

PUFA changes in white adipose tissue during hibernation in common hamsters

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Behavioral &
Cognitive Biology

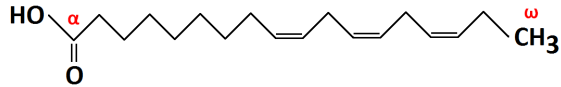
PUFAs

- **PolyUnsaturated Fatty Acids**
- Essential nutrients in mammals

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Alpha-linolenic acid
(ALA 18:3 n-3)

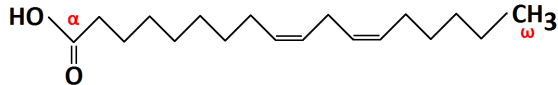


Flaxseed



Walnut

Linoleic acid
(LA 18:2 n-6)



Sunflower seeds

PUFAs

- **PolyUnsaturated Fatty Acids**
- Essential nutrients in mammals
- Highest concentrations in the central nervous system
- Precursors for eicosanoids
 prostaglandins, leukotrienes
- Positive effects of n-3 PUFAs on neurophysiology, behavior, inflammation, metabolism, reproduction, thermoregulation, etc.

PUFAs & hibernation

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 - delayed hibernation onset
 - reduced torpor expression
 - more BAT and higher body temperature during torpor

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- (fat-storing) hibernators usually retain (n-6) PUFAs and use monounsaturated or saturated fatty acids during hibernation

Common hamsters and PUFA use

- Food-storing hibernators

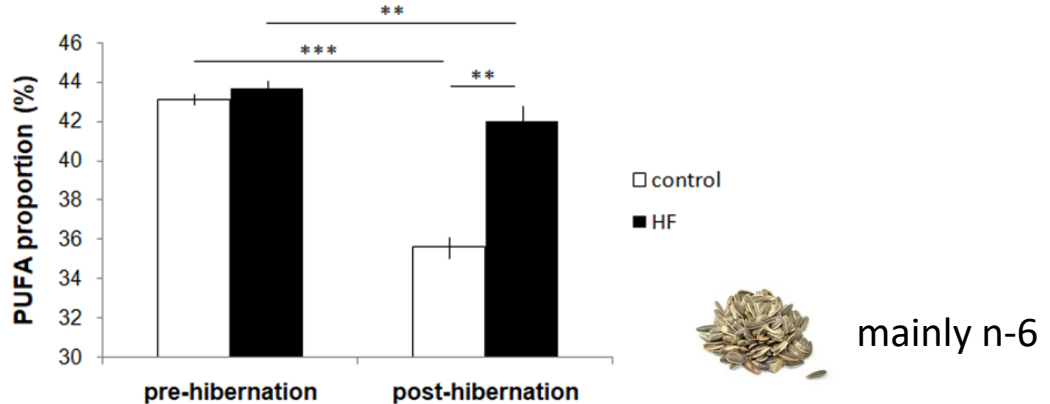


Common hamsters and PUFA use

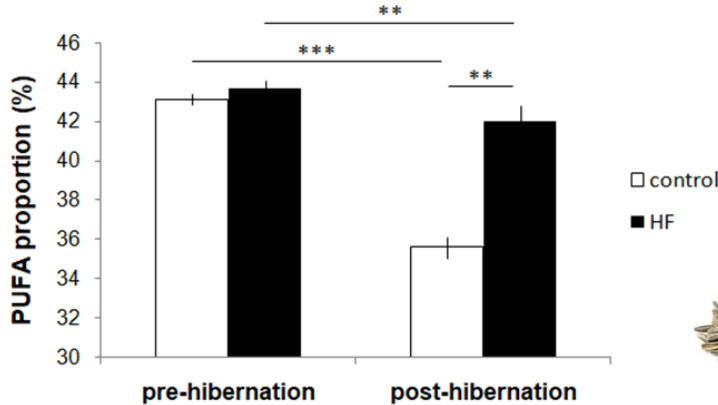
- Food-storing hibernators
- Food store manipulation under controlled conditions (Siutz et al., 2017, PLoS one)
 - Control group: food pellets only
 - High-fat (HF) group: food pellets + sunflower seeds
 - equal amounts of food, different total energy
 - Analyses of hibernation patterns (iButtons)
 - & PUFA proportions in white adipose tissue (WAT)



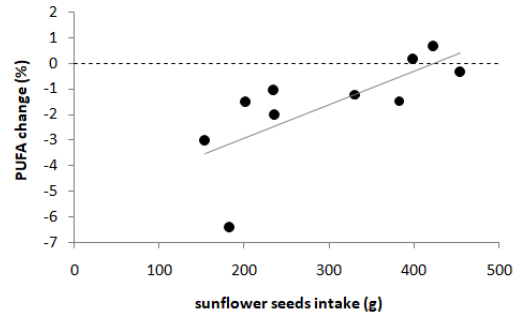
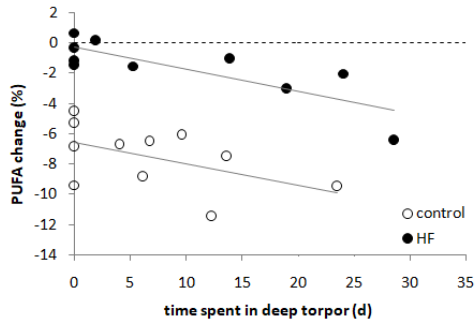
Common hamsters and PUFA use



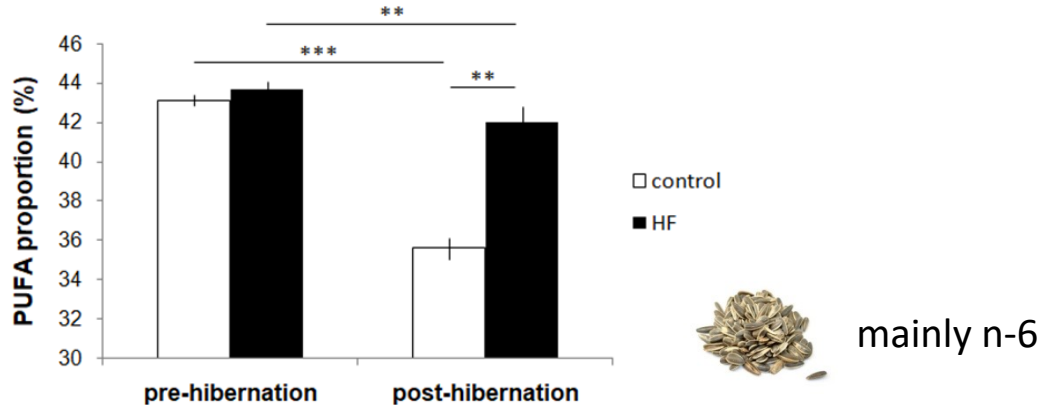
Common hamsters and PUFA use



mainly n-6



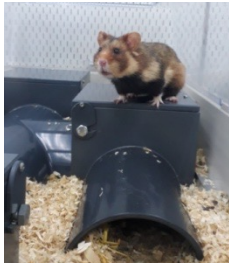
Common hamsters and PUFA use



- PUFA decline in both groups
- hamsters could afford to use PUFAs
- availability not limited (high proportions in WAT)

PUFA changes in common hamsters

2 further studies



1. controlled conditions

→ same type & amount of food (cereal & seed mix) for all individuals (n=30)



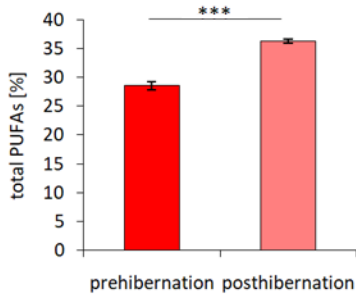
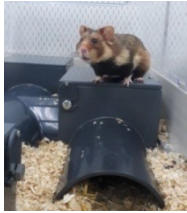
2. natural conditions

→ free-ranging hamsters (n=11)

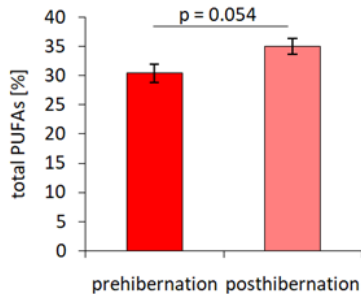
→ Analyses of hibernation patterns (iButtons) & PUFA proportions in WAT before and after winter

PUFA changes during winter

Controlled conditions

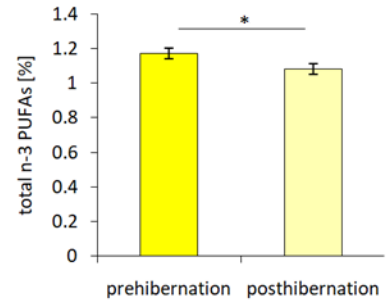
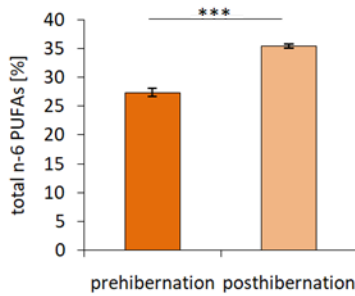
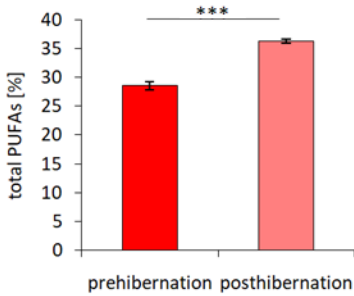
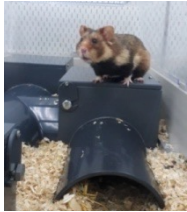


Natural conditions

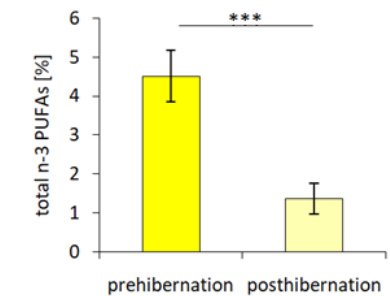
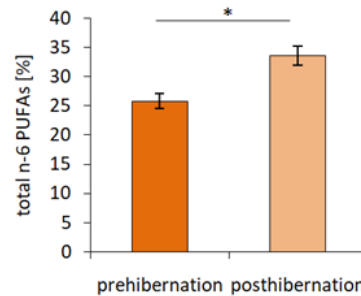
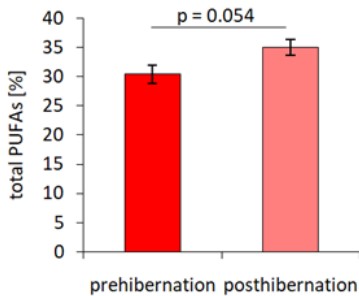


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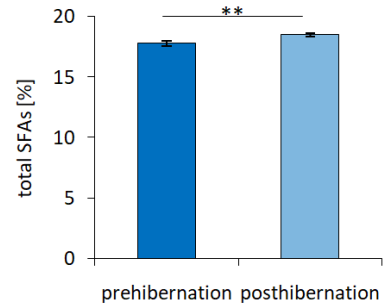
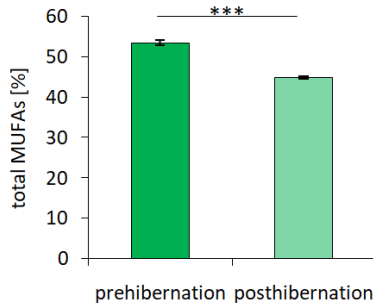
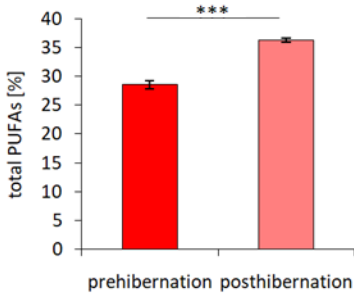
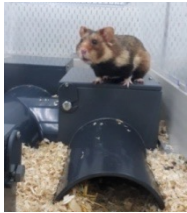


Natural conditions

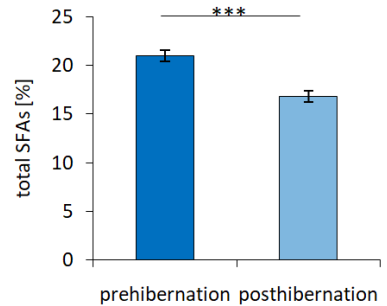
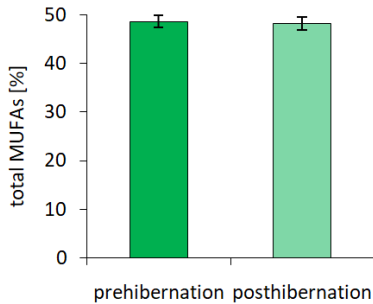
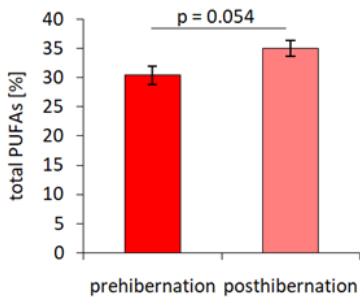


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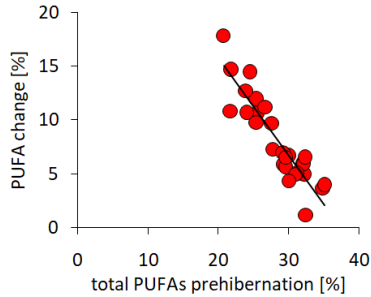
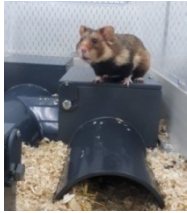


Natural conditions

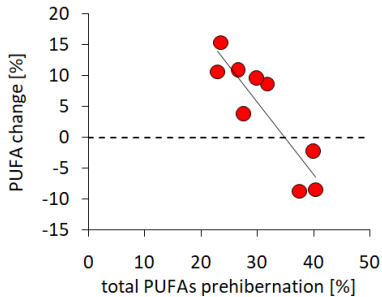


Effects of prehibernation PUFA levels on PUFA change

Controlled conditions

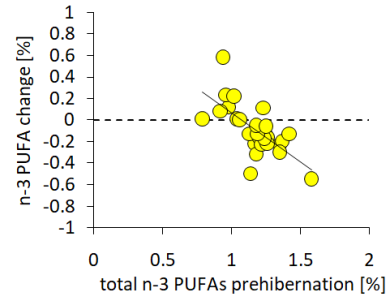
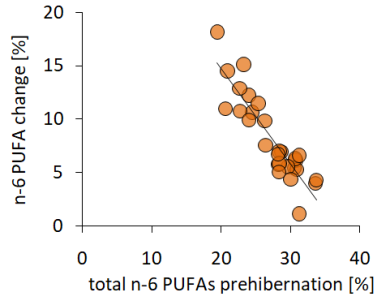
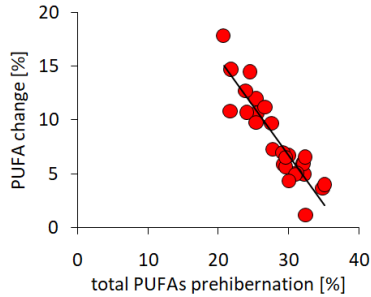
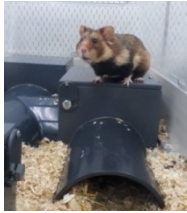


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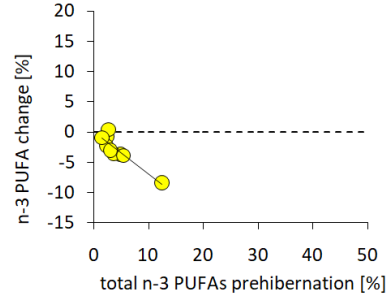
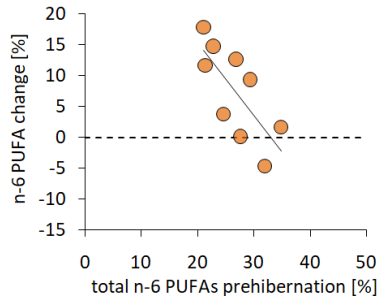
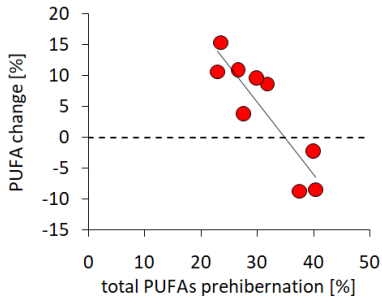


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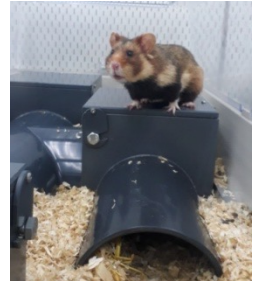
Natural conditions



PUFAs and hibernation performance

Controlled conditions

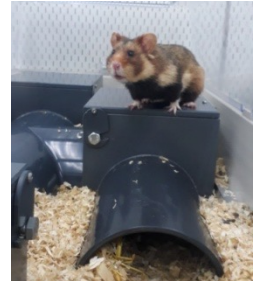
18 individuals hibernated, 12 did not



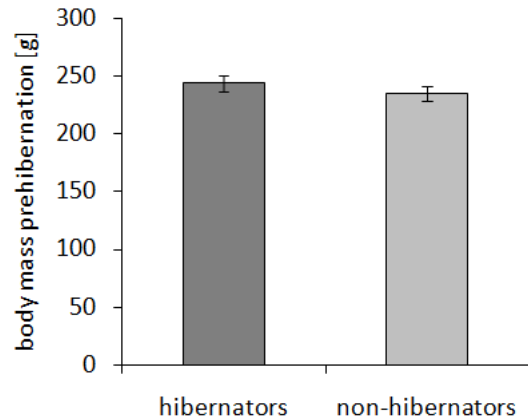
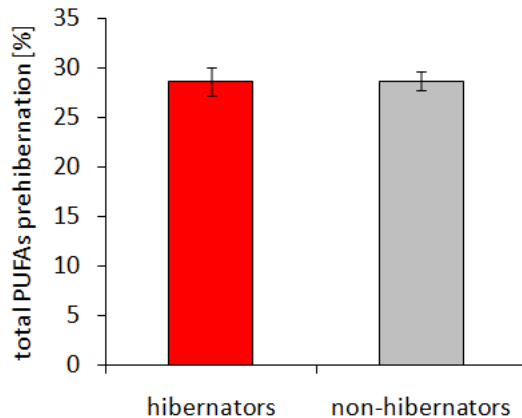
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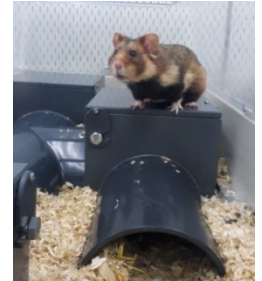
Prehibernation



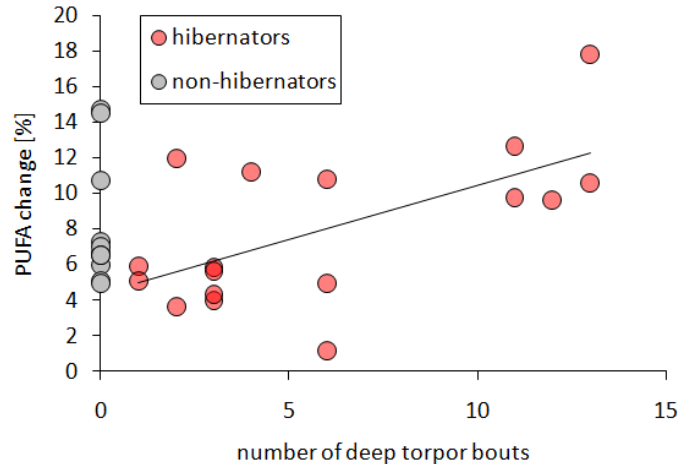
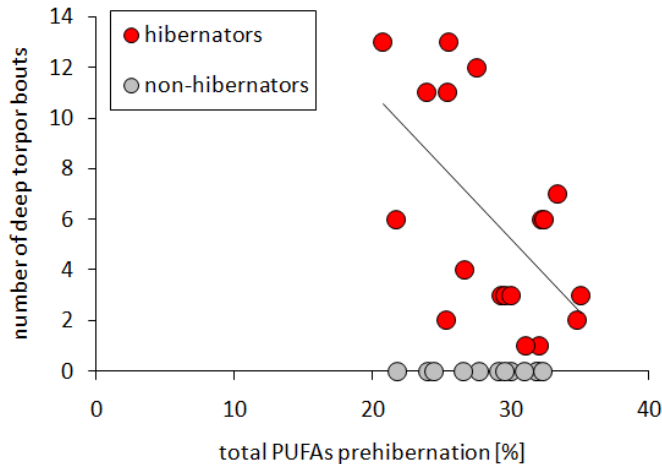
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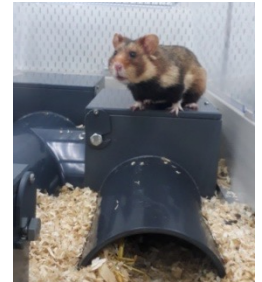
Hibernation



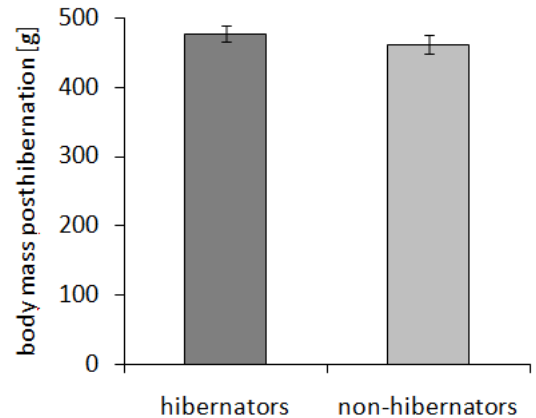
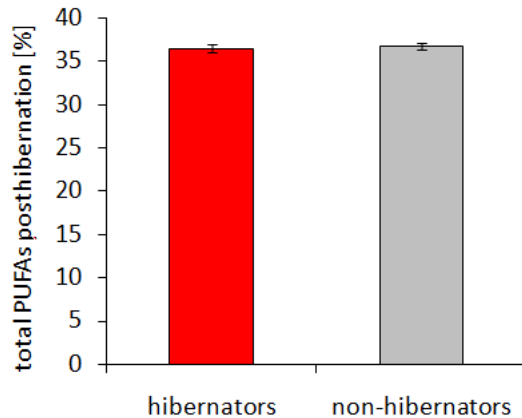
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Posthibernation



PUFAs and hibernation performance

Natural conditions

All individuals hibernated



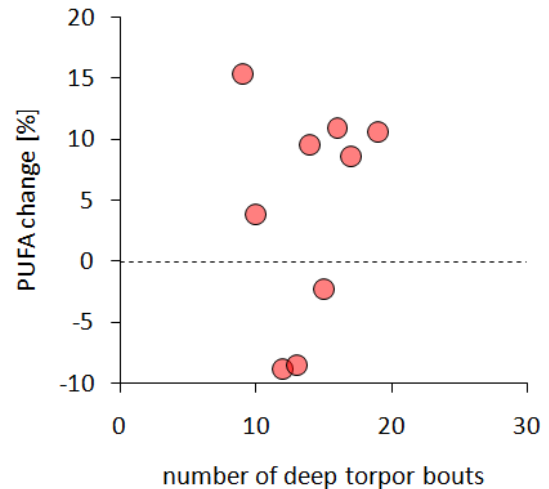
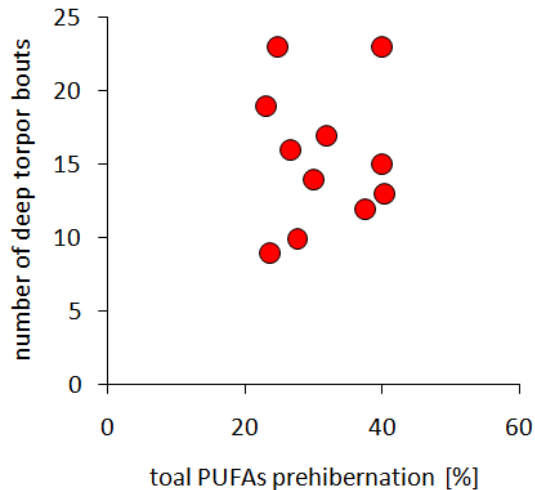
PUFAs and hibernation performance

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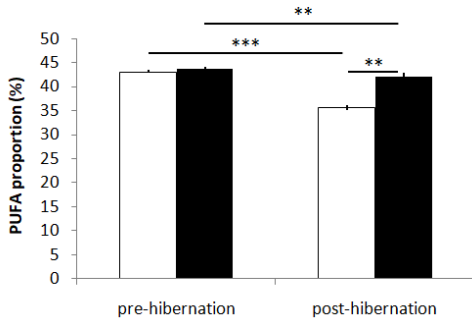
Hibernation



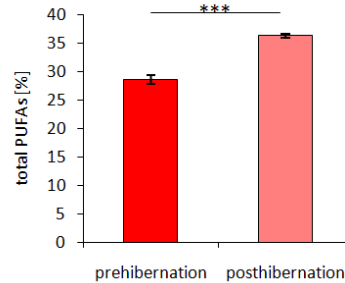
Conclusions

PUFA change

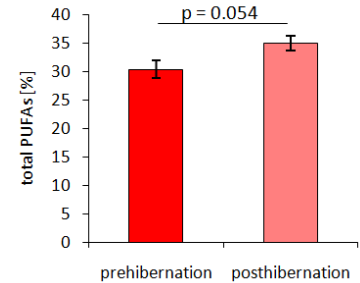
Siutz et al., 2017



Controlled conditions



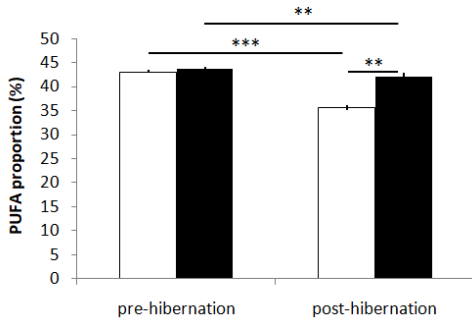
Natural conditions



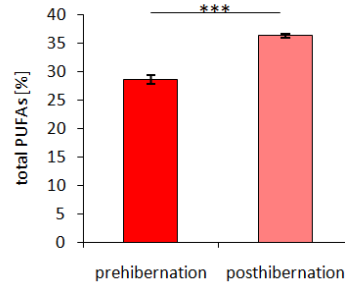
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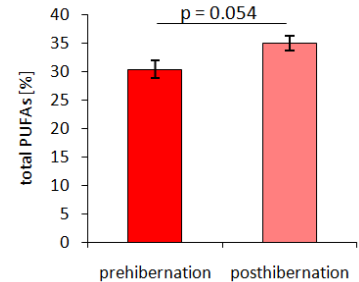
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Controlled conditions



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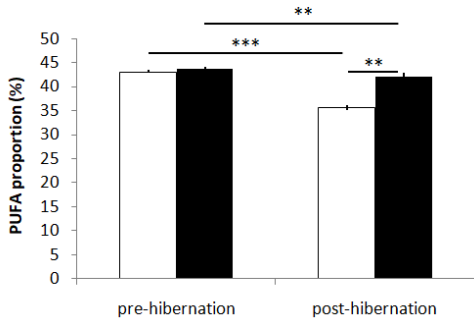


→ availability determines whether PUFAs are used or retained

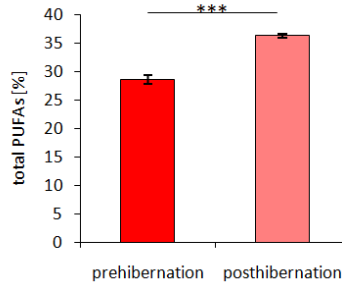
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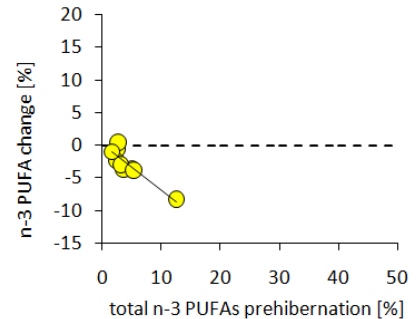
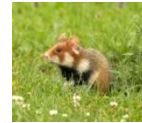
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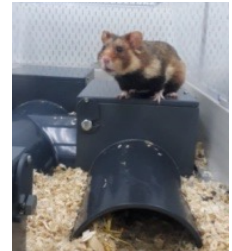
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Conclusions

PUFAs & hibernation performance

Controlled conditions

- hibernators retain PUFAs via torpor expression
- non-hibernators achieve PUFAs by food intake



Natural conditions

- high variation in pre-hibernation (n-3) PUFAs
- role of (unknown) size and quality of food stores



Conservation aspects

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→ **positive effects on litter size, pup survival at birth**

- Avoiding monocultures in natural habitat

...Sunflower seeds (23 % n-6 PUFA),

...Hazelnut (8 % n-6 PUFA)

...Walnut (38 % n-6 PUFA, 9 % n-3 PUFA)

...Rapeseed



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Amman

FWF



Thanks for your attention

