

Nutrition for
saturation divers:
Latest finding and
future developments

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Background: why do we need nutritional guidelines?

Challenges to the body

- Loss in body mass (particularly muscle mass)
- Disturbances to hydration status
- Excess sodium loss
- Enhanced oxidative stress on key cells
- Possible period of immunosuppression (increase chance of cold and flu)
- Reduced red blood cell concentrations
- No vitamin D availability due to lack of sunlight (UVB rays)

Practical challenges

- Chamber limiting daily physical activity
- The environmental conditions (eg. Hyperoxia, helium and pressure)
- Work shift patterns
- Underwater excursions

Nutrition has the potential to support these physiological disturbance and therefore, support the health and performance of divers at work

The Assessment of Daily Energy Expenditure of Commercial Saturation Divers Using Doubly Labelled Water

Sanjoy K. Deb^{1,2}, Eimear Dolan³, Catherine Hambly⁴, John R. Speakman^{4,5}, Olav Eftedal⁶, Mohammed Gulrez Zariwala¹ and Ingrid Eftedal^{2,7}*

10 saturation divers volunteered for the study

18 d diving operation at a maximum working depth of 81 msw

Each diver completed 7.4 ± 1.7 underwater excursions on average during this operation, with an average underwater working period of 193.1 ± 25.9 min per excursion.

Study outline

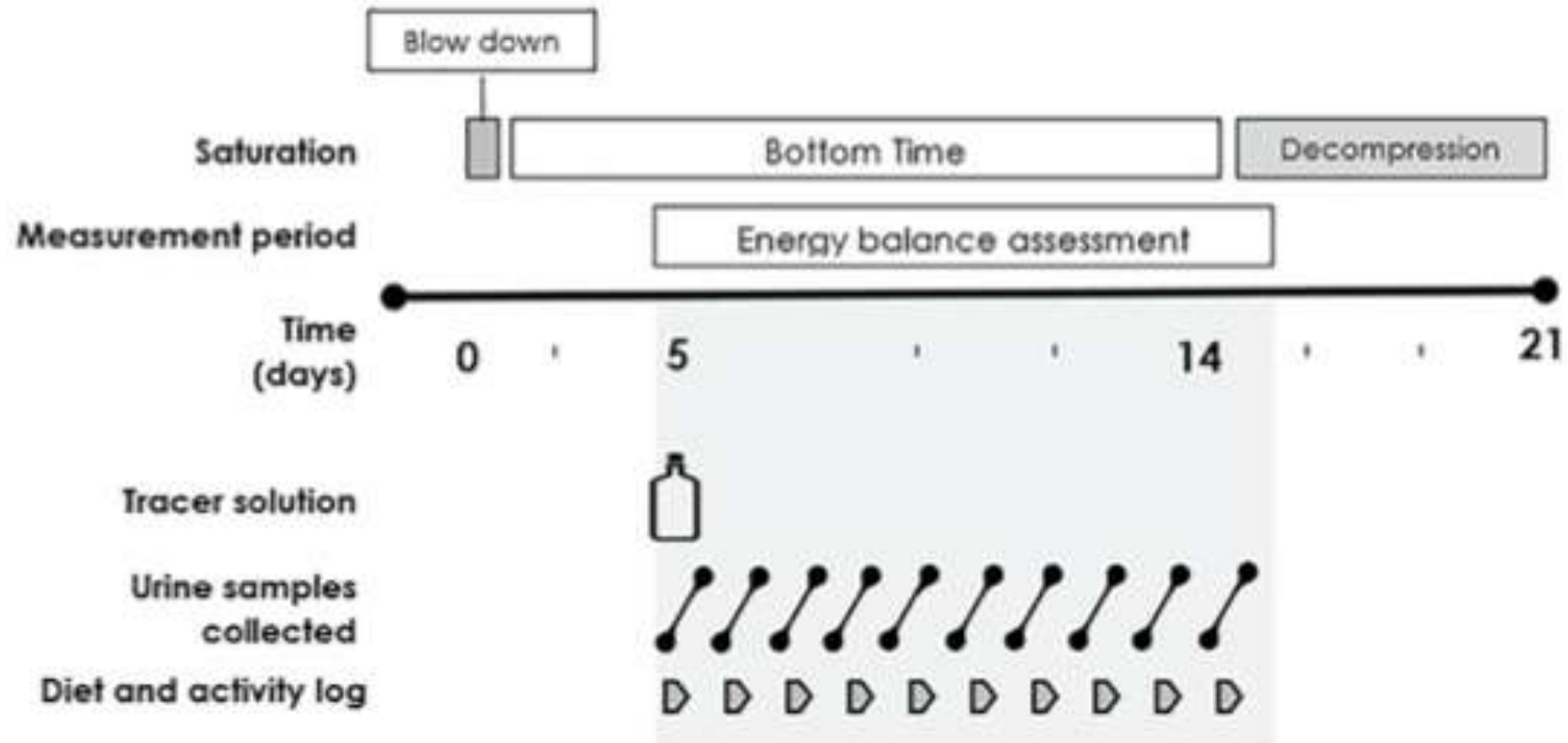
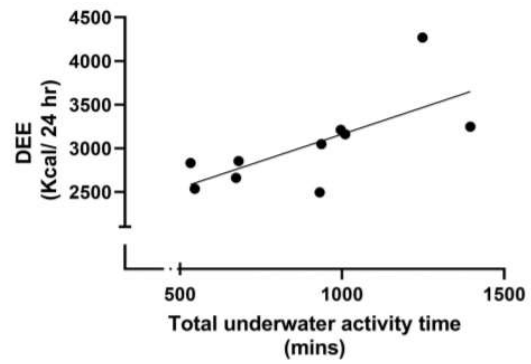
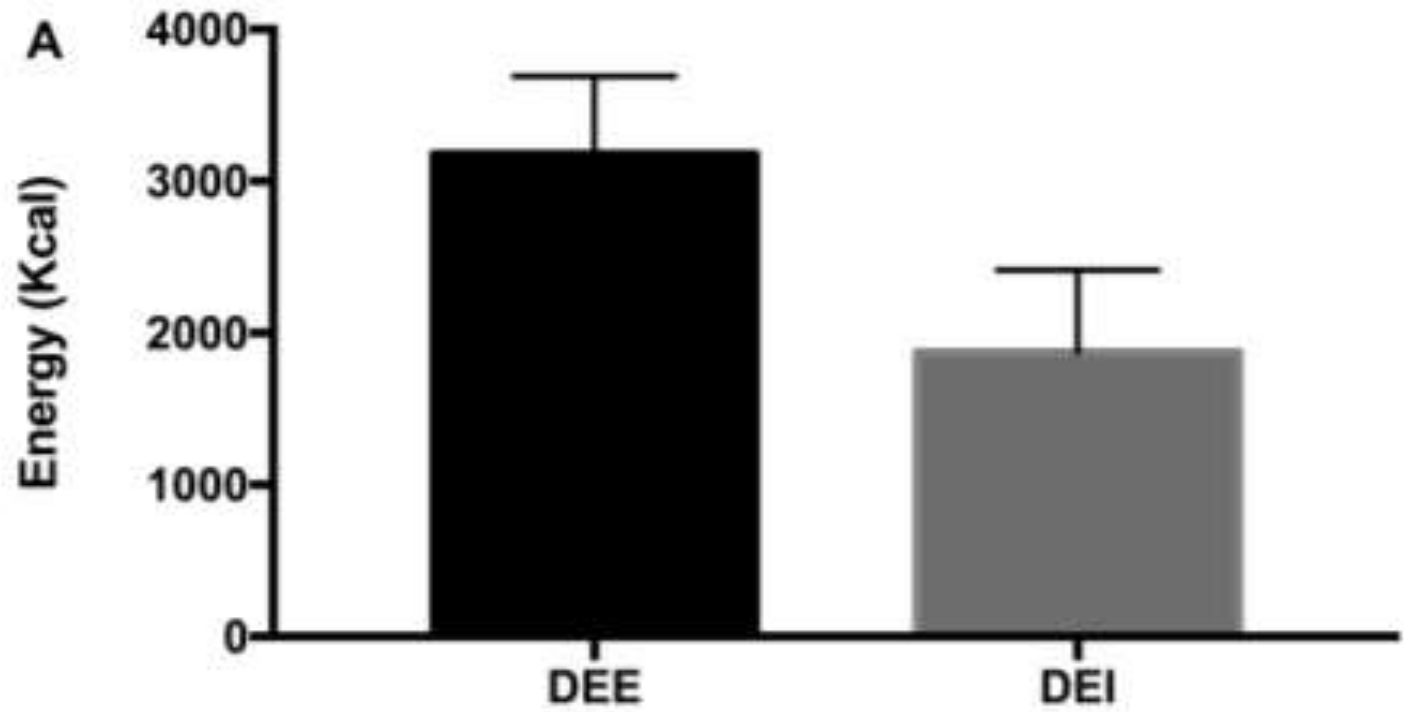
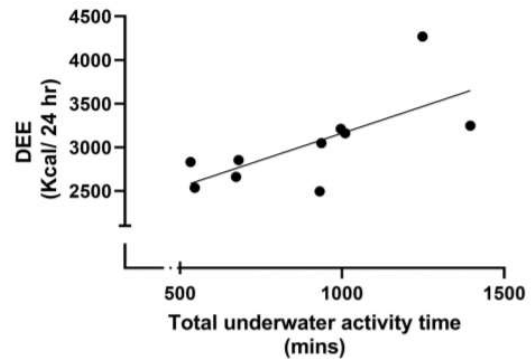
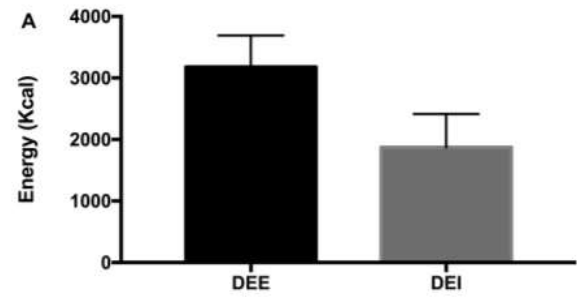


FIGURE 1 | Outline of the study protocol.

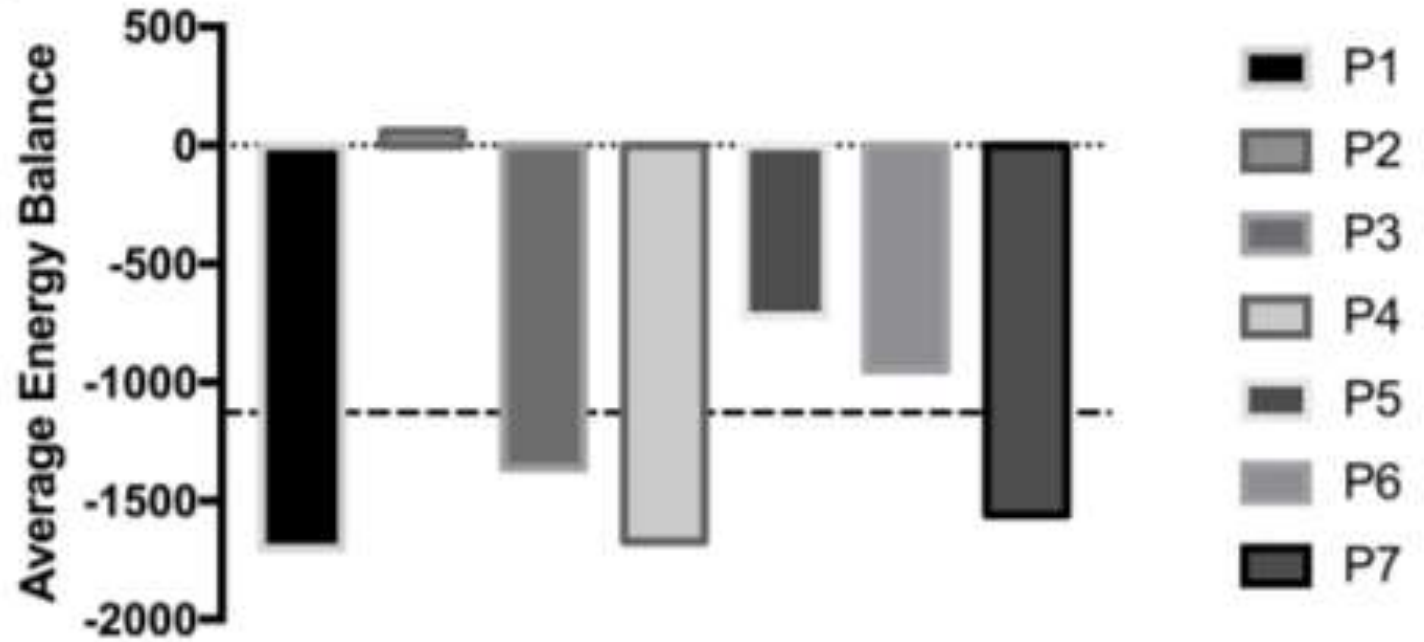


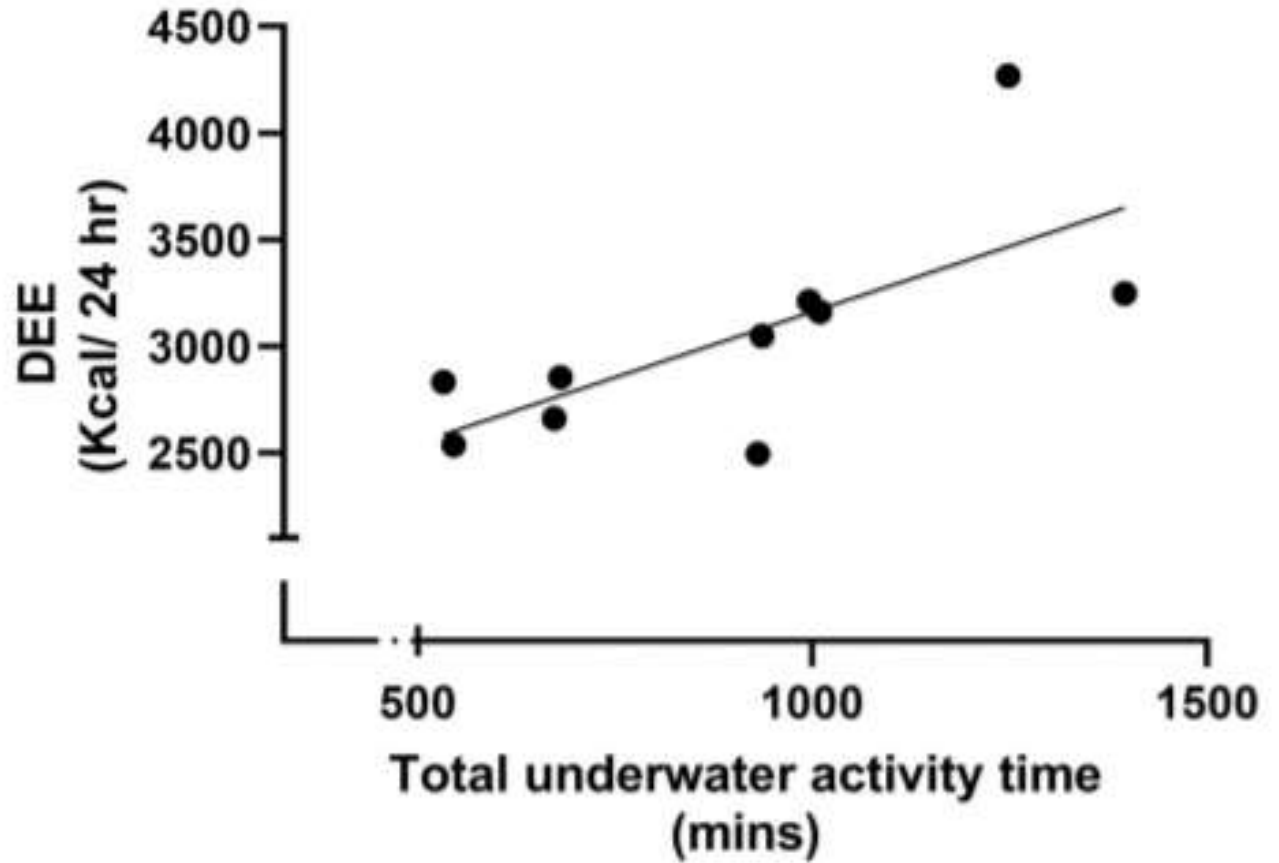
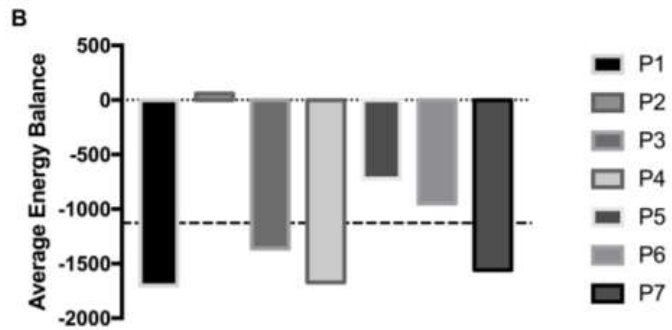
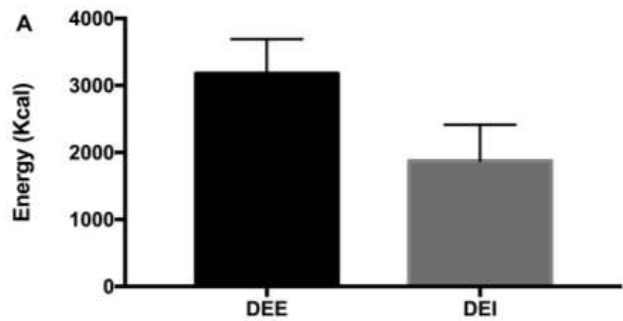
A





B





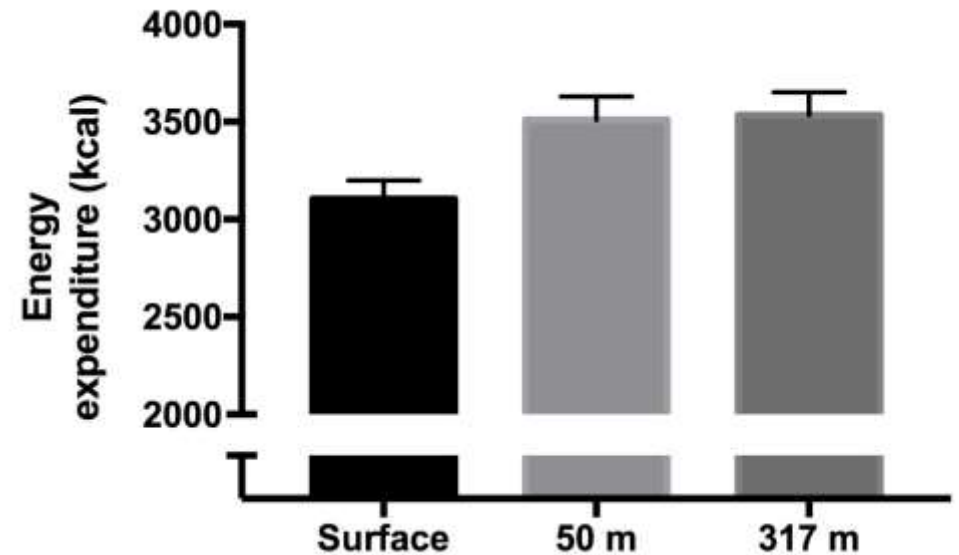
How does it compare to previous research?

Undersea & Hyperbaric Medicine, Vol. 21, No. 2, 1994

Energy expenditure and fluid production in hyperbaric He-O₂ environments using doubly labeled water

J. L. SEALE, J. W. THORP, J. M. CONWAY, W. V. RUMPLER,
and K. J. HABERMAN

U. S. Department of Agriculture, Agricultural Research Service, Beltsville Human Nutrition Research Center, Energy and Protein Nutrition Laboratory, Beltsville, Maryland; and U.S. Navy Medical Research Institute, Diving Medicine Laboratory, Bethesda, Maryland 20889



Significant increase in energy expenditure (average 430 kcal) was observed regardless of magnitude of hyperbaric pressure, therefore suggesting the hyperoxic and helium atmosphere are principle drivers.

Saturation Divers Are Susceptible To A Negative Energy Balance

Consequence:

- Body weight loss (Busch-Stockfish + Bohlen, 1994)
- Increase likelihood of colds and flu (Brenner et al. 1999)
- Impaired cognitive function and decision making
- Early fatigue development during underwater excursions

Calories consumed
may also reduce

Environmental factors

Under water activity

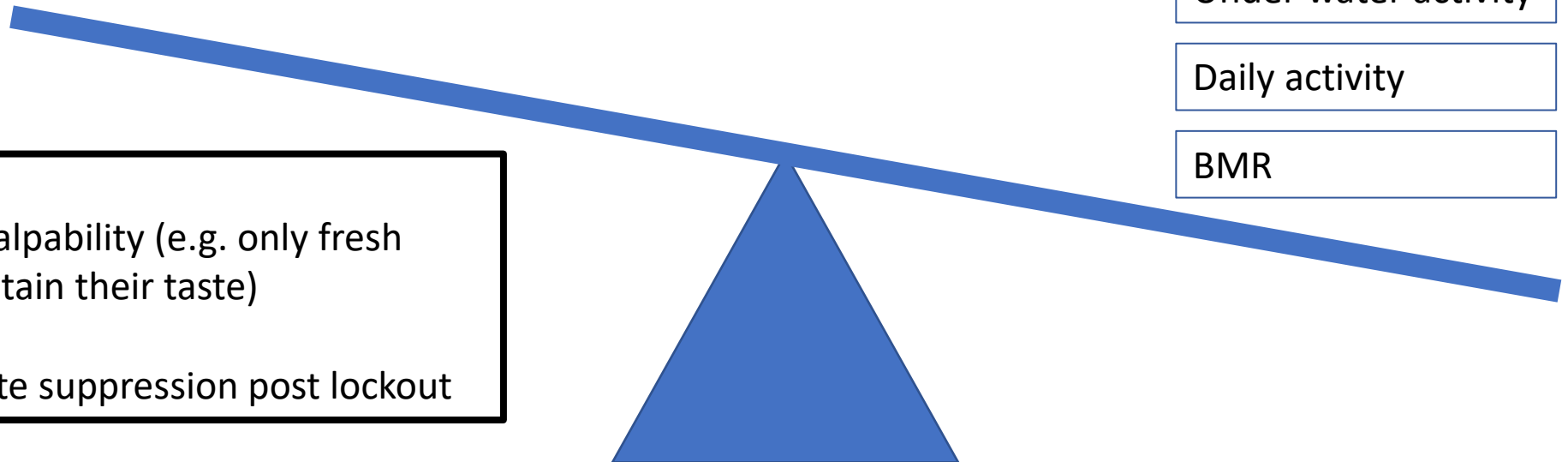
Daily activity

BMR

Due to:

Reduced food palpability (e.g. only fresh vegetables maintain their taste)

Potential appetite suppression post lockout



Study Conclusions and future directions

Both the environment and underwater activity can influence energy expenditure of saturation divers

Energy balance of saturation divers can differ, but with some divers susceptible to a negative energy balance

Future research should consider diving operations of a greater depth and more intensive work schedule

Wearable heart rate monitor devices may offer a solution to objectively monitor the intensity of underwater work and identify real time individual nutritional requirements of each diver

Future directions: The gut and saturation diving


ORIGINAL RESEARCH

Changes in the gut microbiota during and after commercial helium–oxygen saturation diving in China

Yuan Yuan ¹, Guosheng Zhao,² Hongwei Ji,³ Bin Peng,¹ Zhiguo Huang,³ Wei Jin,³ Xiaoqiang Chen,⁴ Haitao Guan,⁵ Guangsheng Tang,⁴ Hui Zhang,³ Zhenglin Jiang¹

J Appl Physiol 121: 973–979, 2016.
First published September 15, 2016; doi:10.1152/jappphysiol.00503.2016.

Gut fermentation seems to promote decompression sickness in humans

 Sébastien de Maistre,¹ Nicolas Vallee,² Emmanuel Gempp,¹ Pierre Louge,¹ Claude Duchamp,³ and Jean-Eric Blatteau²

¹*Service de Médecine Hyperbare et Expertise Plongée, Hôpital d'Instruction des Armées Sainte-Anne, Toulon, France;*
²*Équipe Résidente de Recherche Subaquatique Opérationnelle, Institut de Recherche Biomédicale des Armées, Toulon, France;* and ³*Laboratoire d'Ecologie des Hydrosystèmes Naturels et Anthropisés, UMR 5023-CNRS/UCBL, Université Claude Bernard Lyon 1, Villeurbanne, France*

Submitted 6 June 2016; accepted in final form 8 September 2016

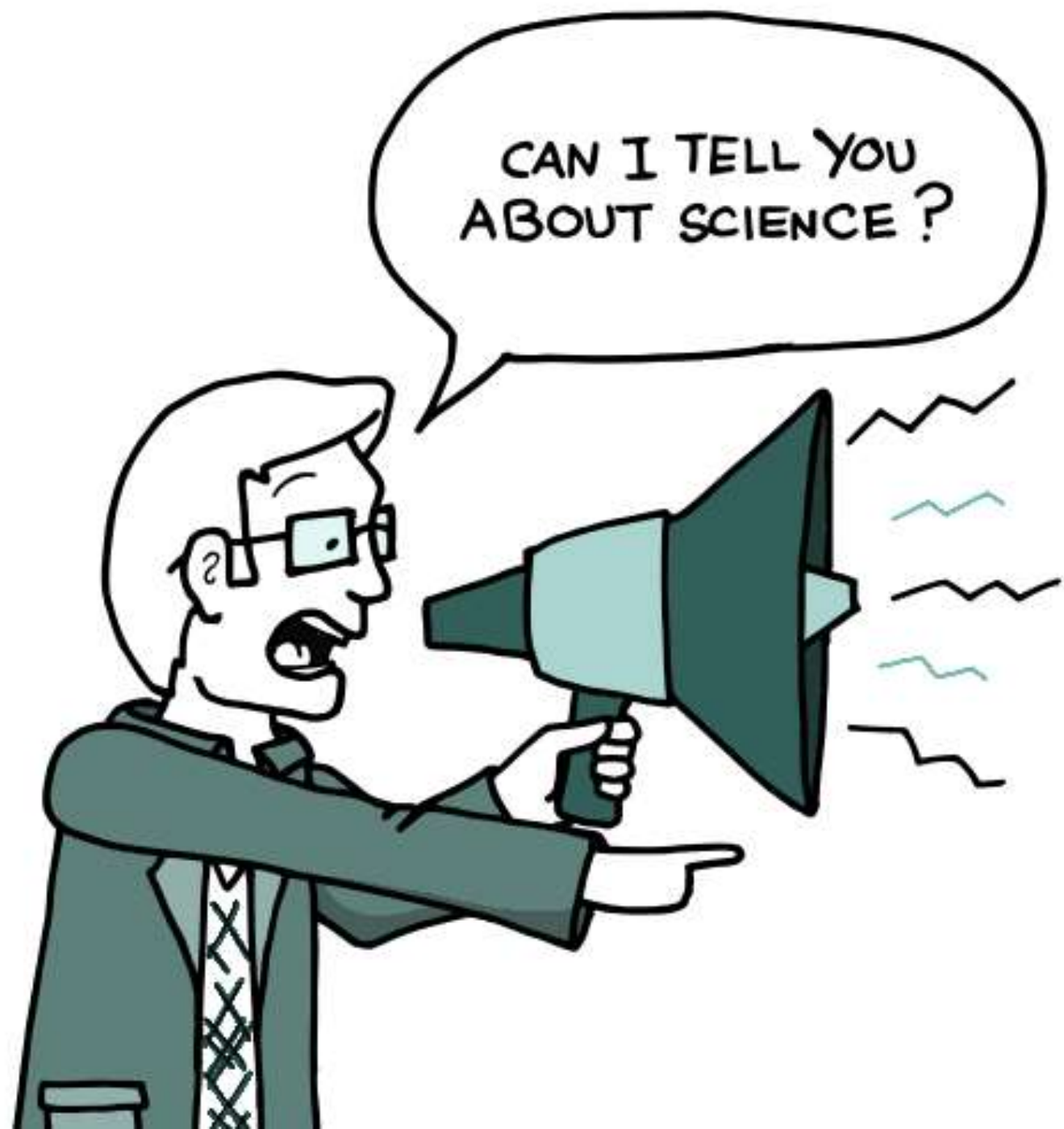
Can the use of specific diets (such a low fodmap) be beneficial in reducing the hydrogen production in the gut during decompression?

Future directions: post dive recovery with nutrition

Commercial Divers' Subjective Evaluation of Saturation

 Jean Pierre Imbert¹,  Costantino Balestra^{2,3},  Fatima Zohra Kiboub^{4,5*},  Øyvind Loennechen⁵ and  Ingrid Eftedal^{4,5,6}

- Twenty-two (44%) of the divers who responded declared having headaches; near surface (44%) or after surfacing (56%).
- 71% reported post-saturation fatigue after their last saturation, 82% of them described it as typical and systematic after each saturation.
- Recovery was reported to normally take from 1 to 10 days.



Thank you

