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Analysis of food intake during a 20-day expedition in the cold







- **Energy deficit is common in soldiers and athletes** (*Heydenreich et al 2017, Tharion et al 2005*)
Especially during crucial phases (training/mission and high load training/competition)
- **Contextual limitations may severely precludes increases in energy intake** (*Charlot 2021*)
Environment, food accessibility, priorities management...

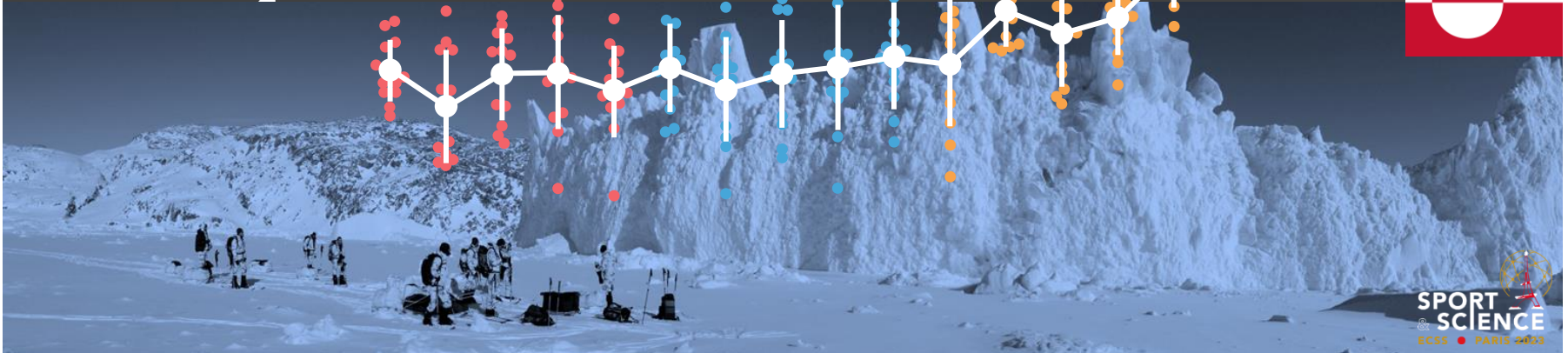
Decreases in body mass, cognitive-physical performances and disturbances in physiological functions may be expected (*O'Leary et al 2020, Logue et al 2020*)
As long as food intake remains spontaneous and not calculated/planned

A successful strategy to limit energy deficit in cold environment

■ 20-MJ bags of highly palatable, familiar, and easy-to-use foods during 15-day expeditions in Greenland (Charlot et al 2020, Charlot et al 2021)

Realized by 12 French soldiers between -5 and -30 °C

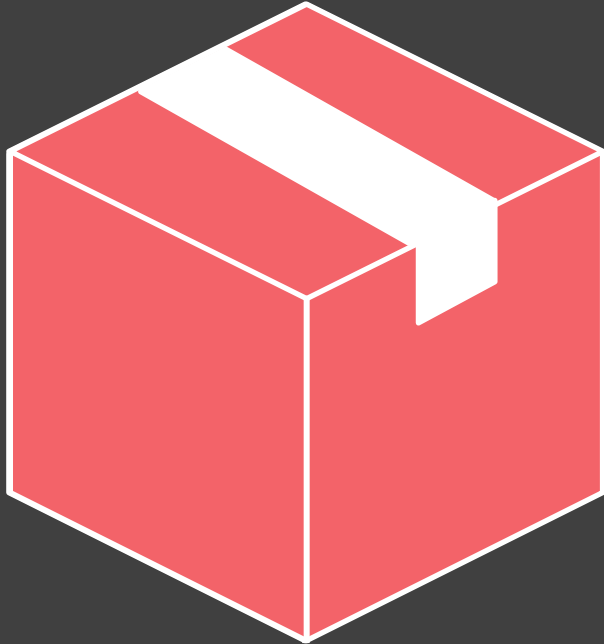
■ Contrary to the almost all military trainings/expeditions, body mass loss was prevented (~ -1 kg) (Charlot et al 2020, Charlot et al 2021)



The problem of load carriage

■ Request to downsize rations (volume and weight)

20-MJ rations considered not realistic in a military context



1200 g



1010 g

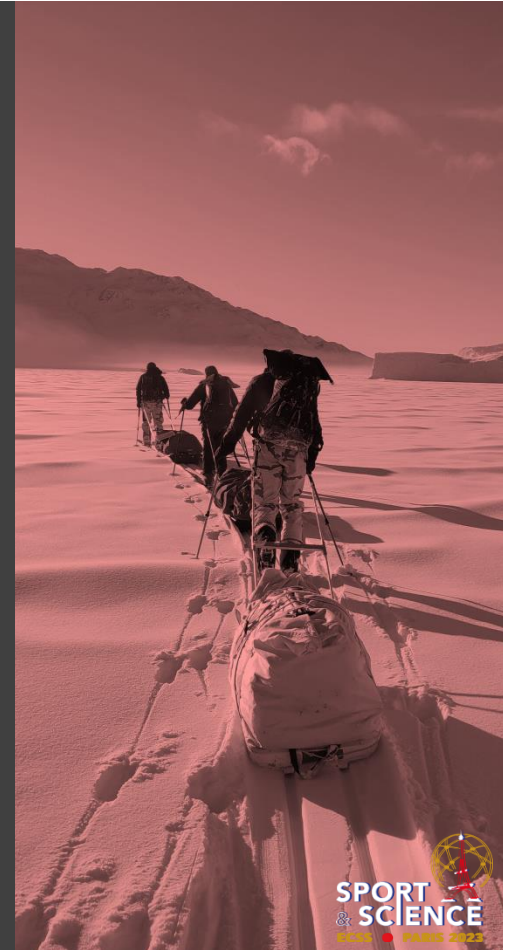
20 days: - 3.8 kg

19.7 MJ



15.8 MJ

20 days: - 78 MJ





Objectives

Assessment of this downsized ration during a 20-day expedition in the cold in 10 French soldiers

Quantitative analysis

Energy intake, appetite, and body mass loss

Qualitative analysis

Food palatability and reasons to not consume an item

Temporal analysis

Repartition of food intake during the day and fluctuations during the expedition

To conceive an efficient ration adapted to a cold environment

Best compromise between load/volume and part of ration that is actually consumed

Breakfast

Mueslis
(x7)



Stuffed bread
(x2)

Day (sweet)

Chocolate bar
(x1)

Protein bar
(x2)

Fruit paste
(x4)

Energy balls
(x3)

Dried fruits
(x3)

Energy bar
(x5)



Day (savory)

Beef bar
(x6)

Jerky
beef
(x1)

Freeze-
dried
cheese
(x6)



Dinner

Freeze-dried dessert
(x7)

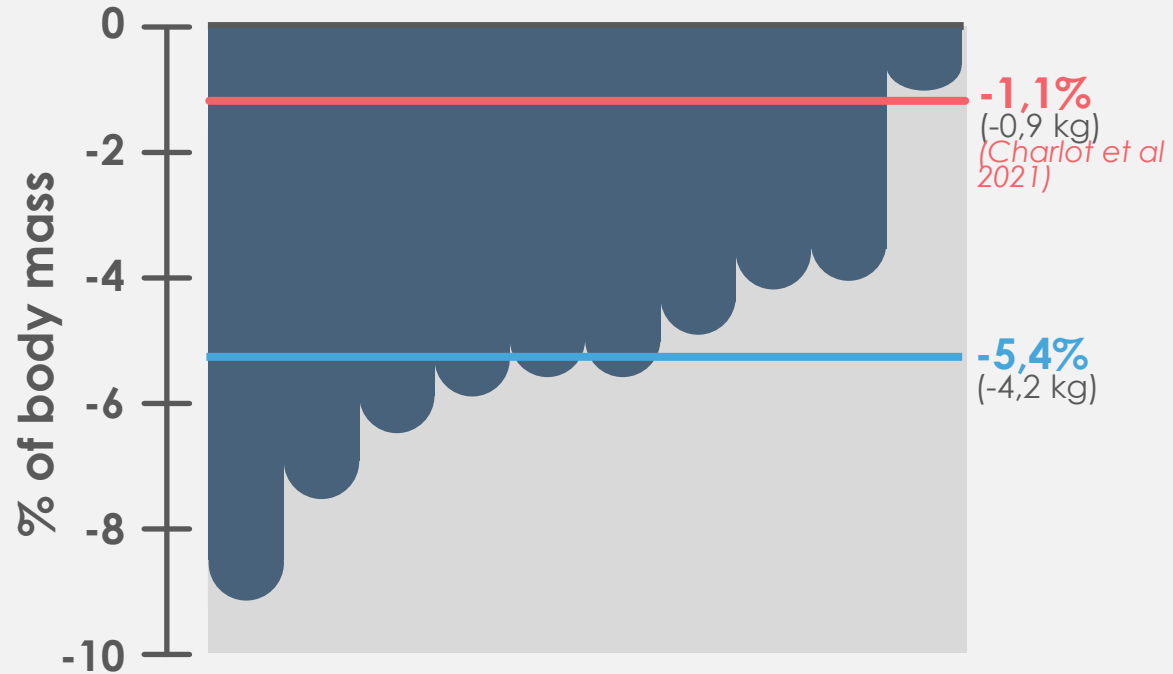
Freeze-dried dishes
(x11)

Soup
(x7)

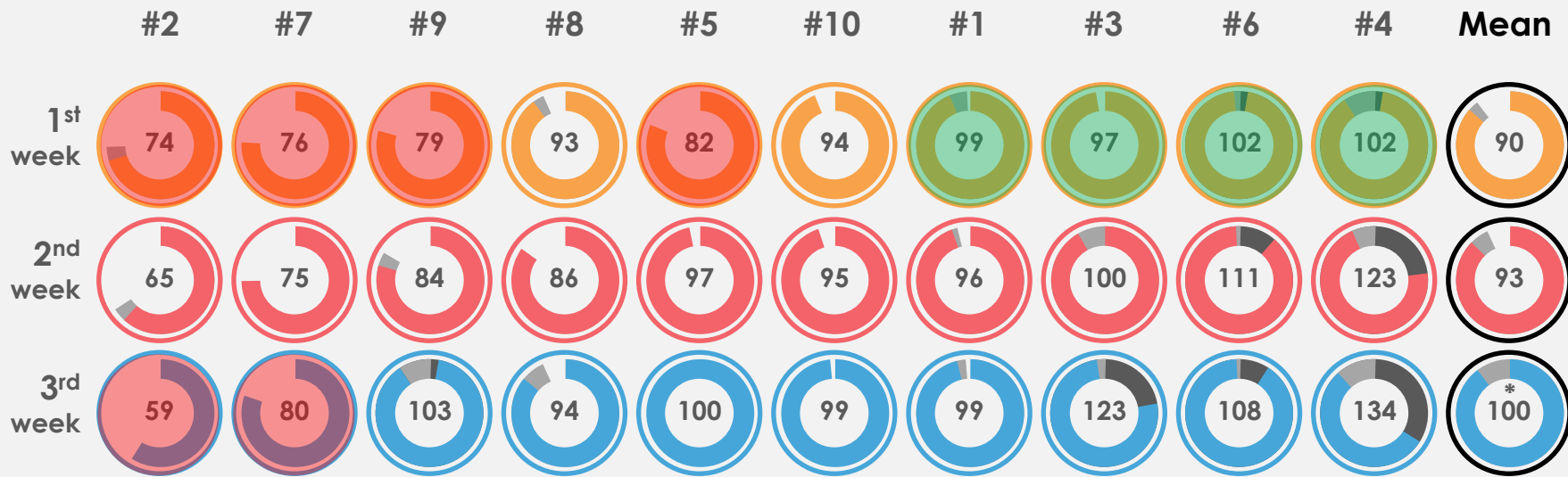
Freeze-dried beef
(x2)



Body mass loss



Part of the ration that was consumed (%)



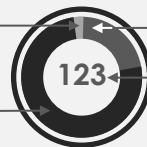
LEGEND

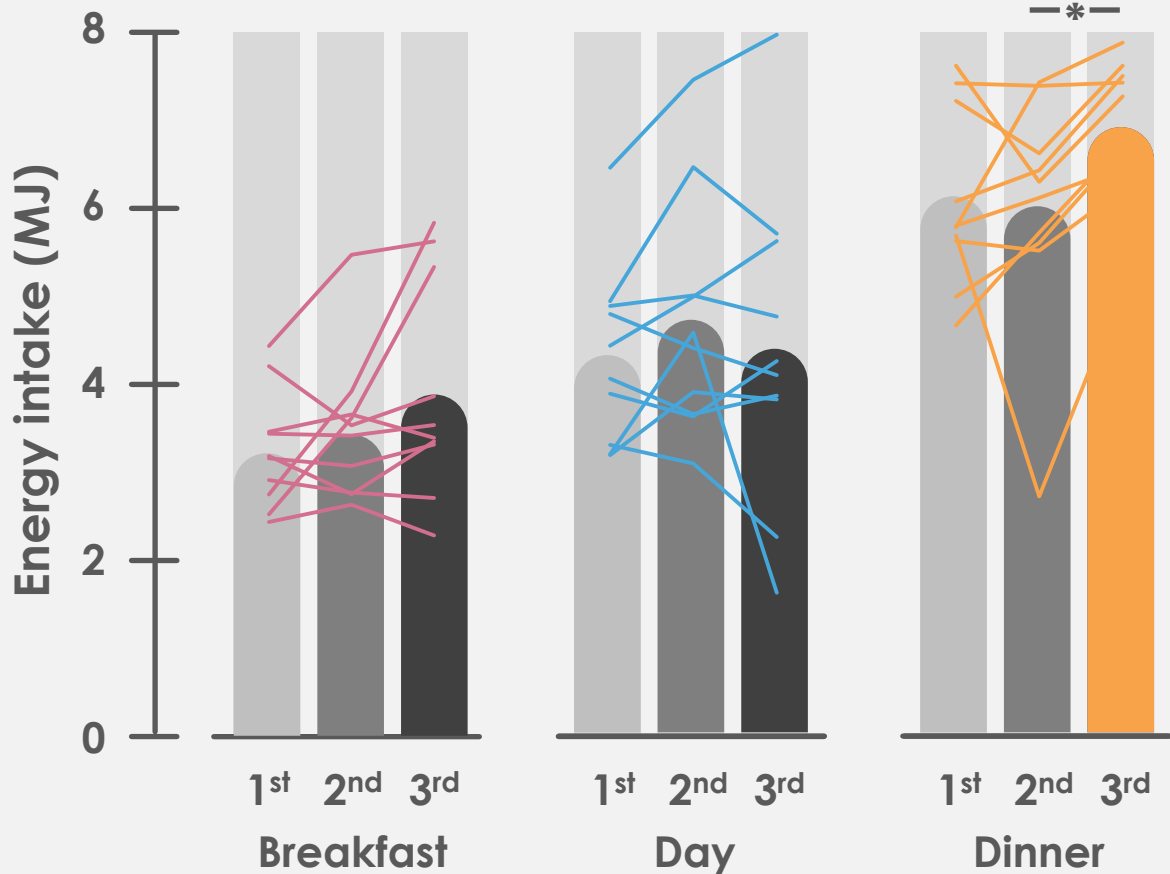
Energy from supplement foods

Excess intake compared to the basal ration

Energy from ration foods

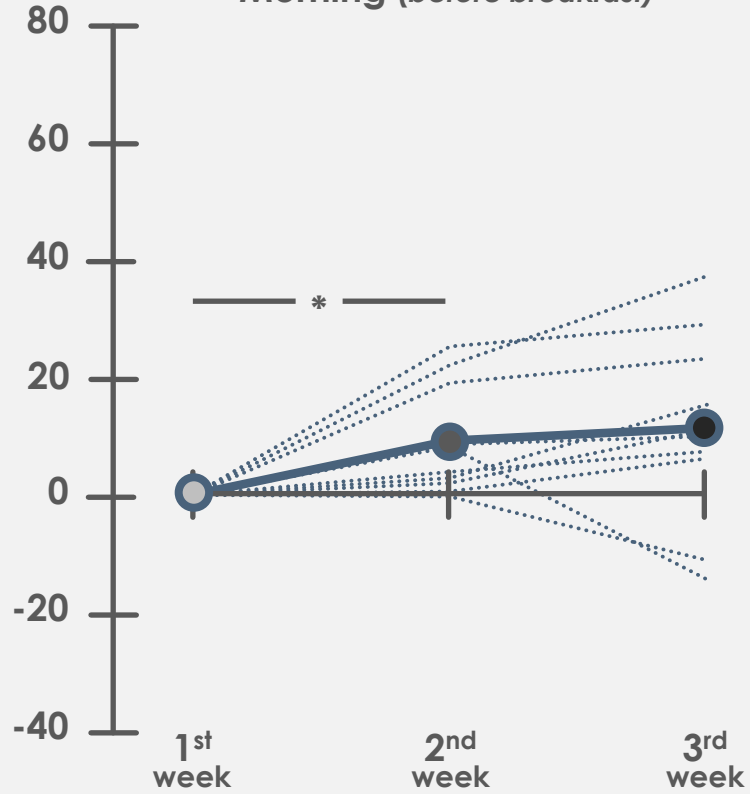
Energy from all foods



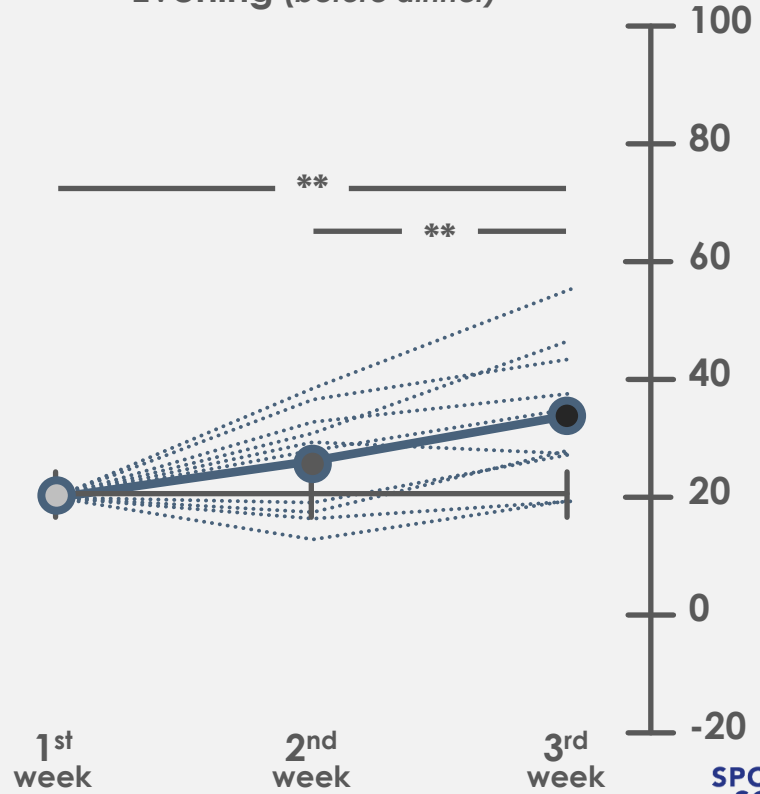


Modifications of hunger score (/100)

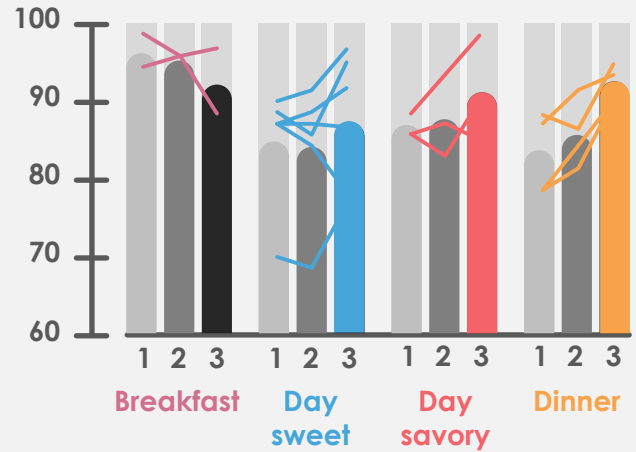
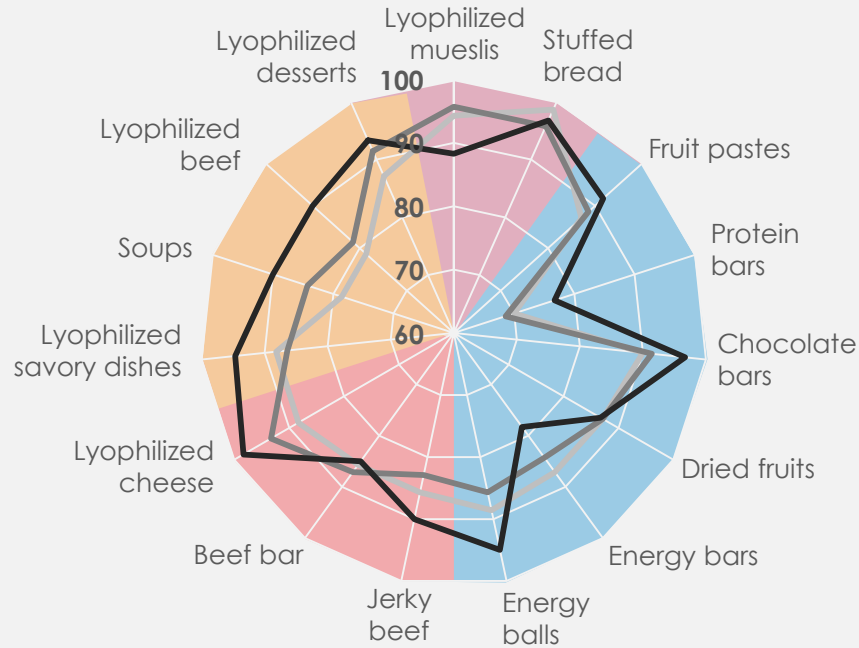
Morning (before breakfast)



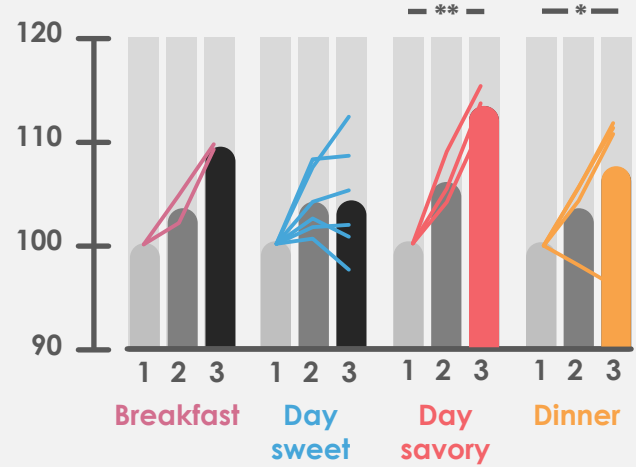
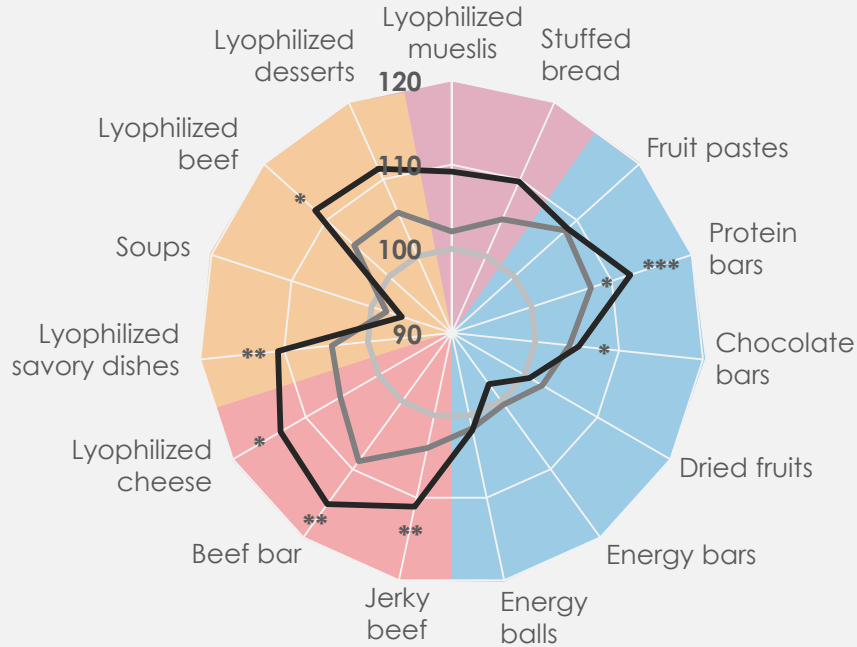
Evening (before dinner)



Frequency of consumption (%)

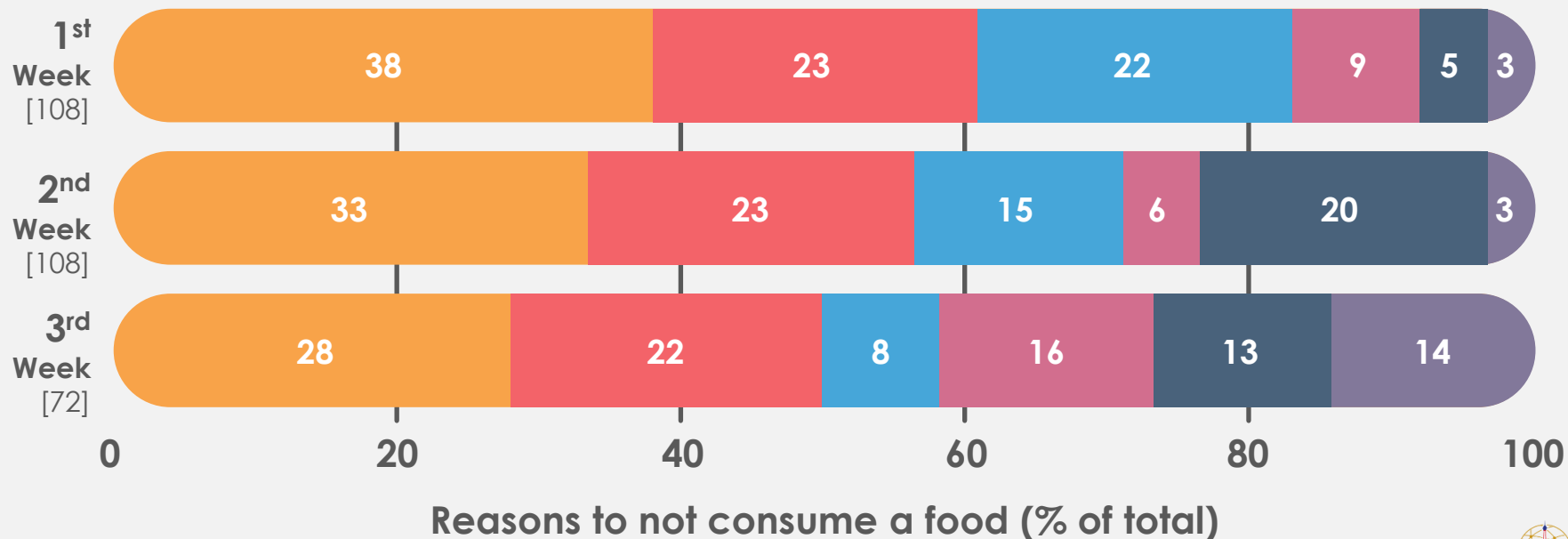


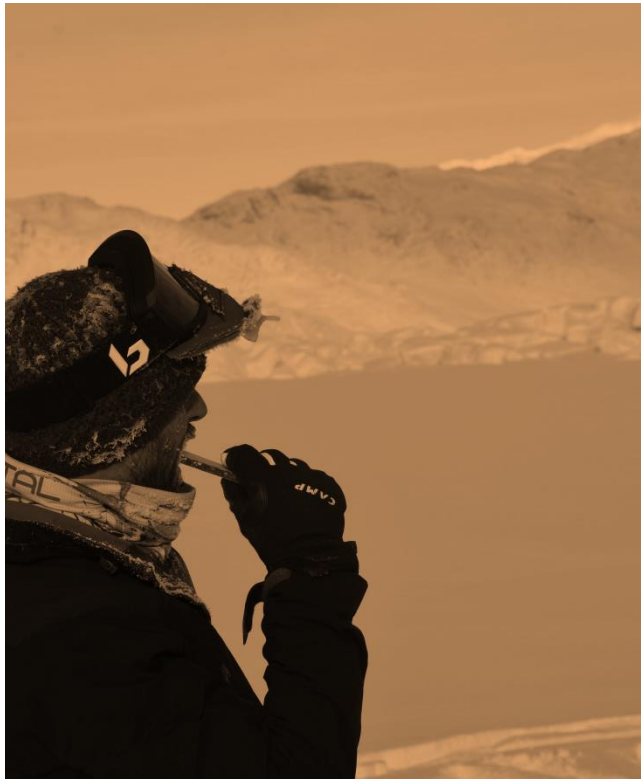
Relative palatability (%)



LEGEND

- Not hungry
- Not good
- Conserved for later
- Too hard to eat
- Not enough time
- Lassitude





Discussion/Conclusions

Quantitative and temporal analysis

Energy intake was insufficient to avoid important body mass loss

Energy intake increased during the expedition (100% of the ration at the end of expedition)

Some participants did not compensate and left behind a large part of the ration despite major body mass loss

Hunger kept increasing before dinner suggesting that food offer during the day was insufficient

The content of the rations remains to be adjusted

Modification of the offer during the day to enhance food intake



Discussion/Conclusions

Qualitative and temporal analysis

Some items (protein bars, beef, soups, beef bars) were clearly less appreciated than others

BUT their palatability and their intake increased (familiarization, increase in hunger especially during the afternoon/evening ?)

A lack of hunger and a depreciation were the main reasons (> 60%) to not consume some items

Some tactical (conservation, 15%) or contextual reasons (lack of time, 13%) are also mentioned

Reasons to not eat were barely modified: participants kept not consuming items for marginal reasons (lack of hunger and relative depreciation of foods)

Participants were surprisingly 'picky' while experiencing major body mass loss

Some items may be replaced to enhance their spontaneous consumption

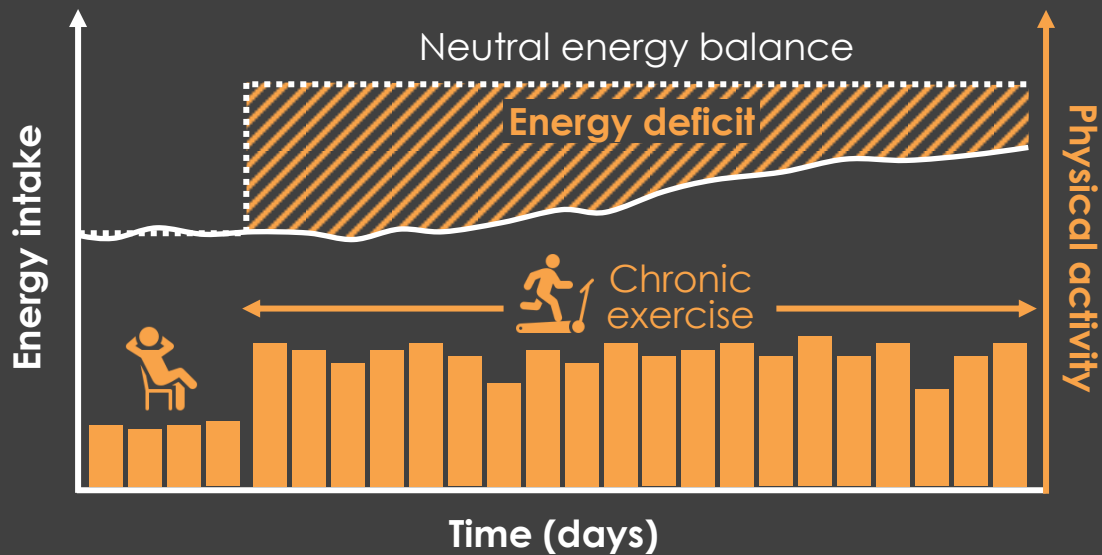


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Exercise and energy compensation

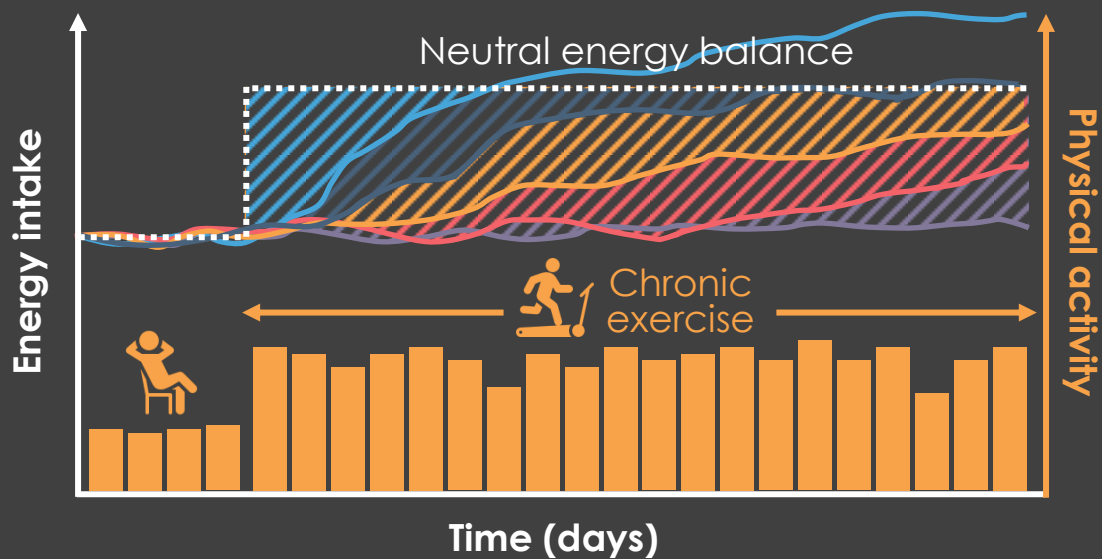
- **Long period of inertia** (*Stubbs et al 2002, Myers et al 2019, Riou et al 2016*)
Weeks or months are required to reach complete compensation

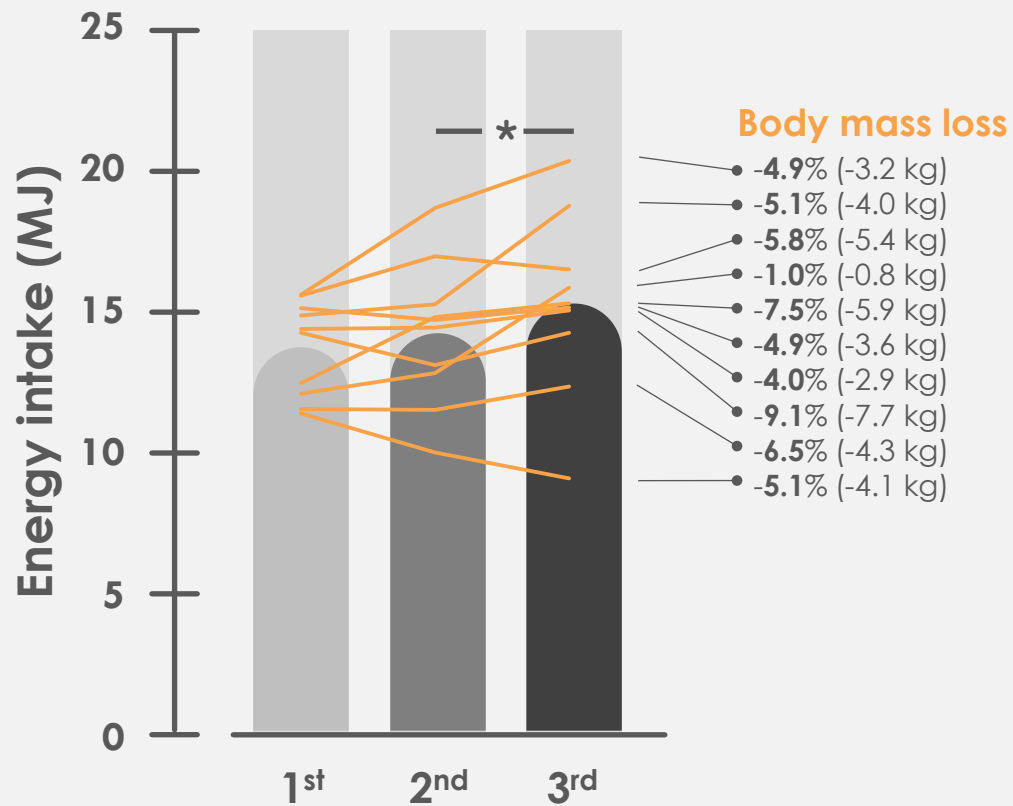




Exercise and energy compensation

- **Long period of inertia** (*Stubbs et al 2002, Myers et al 2019, Riou et al 2016*)
Weeks or months are required to reach complete compensation
- **Large variability between individuals** (*Blundell & Beaulieu 2023*)
Some may need days, others months to adequately increase their food intake

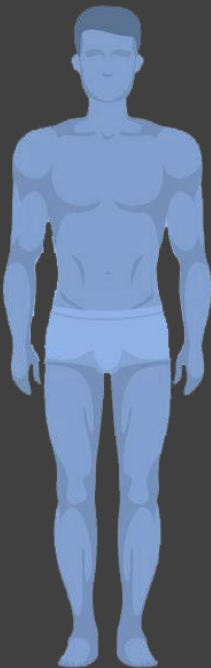




Participants

■ 12 male French soldiers

Familiar with mountain and cold environment



34.6 ± 6.2 years old
[min-max: 22 – 44]



178 ± 6 cm
[170 – 191]



77.7 ± 7.3 kg
[66.4– 92.6]



10.8 ± 2.9 %
[6.8– 15.1]



Expedition

■ 20 days

Separated in 3 periods
(1st, 2nd, and 3rd weeks)

■ Cold to extreme cold

-30 to 0 °C (mean: -15 °C)

■ ~120 km

In cross-country skiing
or kite surf (pulka: 65 kg)

■ 3 sedentary days

Bad weather and medical
evacuation of 2 participants

■ A diary to fill each day

Consumed foods (quantities,
palatability), reasons to not eat
some items

