mean Weight/Kilograms (+/-SD)	63.9 +/-14.8	73.09 +/-14.5	69.7 +/-34.1

	ATHLETE PROTOCOL B	NONATHLETE	TOTAL
Number (%)	13(39)	20(61)	33(100)
Mean Age/Yrs (+/-SD)	34.2Yrs +/-12.8	35.35Yrs +/-9.25	35 Yrs +/-11.2
Mean Height/Centimeters (+/-SD)	169.77 +/-10.2	168 +/-12	166.8 +/-3.8
Mean Weight/Kilograms (+/-SD)	63.9 +/-14.8	71.5 +/-14.7	68.18 +/-15

Protocol A: Nonathlete is 12.5 % heavier than Athlete, and 0.05 Centimeters shorter
Protocol B Nonathlete is 11% heavier than Athlete, and 1.77 Centimeters shorter

Methods: Gas tensions in resting MM & SC tissues were recorded using a mass spectrometer at 4-minute intervals during 2½ to 3 hr. periods in athletes & non-athletes during normobaric, normoxic (room air) & hyperbaric (HB) conditions. Two HB oxygen (HBO) protocols were utilized: Protocol A employed the continuous breathing of oxygen (O₂) at 2 ATA, a typical monoplace HB chamber treatment, while Protocol B utilized intermittent air breaks between O₂ breathing periods at 2 ATA representative of a multiplace HB chamber treatment.

Results: All tissue gas tensions changed significantly (repeated measures of variance, $p=0.00001$) with time as pressures & gas mixtures breathed were altered. Significant Individual Step Analysis (ISA) differences occurred with unloading of nitrogen (N₂) from the muscle compartment in both protocols (T-Test & Wilcoxon's Rank Sum). The interaction of grouping variable & time revealed significant differences between athletes & non-athletes in loading SC O₂ ($p=0.035$), MM O₂ ($p=0.0001$) & SC N₂ (Protocol B). Carbon dioxide (CO₂) levels in both protocols decreased significantly with time when exposed to HBO while increasing when breathing air at 2 ATA.

P- Values for Repeated Measures Analysis of Variance:

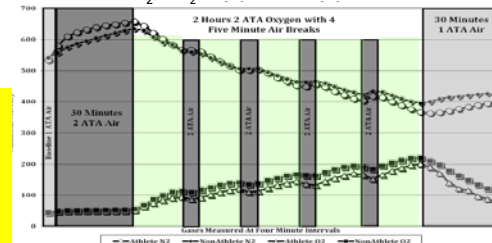
	ATHLETE Protocol A			NONATHLETE Protocol B		
	S	R	R X S	S	R	R X S
SO ₂	0.205	1E-05	0.035	0.682	1E-05	0.999
SN ₂	0.083	1E-05	0.726	0.839	1E-05	0.01
MO ₂	0.004	1E-05	0.0001	0.443	1E-05	0.611
MN ₂	0.085	1E-05	0.976	0.066	1E-05	0.998
SCO ₂	0.303	1E-05	0.974	0.632	1E-05	0.332
MCO ₂	0.905	1E-05	0.066	0.892	1E-05	1

Legend for repeated measures of Variance:
S = Grouping Variable effect
R = Time effect
R X S = Interaction of Grouping Variable and Time

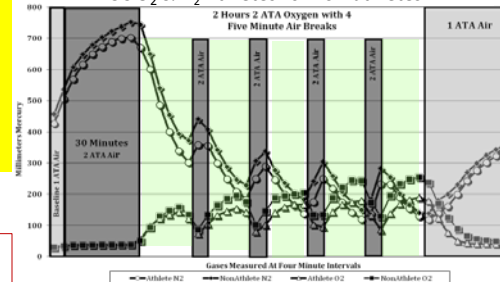
SO₂ = Subcutaneous Oxygen.
SN₂ = Subcutaneous Nitrogen.
MO₂ = Muscle Oxygen
SCO₂ = Subcutaneous Carbon Dioxide
MCO₂ = Muscle Carbon Dioxide
MN₂ = Muscle Nitrogen

Protocol B (HBO with air breaks)

SC O₂ & N₂ Athletes vs. Non-athletes



SC O₂ & N₂ Athletes vs. Non-athletes



Probe Insertion

14 Gauge Needle !!!

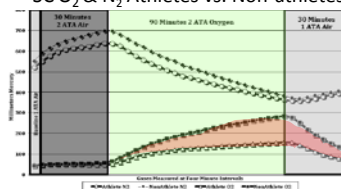


Casket Rule

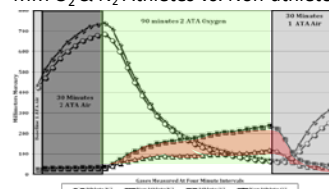
Try on yourself 1st that which you would not have others do... and errors will not be repeated

Protocol A (Continuous HBO)

SC O₂ & N₂ Athletes vs. Non-athletes



MM O₂ & N₂ Athletes vs. Non-athletes



Conclusions:

1. At rest athletes do not load O₂ to the same extent as non-athletes ($p= <0.001$)
2. During 5 minute air-breaks, athletes significantly increase SC & MM tissue O₂'s
3. Differential uptake of O₂ during HBO may reflect aerobic condition effects in athletes and warrants further studies