

Demography subjects S1 - S5

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Introduction

The descent is critical phase of dive (pressure-equalizing, low luminance adaptation, mental stress, ..).

Hypotheses:

- More air consumption in novice divers,
- less in medium experienced divers
- more in expert divers to prevent hypercapnia and N2-narcosis.

Aims of this novel pilot in diving-physics and physiology:

- 1 develop exact method of calculating air consumption,
- 2 examine above hypotheses
- 3 examine heart rate during descent and beyond.

Methods

Five divers, various experience, open sea descent to 34 msw, then ascent to 13-8 msw.

Every 4 s tank pressure, water temp and HR sampled (UWATEC Galileo Luna with HR meter)

Air consumption (AC) in ambient pressure (aL/min) was calculated and correcting for lung volume equilibration.

Sj	Sex	Age	Weight	BMI	Dive experience	
		years	kg	kg/m ²	# dives	
S1	f	39	72	23.5	35	novice
S2	m	45	72	23.8	250	medium
S3	m	59	102	31.5	>2000	expert
S4	m	66	72	23.5	210	medium
S5	m	72	64	23.5	>1500	expert

Calculation

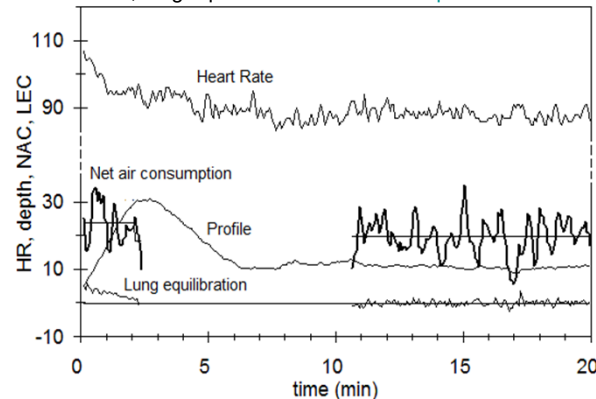
With $PV = nRT$ and $PV^\gamma = \text{constant}$, and defining: V tank volume (12 L), R universal gas constant, T water temperature (Kelvin), P_t measured tank pressure, $P_{a,j}$ j -th tank pressure after j -th inspiration ($j = 1, 2, \dots, 300$), γ adiabatic index, h halftime heat transfer, for the j th interval it holds that:

$$2^{-\Delta V/h} \cdot P_{t,j-1} (n_j/n_{j-1})^\gamma + n_j \cdot kRT_j/V - P_{t,j} = 0,$$

The solved n_j gives momentary total AC (ambient L/min, 37°).

Results

Net-AC, lung equilibration and HR of expert S3.



Conclusions

During descent: heart rate elevated, experience? And subject-dependent extra ventilation.

Future research

Use standardized profiles and more subjects to unravel air consumption during descent.

Sub-ject	Descent rate	netAC descent	netAC MDD	netAC 13-8	HR descent	HR MDD	HR 13-8 msw
	msw/'	aL/'	aL/'	aL/'	beats/'	beats/'	beats/'
S5	27	30.9	21.5	16.7	124	118	95
S3	14	24.0	18.6	19.8	98	95	88
S3	17	24.4	19.2	18.1	99	89	85
S4	25	23.6	31.3	16.5	107	103	82
S4	35	12.8	17	16.3	128	120	95
S4	31	13.8	15.5	16.3	101	99	85
S2	23	15.3	17.1	15.4	117	113	98
S1	16	21.7	14.4	15.5	104	95	98
mean	23.6	20.8	19.3	16.8	109.8	103.9	90.8

* P < 0.05

Surface temperature ca. 27.5 0C, MDD 30.6 – 37.3 msw with 24.0 oC

