

## A8 Body fat does not influence venous bubble formation after air dives: nitrogen load models and experiments

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### Study questions

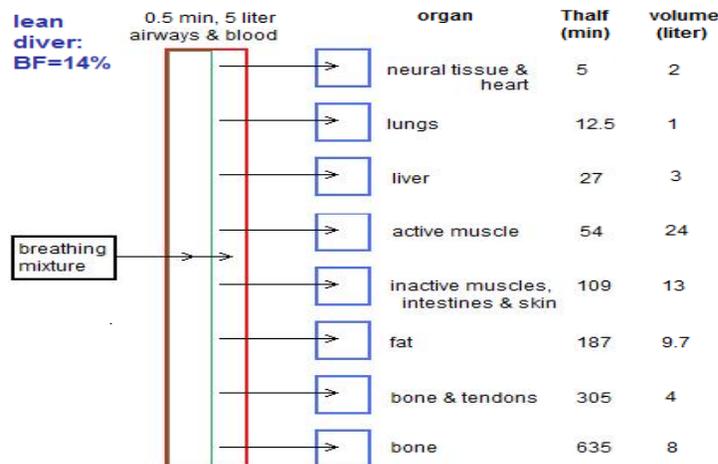
A. Is it theoretically possible that body fat (BF) affects venous gas bubble grade (VGB)?

B. Shows a Doppler experiment with subjects with a **wide range of body fat** but with (about) the **same age  $VO_{2max}$  and gender** (to negate multicollinearity) an influence of BF?

To simulate  $N_2$ -loads of lean and fat divers a series-parallel model was developed.

**Novelty: 1. blood compartment** (airways&circulation) precedes all //compartments;

**2. //compartments have halftimes and volumes**



### Material and methods

Modeling principle: every time interval  $PN_{2blood}$  is corrected by summed  $\Delta N_2$ -load $_{//comp}$  via Henry's law. Next,  $PN_{2blood}$  recalculated with  $PN_{2ambient}$ , then  $PN_{2//comp}$  from new  $PN_{2blood}$  and new summed  $\Delta N_2$ -load $_{//comp}$ , etc.

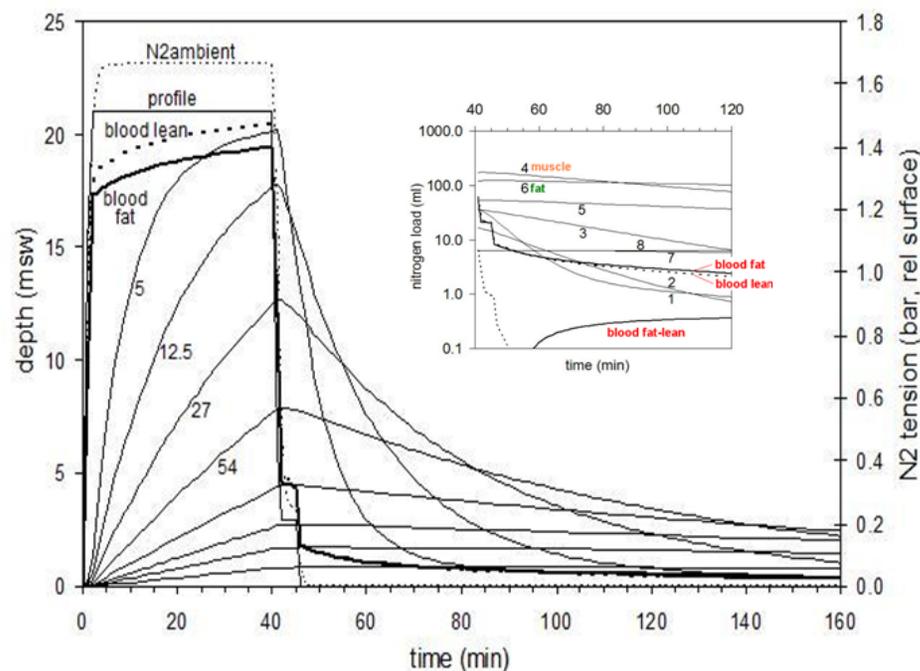
Preordial Dopplers (KM) were taken at 40, 80, 120, and 160 min. Profile 40 min/3.1 bar(a); 53 male divers. KM values transformed to  $\log KISS$  and to  $\log\{\#bubbles/cm^2\}$  ( $\log B$ ). Independent test variables: BF, age,  $VO_{2max}$ .

### Results

The model shows strongly delayed  $N_2$  uptake and especially release (see graph; //compartments of lean diver). One hour after surfacing, a 14 to 28% increase of BF gives a whole body increase of 51%, but only 15% in the blood (see inset)  $\rightarrow$  only a 0.01 KM 'units' increase (near KM = 1.)

Substantial changes in  $T_{half}$ 's, compartment volumes, profiles (saturation) and changes of  $T_{half}$ 's, after surfacing do not matter. The long supersaturation of blood compartment allows bubble grow (critical diameter concept).

All statistical outcomes of partial correlations between VGB data and BF are non-significant (P-values about 0.50), supporting the model outcomes.



### CONCLUSIONS

- 1 The robust series// $N_2$ -load model shows a **much slower uptake and release** than Haldanian models. This promotes bubble grow ( $d^{crit}$  concept).
2. The model shows that **BF is irrelevant for VGB**, even for saturation exposures (caisson work).
3. **Experiments and former experimental studies** (Schellart et al. ASEM 2012, reanalysis of Carturan et al. 2002) indicate that **BF does not affect VGB**.

Schellart et al., JAP, 2013:114;602-10.