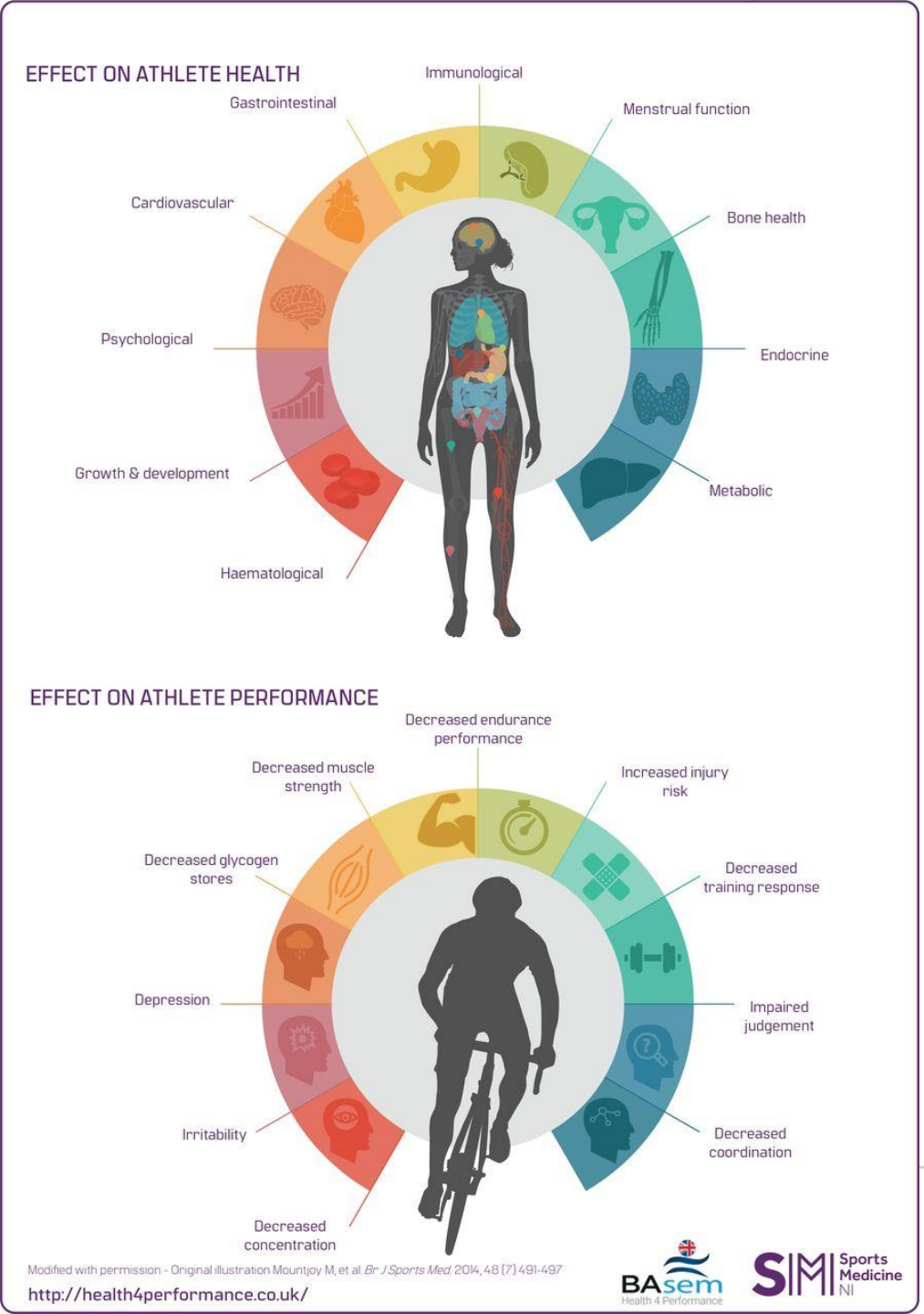
FUEL FOR PERFORMANCE

Christel Dunshea-Mooij

(MSc Nutrition)

Registered Nutritionist



Relative Energy Deficiency in Sport (RED-S)

- RED-S was first introduced by the International Olympic Committee (IOC) in 2014.
- RED-S is a syndrome that encompasses a myriad of negative impacts caused by energy deficiency for both male and female athletes.
- RED-S results in an impairment of athlete's health and performance
- The underlying factor of this syndrome is caused by low energy availability.

Energy availability is described as the energy available to the body (from food) after the costs of exercise has been accounted for. It is the fuel (energy) available for physiological processes within the body.

Energy available from food (kCal)

Cost of exercise (kCal)

Energy Available for normal bodily processes ($kCal * kg^{-1} * FFM^{-1} * day^{-1}$)

When 'LOW' EA?[2,6-8]

Green = High EA for mass gain and growth ≥45 kcal/kg FFM/day

- Athletes consuming sufficient kcal for the energy expended.

Orange = reduced EA for body mass/fat loss=30–45 kcal/kg FFM/day

- Athletes are not consuming sufficient energy.

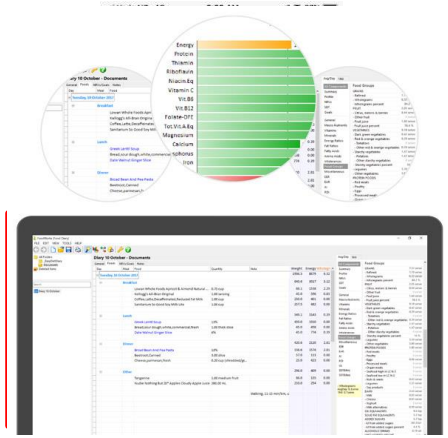
Red = LEA causing health implications ≤30 kcal/kg FFM/day)

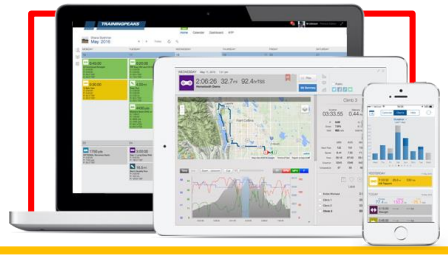
- Athletes are not consuming sufficient energy.

Rowers @ **high** risk for LEA

- Elite rowers high training load; average 19.8 h/w
- Unintentional under fuelling
- Perceived expectations and influences from our social environment

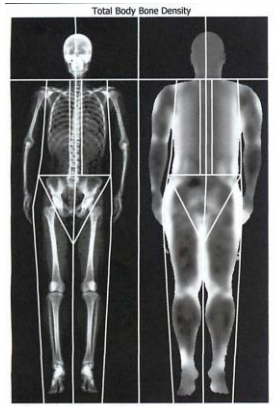
Screening for Energy Availability

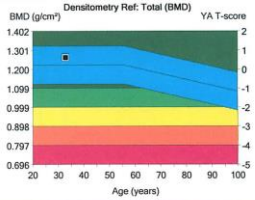




B3 training week

Day 1 Day 2 Day 3 Day 4



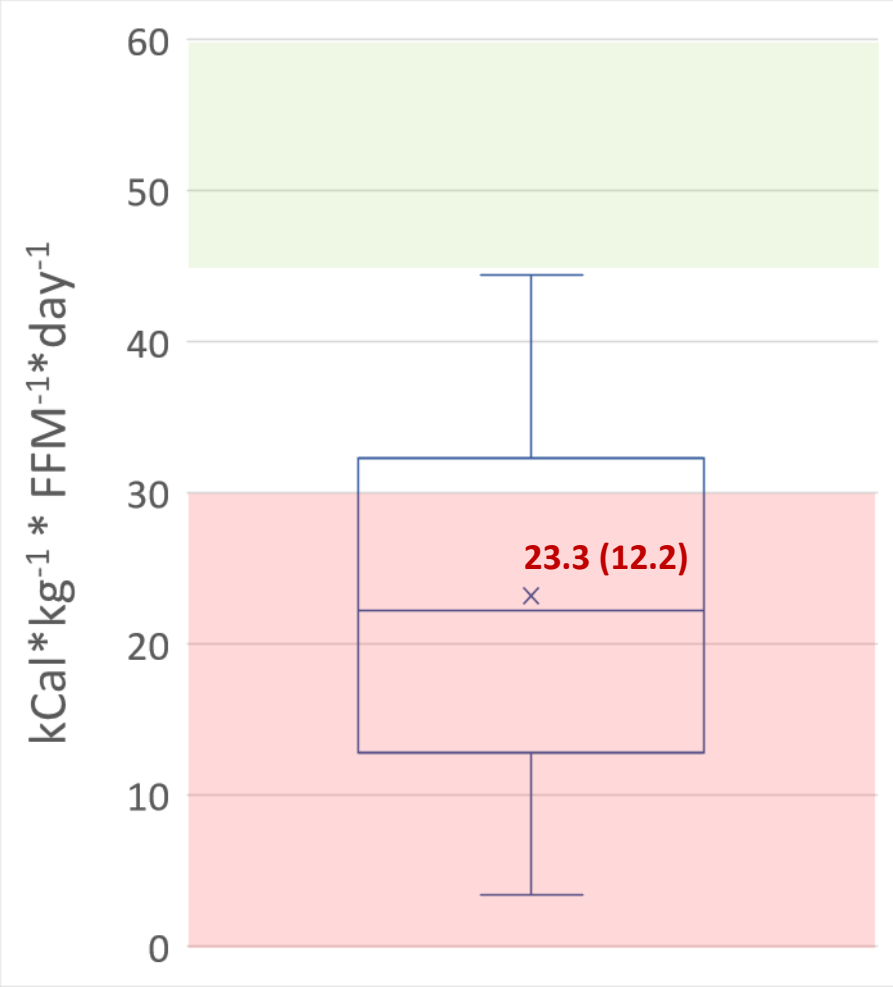


Region	1 BMD (g/cm²)	2 Young-Adult T-score	3 Age-Matched Z-score
Head	2.002	-	-
Arms	1.064	-	-
Legs	1.333	-	-
Trunk	1.075	-	-
Ribs	0.998	-	-
Pelvis	1.076	-	-
Spine	1.199	-	-
Total	1.264	0.6	0.4

Addressed the barriers and challenges:

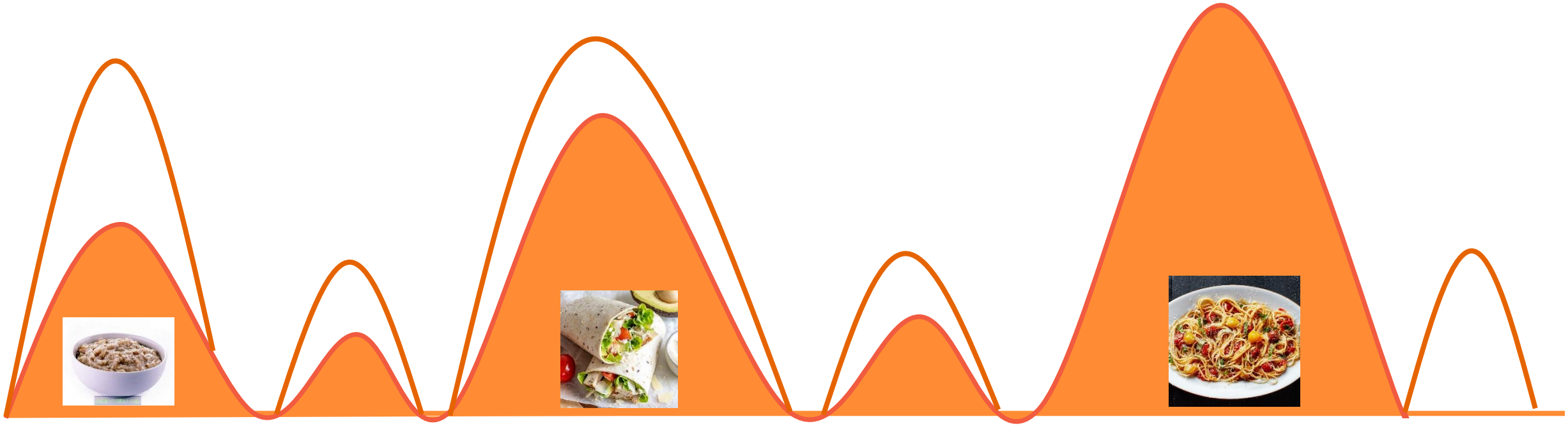
1. Increase food intake when the intensity or duration of training increases.
2. Awareness of changes ofenergy requirements from day to day and across the season. "*If you follow the same basic nutrition plan by eating the same thing every day your energy availability could be inadequate for some days.*"
3. Get an idea of the energy cost of your training sessions. "*Most people I work with underestimate the cost of training and tell me "I don't have to eat for this session as it was only a ……". Because you drive your car only a small distance, this doesn't mean that you don't have to fill it up with petrol!*"
4. Be aware what's done outside your training. Not factoring the additional energy required from these activities could lead to unintentional low energy availability.
5. Burst myths; don't assume that you lose weight when you under fuel. This is NOT the case as our bodies are smartly designed to defend against any perceived starvation by slowing down your metabolism.

Results 2018



	EA <30	EA ≥30	*p*-value	Effect Size
	n = 16 (64%)	**n = 9 (36%)**		
Age (years)	24.4 ± 2.5	25.5 ± 3.0	0.34	0.5
Height (cm)	179.0 ± 5.3	177.4 ± 5.7	0.49	0.3
Weight (kg	77.7 ± 5.3	72.0 ± 5.9	0.03*	1.1
BMI (kg/m2)	24.2 ± 1.4	22.9 ± 1.0	0.01*	1.1
Skinfolds (mm)	85.6 ± 13.4	72.5 ± 13.4	0.03*	1
Body fat (%)	24.9 ± 2.5	20.5 ± 4.0	0.01*	1.7
FFM (g)	57.9 ± 3.8	57.0 ± 4.2	0.6	0.2
Years Elite Team	3.1 ± 2.2	3.3 ± 3.0	0.86	0.1
Energy Availability	15.5 ± 6.7	36.8 ± 5.6		

Small changes can make a big difference



Breakfast:
Porridge + milk

Plus: maple syrup + 1 tsp peanut butter + banana + walnuts

Recovery
Whey protein + water

Plus: milk + piece of toast + jam

Lunch:
Wrap + ham + salad

Plus: change the wrap for toast or add beans + glass of juice

PM
Piece of fruit

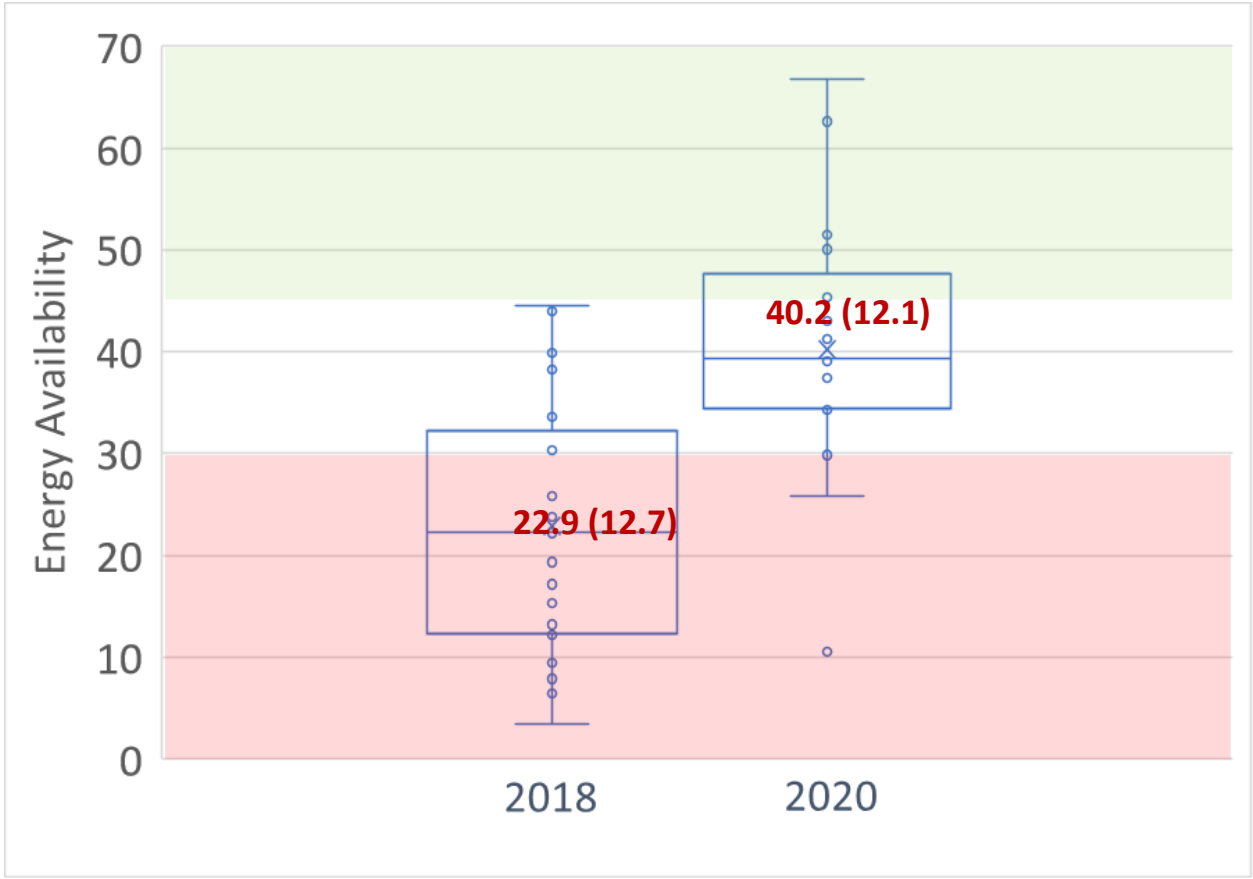
Plus: milk + peanut butter + banana (smoothie)

Dinner:
¼ plate carbohydrate
¼ plate protein
½ plate vegetables

Plus:
fruit crumble + yoghurt

Gary Hay – Women's coach RNZ (2021)

The women were re-assessed in 2020



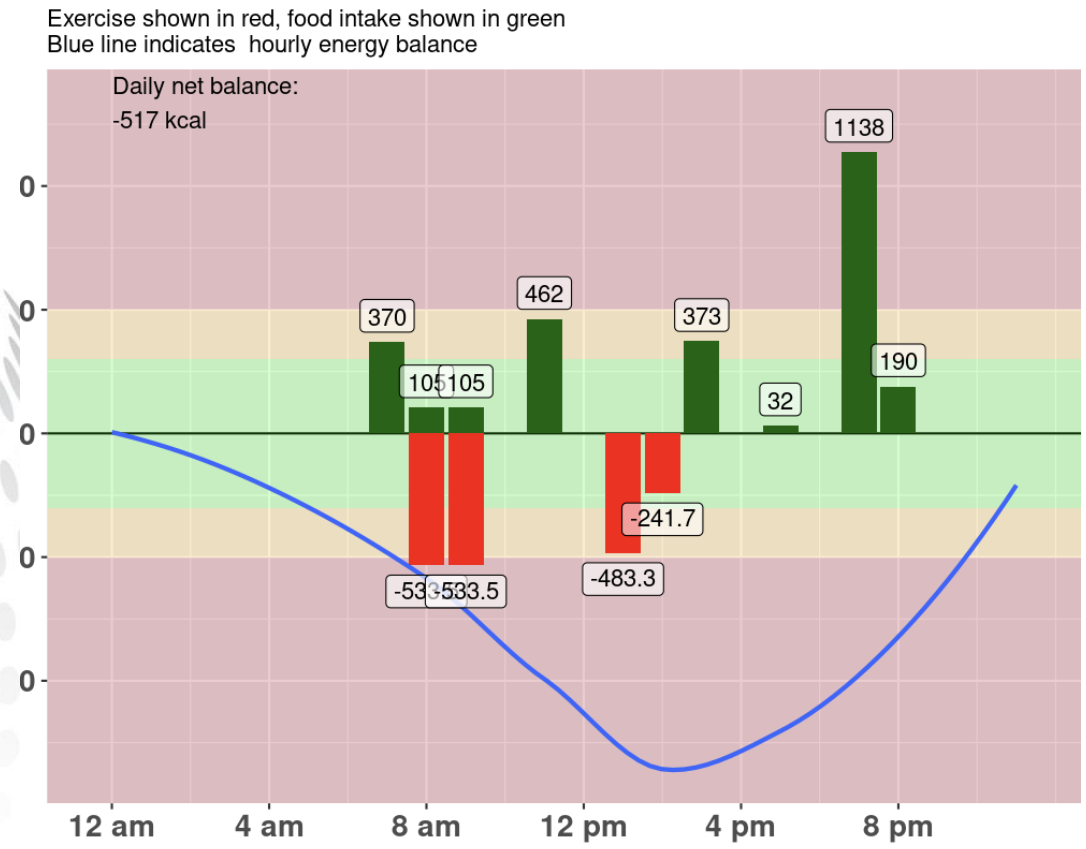
Significant EA improvement ($P < 0.05$)

Summary of the results 2018 vs 2020

- EA improvement (*P < 0.05*)
- Reduced GI symptom score (*P < 0.05*)
- Significant increase in lean mass (*P < 0.001*)

	2018	**2020**	**p-value**	**ES**
	n=21	n=21		
Age (years)	25.2 ± 5.8	27.2 ± 2.5		
Height (cm)	178.5 ± 5.5	178.5 ± 5.4		
Weight (kg	75.7 ± 5.8	75.1 ± 5.7	0.33	0.1
BMI (kg/m2)	23.7 ± 1.2	23.6 ± 1.4	0.37	0.1
Skinfolds (mm)	81.1 ± 15.2	71.2 ± 12.1	0.001*	0.6
Body fat (%)	23.2 ± 4.0	21.9 ± 3.5	0.06	0.3
FFM (kg)	57.8 ± 3.5	59.2 ± 3.5	0.002*	0.4
Lean mass (kg)	**54.7 ± 3.4**	**56.3 ± 3.4**	**<0.001***	**0.5**
Years Elite Team	3.6 ± 2.4	5.5 ± 2.6		
EA (kcal*kg^{-1}/FFM*day^{-1})	**22.9 ± 12.7**	**40.2 ± 12.1**	**<0.001***	**1.4**
BMD Z-score	**1.6 ± 0.6**	**1.6 ± 0.6**	**0.66**	**0**
LEAF-Q	n=17	n=18		
overall score (cut off ≥8)	**9.1 ± 4.8**	**6.3 ± 3.5**	**0.1**	**0.6**
Injury score	2.1 ± 1.9	2.0 ± 1.8	0.7	0
Gastro-intestinal symptom score	2.6 ± 1.6	1.5 ± 1.5	0.02*	0.7
Menstrual cycle / contraception	3.8 ± 2.9	3.4 ± 2.9	0.81	0.1

Focus on within day energy balance - example



Pre training meal

Your pre-training meal depends on how much time you have to digest your meal

Should contain carbohydrate and protein

More than 3 hours before training

Less than 1 hour before training

Brooke Francis

Silver Olympic Medal

Winner Tokyo

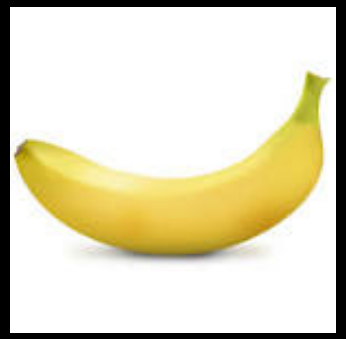
Olympic Games W2X


ROWING
NEW ZEALAND

What do you eat during training

HIGH PERFORMANCE
SPORT NEW ZEALAND

Time	Recommendations
< 1 hour	Water **OR** Carbohydrate snack/drink for a high intensity session
1-2 hours	30-60 g of carbohydrate per hour



Banana

Fruit leather

onigiri

What do you eat after training?

4 R's for Recovery

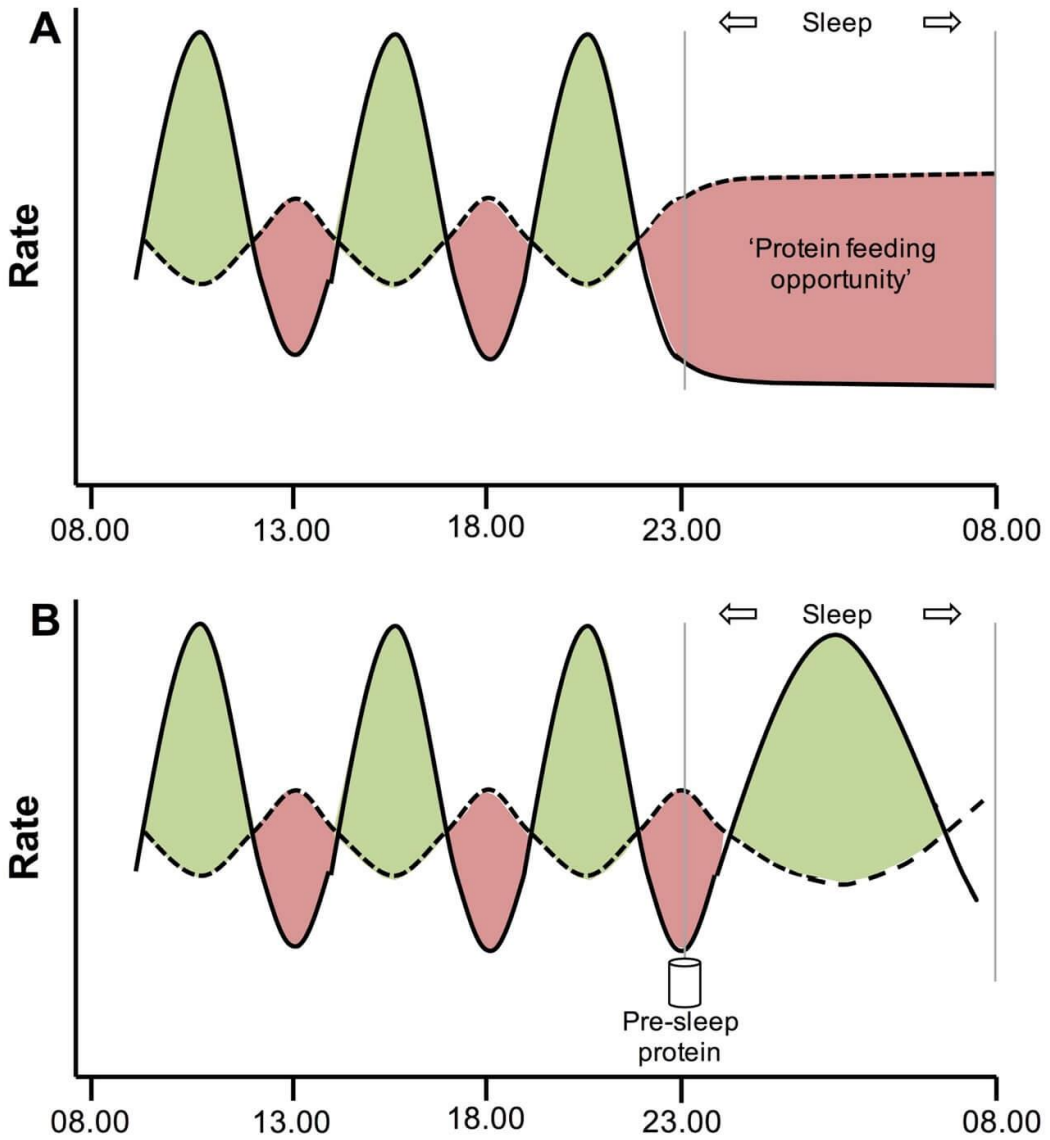
1. Replenish glycogen with carbs
   1 g/kg carbohydrate within 30 min
2. REPAIR tissues with protein
   0.3 g/kg of good quality protein
3. REHYDRATE with fluids and electrolytes
   1L/kg lost with sodium/carbs
4. RE-INFORCE immune system
   All the above + diet rich in fruit / vege & variety

1. Replenish

2. Repair your muscles

Muscle is stimulated to increase its protein synthetic rates for up to **24 hours after a workout.**

Aim to spread protein over meals and snacks consumed over the day



Trommelen *et al*, 2016
Strongerbyscience.com
Nutritiontactics.com

20 g Protein

525 ML
MILK

300 ML
YOGHURT

3 WHOLE
EGGS

300 G
LENTILS

75 G
EDAM CHEESE

90 G
CHICKEN

80 G GROUND
BEEF (RAW)

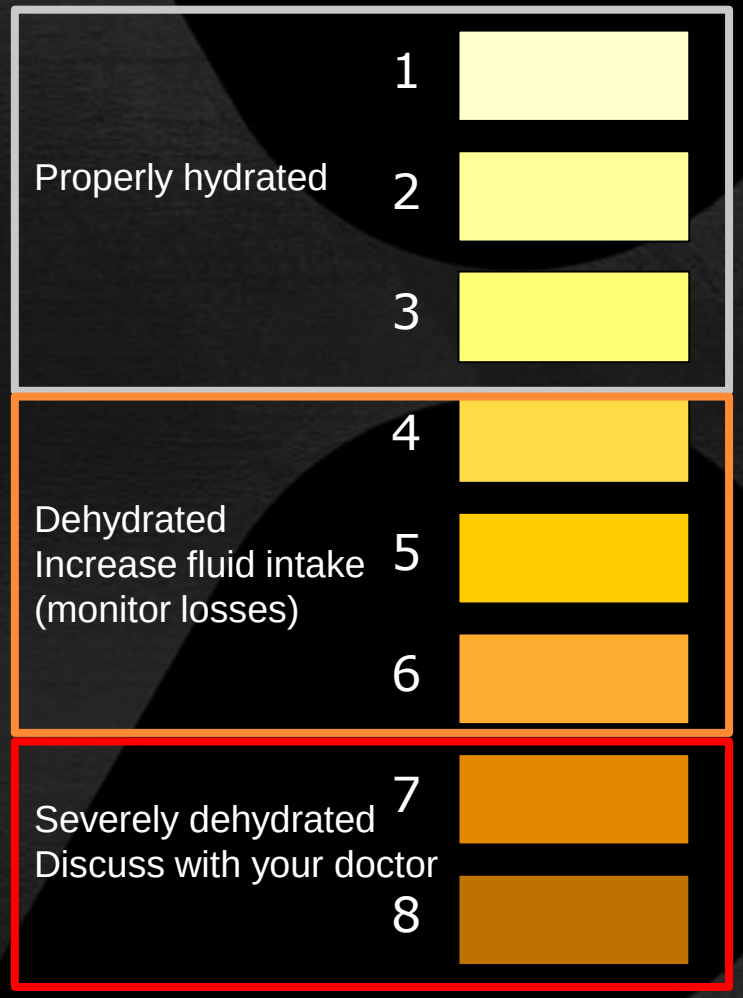
60 G LEAN BEEF
(RAW)

95G LAMB
(RAW)

95G PORK FILLET
(RAW)

3. Rehydrate

Hydration Tips



Urine color

Thirst

Body mass

KO TĀTAU TE KAPA O AOTEAROA
WE ARE THE NEW ZEALAND TEAM

Aim to replace 150% of the fluid lost during training	
Weight before training	70.0 kg
Weight after training	69.6 kg
Fluid drank during training	0.5 kg (ml)
Total fluid lost	0.9 kg

To fully replace fluid losses before the next training session you need to drink 0.9 X 1.5 = 1.35 ml before the next training session

Tom Mackintosh

Gold Olympic Medal

Winner Tokyo

Olympic Games M8+

—

- Optimal Nutrient timing
- Excellent quality of food
- Fuelling according to the work you are doing by adding snacks throughout the day
- Optimise protein pulsing by avoiding long periods without food (more than 4+ hours)