

# ANALYSIS OF PROGRESSIVE ENERGY COMPENSATION DURING A 15-DAY EXPEDITION IN THE COLD

THROUGH AN ASSESSMENT OF COMPONENTS OF EATING BEHAVIOR

5<sup>TH</sup> INTERNATIONAL  
CONGRESS ON  
SOLDIERS' PHYSICAL  
PERFORMANCE

CHARLOT K - FAMEL C - SIRACUSA J - COLIN P - BOURRILHON C



# INTRODUCTION

## MILITARY EXPEDITIONS/TRAININGS

HIGH LEVELS OF  
ENERGY EXPENDITURE

LACK OF INCREASE IN  
ENERGY INTAKE

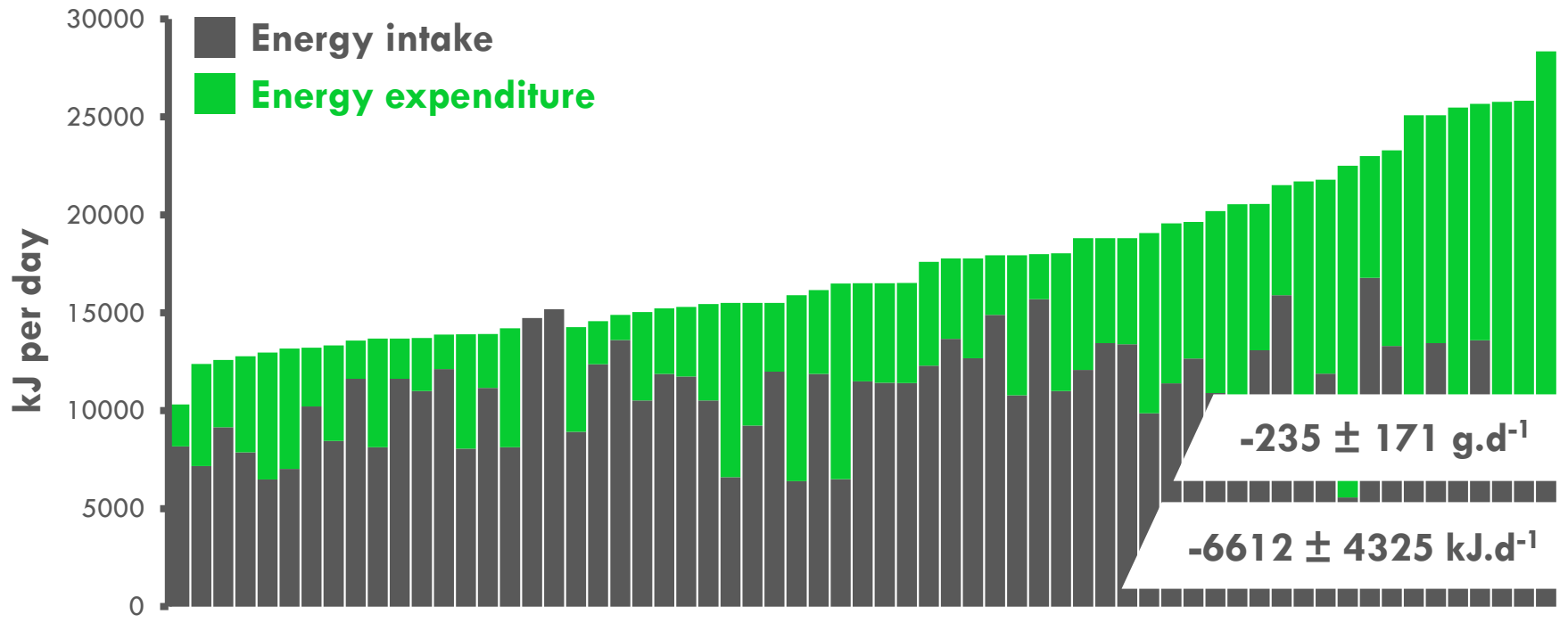
COLD

LARGE ENERGY DEFICIT

POTENTIAL DECREASE IN PERFORMANCES  
PHYSICAL – COGNITIVE - MOOD

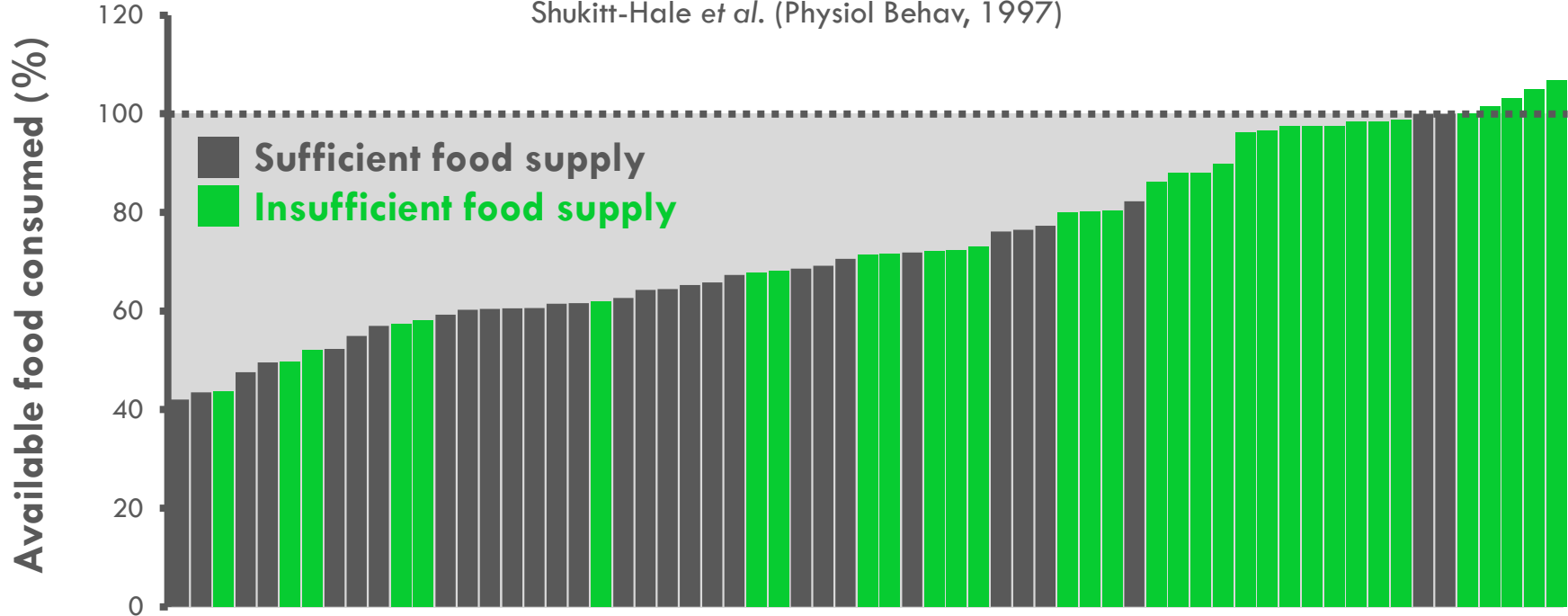
# INTRODUCTION

## ENERGY BALANCE



### « Voluntary undersconsumption »

Shukitt-Hale et al. (Physiol Behav, 1997)



# INTRODUCTION

## LIMITATIONS OF FOOD INTAKE

ALIMENTARY LIMIT ?

*Thurber et al. (Sci Adv, 2019)*

CONTEXTUAL TRAINING  
LIMITATIONS ?

HIGH LEVELS OF  
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ENERGY INTAKE

COLD

LARGE ENERGY DEFICIT

POTENTIAL DECREASE IN PERFORMANCES  
PHYSICAL – COGNITIVE - MOOD

# INTRODUCTION

## LIMITATIONS OF FOOD INTAKE

### TRAINING CONDITIONS

- Thermal conditions
- Weather conditions
- Priorities management
- Training-induced stress
- Water availability

### FOOD CHARACTERISTICS

- Total food quantity
- Item food quantity
- Lack of choice
- Food palatability
- Lack of sensory cues
- Ration handling and preparation
- Variety of rations

### SOLDIERS' ATTITUDE

- Body mass loss expectations
- Experience of previous energy deficits

### EATING TIMING

- Meal frequency
- Meal duration
- Meal timing
- Meal predictability

### EATING CONTEXT

- Lack of non sensory cues
- Individual eating

# OBJECTIVE

## REACH ENERGY COMPENSATION

IS IT POSSIBLE TO LIMIT ENERGY DEFICIT DURING A 15-D EXPEDITION IN THE COLD BY FACILITATING ENERGY INTAKE ?

**Familiar foods**  
**Palatable foods**  
**Practical foods (ready-to-eat)**  
**Trading or giving foods authorized**  
**Sufficient time to cook food**  
**Sufficient time to eat**  
**Frequent eating occasions (5-10/d)**  
**Low operational strain**  
**Sufficient time to sleep (> 7 h/d)**

# METHODS

## EXPEDITION DETAILS

162 km

-16 °C





# METHODS

## MEASUREMENTS – ENERGY EXPENDITURE



Garmin Fenix 5X Sapphire

Hiiloskorpi *et al.* (2003)  
algorithms

HEART  
RATE



ENERGY  
EXPENDITURE

# METHODS MEASUREMENTS – ENERGY INTAKE

FOODS	EATEN ?	%	TIMING
Muesli chocolat	✓	50	08 h 00
Porc et haricots	✓	100	08 h 00
Pâte de fruits fraise			h
Bœuf séché	✓	100	09 h 30
Tortilla	✓	100	09 h 30
Comté	✓	100	12 h 00
Viande des grisons			h
Pâte de fruits Citron	✓	100	12 h 00

FOODS	EATEN ?	%	TIMING
Gel énergétique			h
Maltesers		50	15 h 00
Barre de fruits noix de coco 1		100	15 h 00
Barre de fruits noix de coco 2			H
Lentilles jambon		75	18 h 30
Aligot		50	18 h 50
Crème croustillante		100	19 h 00
Crème de poireaux			h

ADDITIONAL FOODS	EATEN ?	%	TIMING
Snickers	✓	100	15 h 00
			h
			h

ADDITIONAL FOODS	EATEN?	%	TIMING
			h
			h
			h

LIQUIDS	Volume (l)	TIMING
Eau	1	h
Thé + 2 sucres	0,5	08 h 30

LIQUIDS	Volume (l)	TIMING
Café		h
		h



## How hungry/thirsty do you feel?

Not at all



Extremely



*Tanita BC-545N*

The day before and the day after in a fasted state in the morning

Moderate accuracy

# METHODS

## FOODS - BREAKFAST

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SAVORY DISH



SWEET DISH





ENERGY BARS



CANDY BARS



FRUIT JELLIES



ENERGY GELS





CHEESE

TORTILLA

SAUCISSON

JERKY BEEF



LYOPHILIZED BEEF

2 LYOPHILIZED SAVORY DISHES

SOUP

LYOPHILIZED DESSERT



# METHODS

## TOTAL RATIONS

5<sup>TH</sup> INTERNATIONAL  
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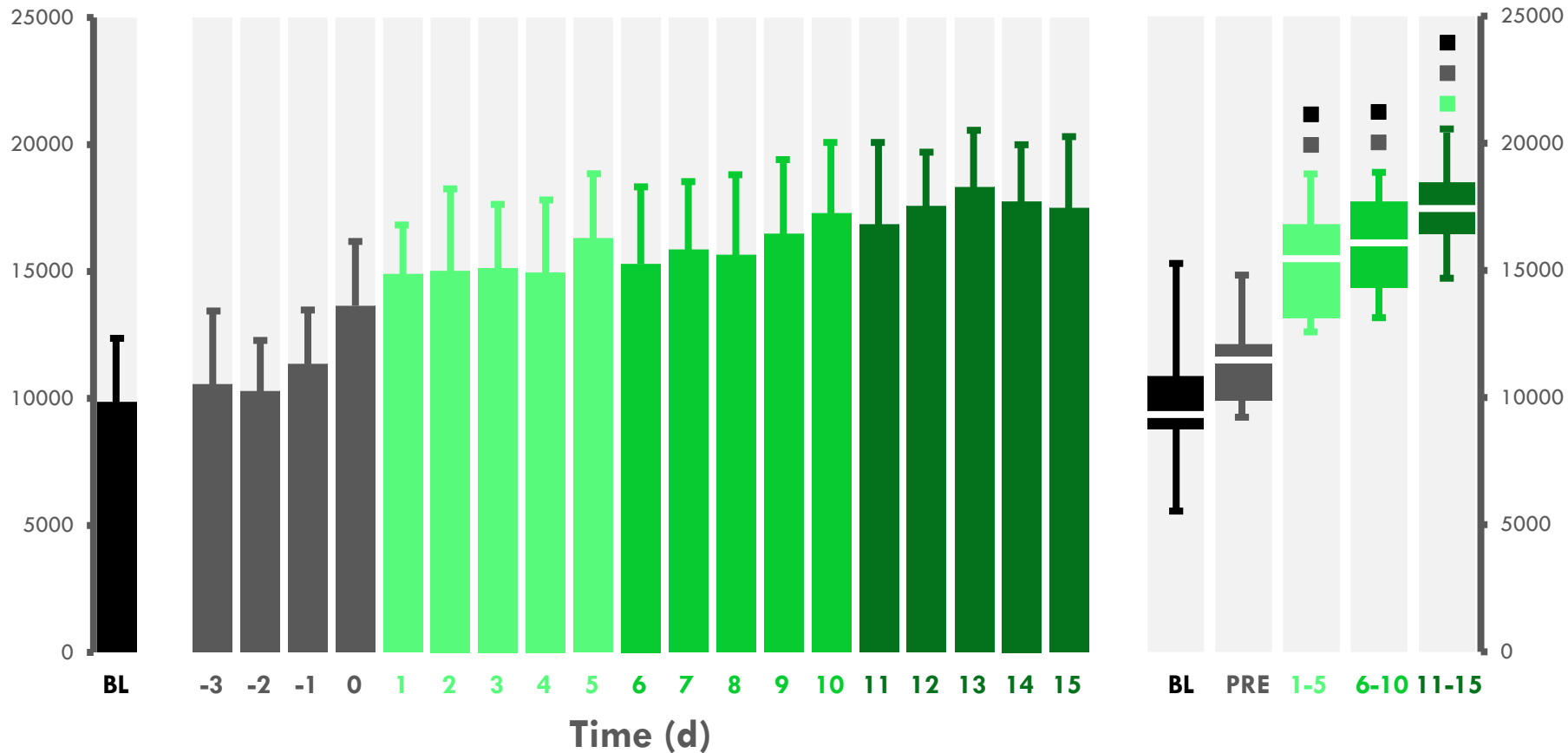
~ 20 MJ (4700 kcal)

46% CHO / 32 % FAT / 20 % PRO

7 different meals

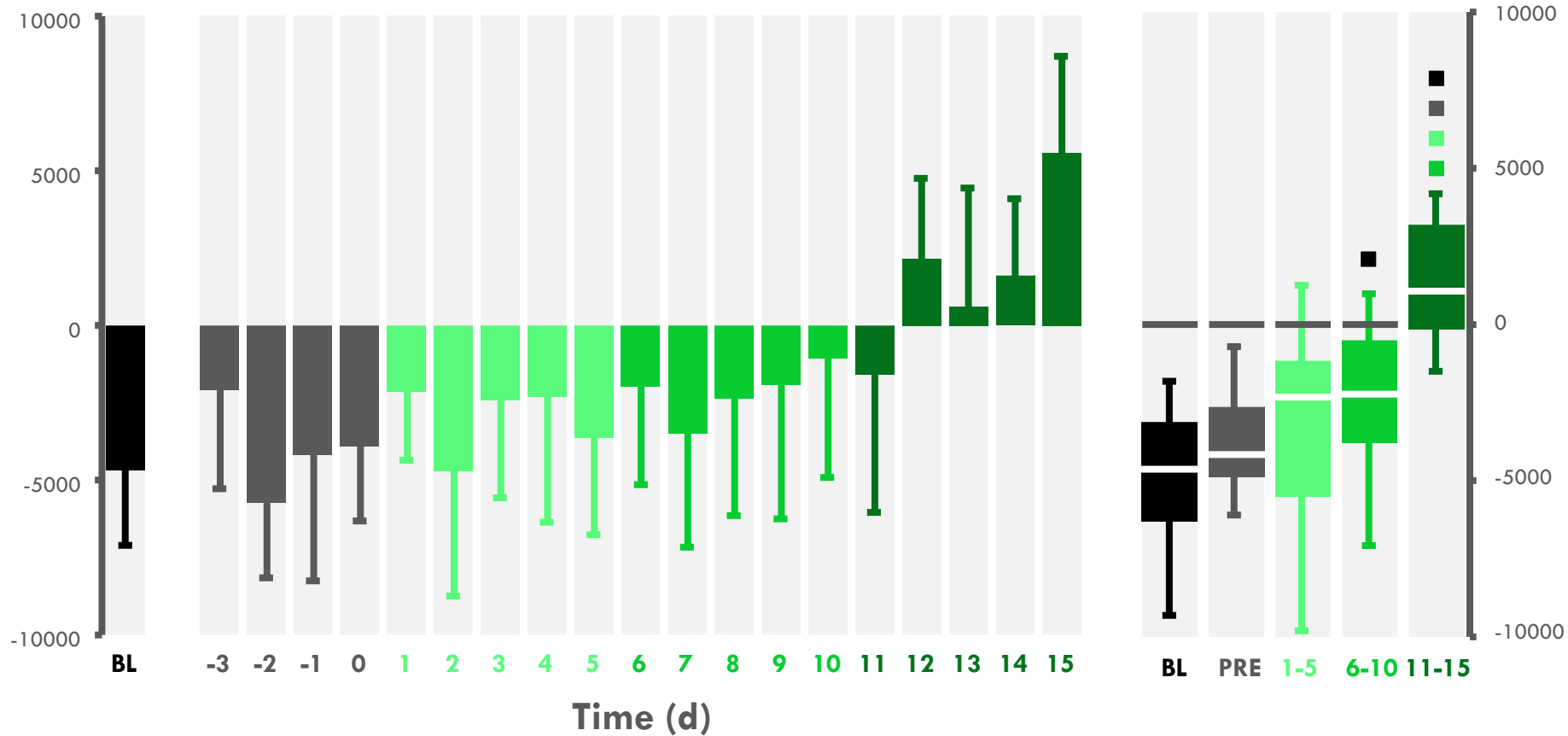
# RESULTS

## ENERGY INTAKE (kJ)



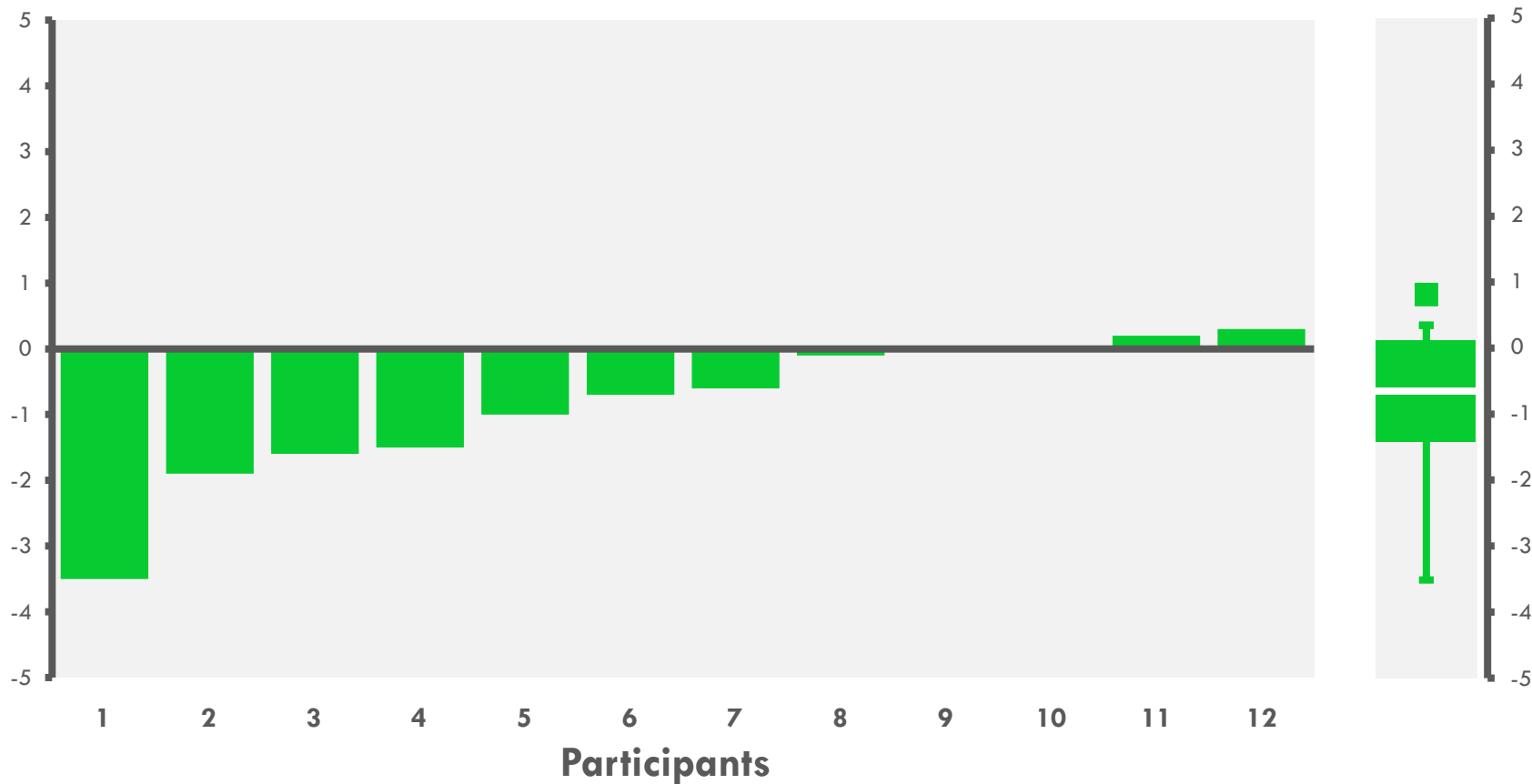
# RESULTS

## ENERGY BALANCE (kJ)



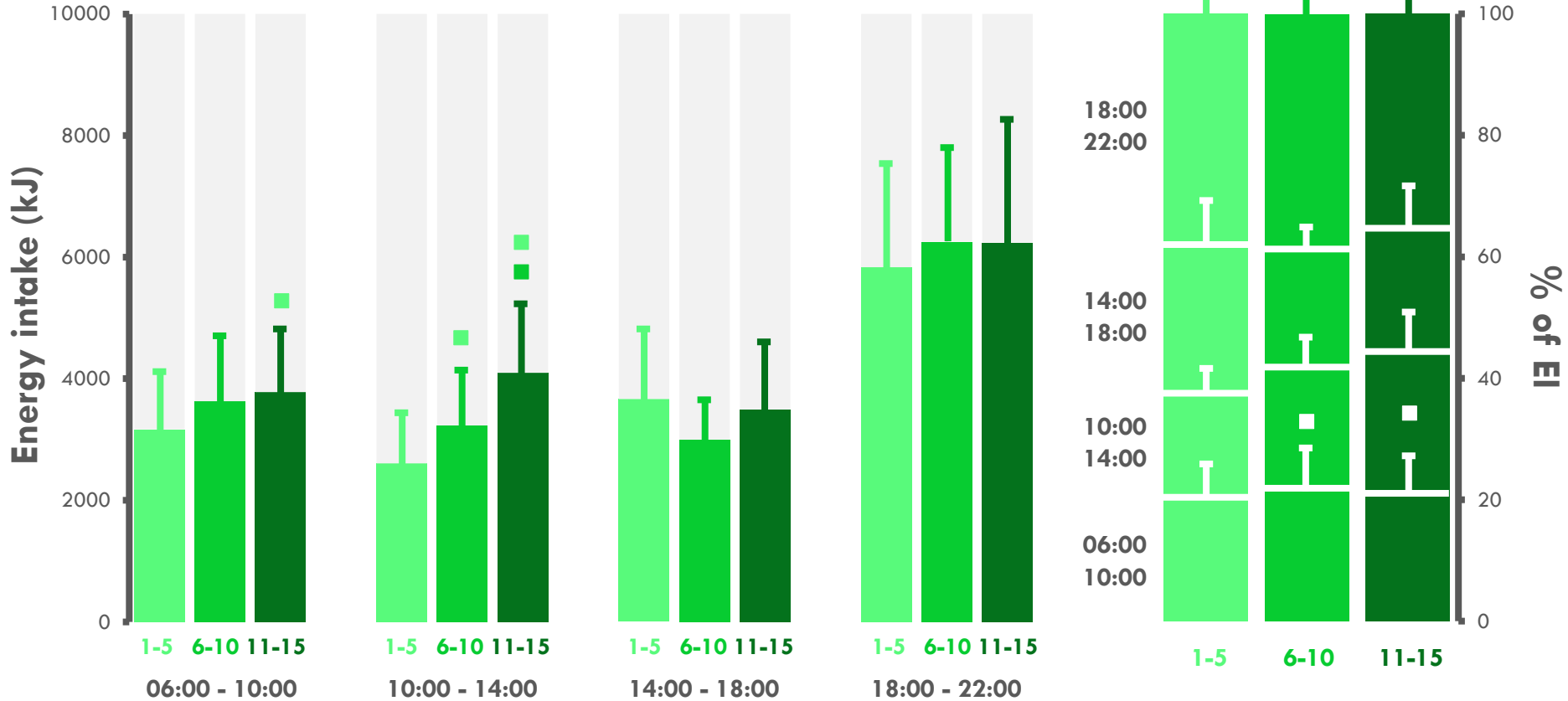
# RESULTS

## BODY MASS (kg)



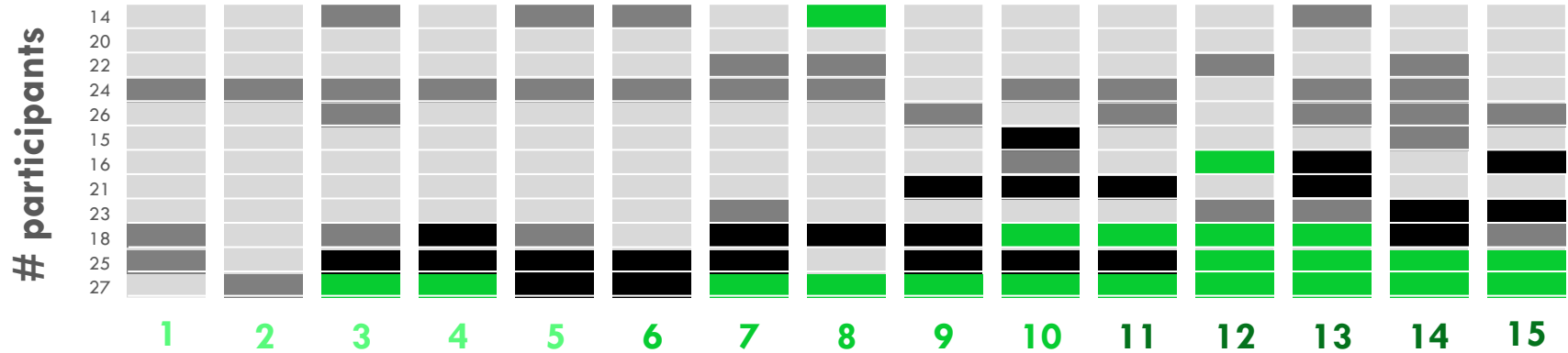
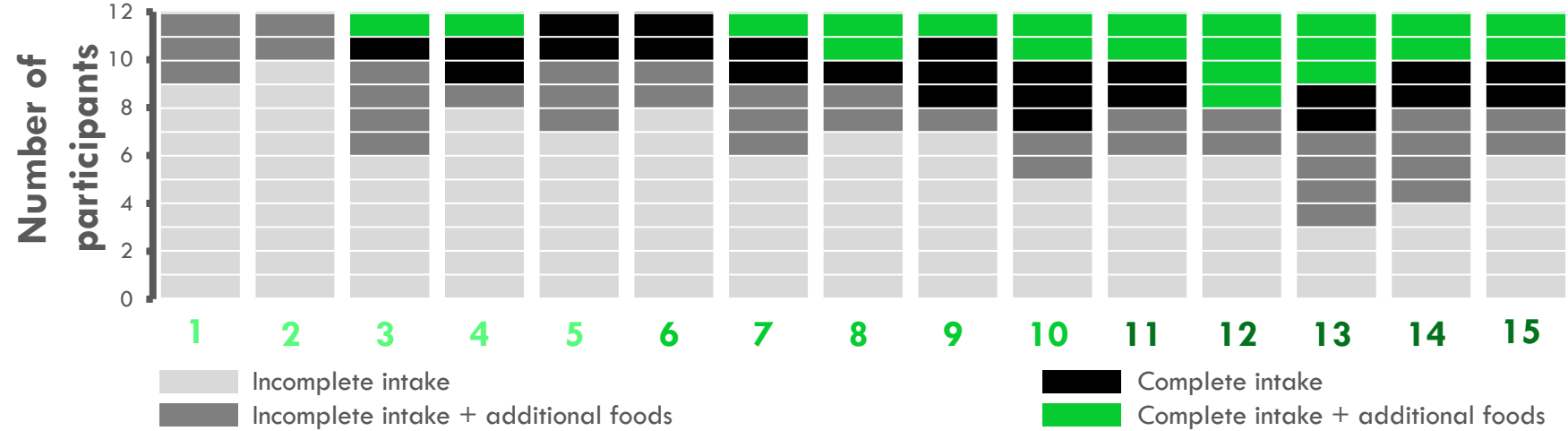
# RESULTS

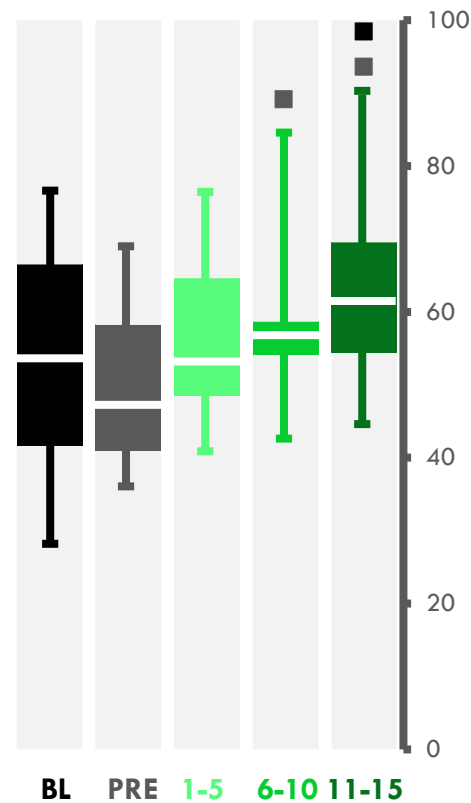
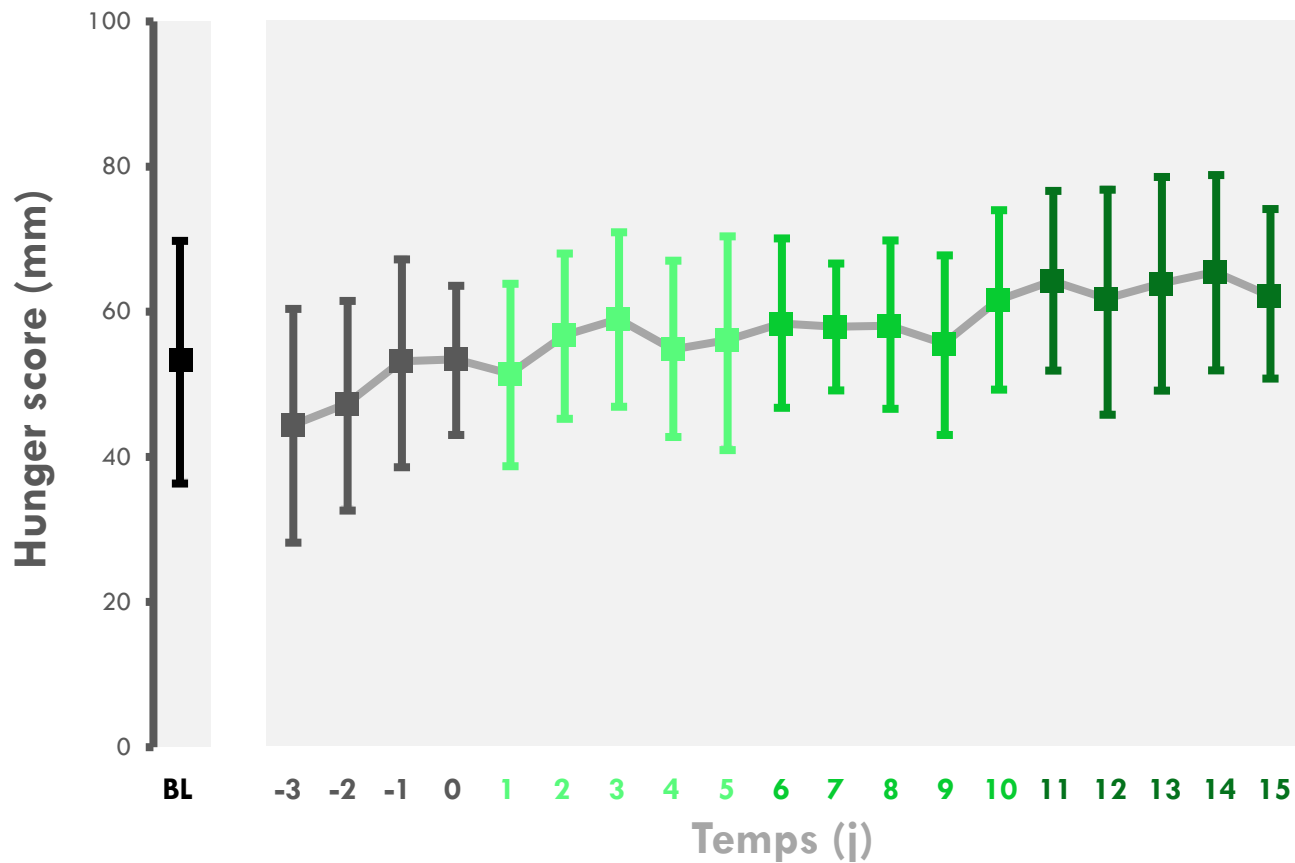
## INTAKE TIMING



# RESULTS

## RATIONS SIZE ADEQUACY





## PROGRESSIVE COMPENSATION LED TO **NEUTRAL ENERGY BALANCE**

Seems to occur in **7 to 10 days** (*Charlot et al. APNM 2020*)

**Anticipatory** phenomenon

**Low** body modifications

## **LARGE** INDIVIDUAL RESPONSES

From **-4.4 to 0.4 %** of body mass modifications

**Sufficient rations** for half of the participants

Food intake is lacking before mid-expedition for **25%** of the participants

## **REMAINING** QUESTIONS

Specific effect of **cold**?

Results in a more **operational** context

Cross-check with **eating behavior hormones**





**MULTIPLE** MEALS/SNACKS

SEVERAL **READY-TO-EAT** FOODS

**PALATABLE** FOODS

MAKE AVAILABLE **TIME TO EAT**



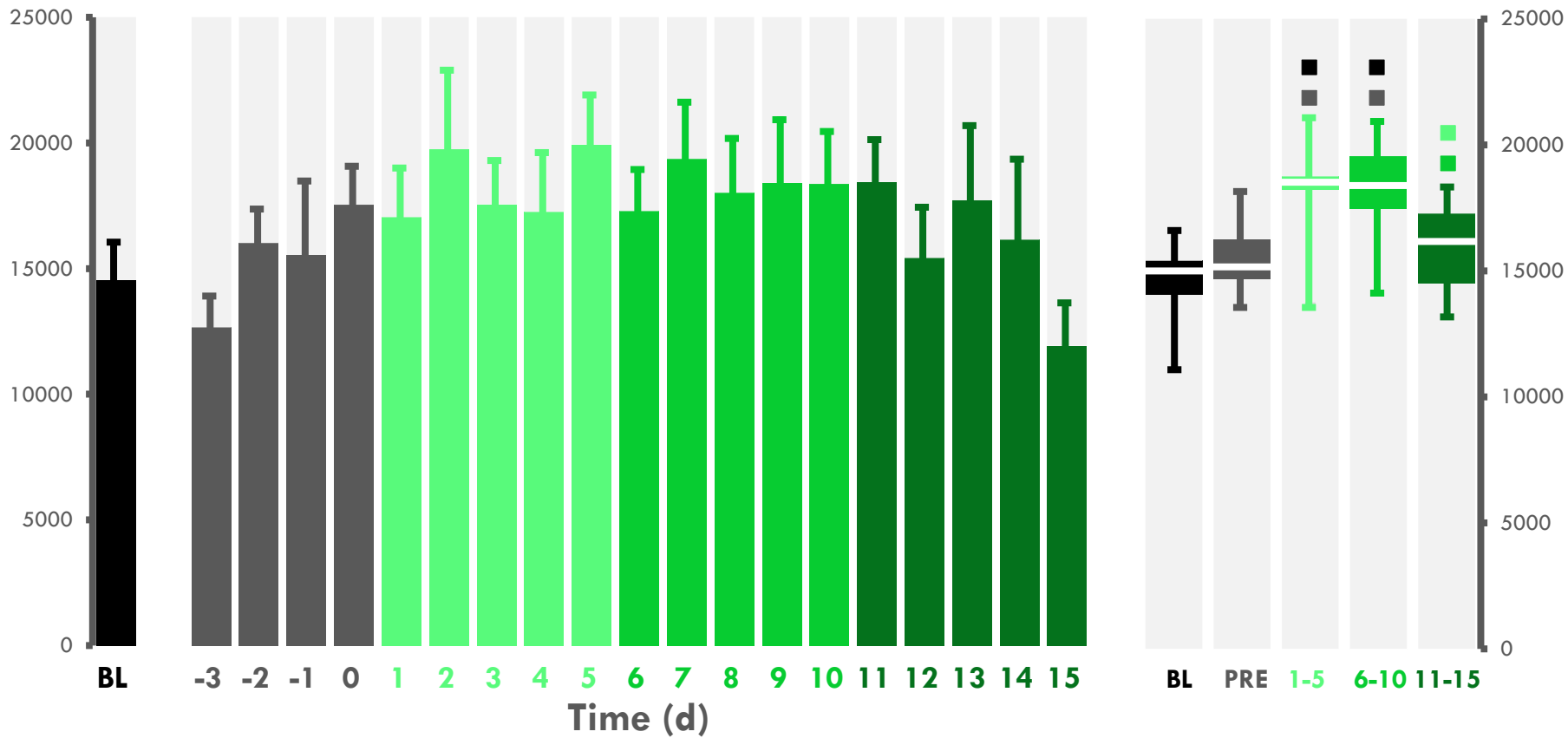
**THANK YOU FOR**  
YOUR ATTENTION

**5<sup>TH</sup> INTERNATIONAL**  
**CONGRESS ON**  
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# RESULTS

## ENERGY EXPENDITURE (kJ)



# RESULTS

## INTAKE TIMING

