

# NUTRITION AND TRAINING PLANS TO ALTER BODY COMPOSITION



**GATORADE  
SPORTS  
SCIENCE  
INSTITUTE**

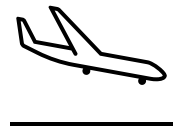
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# OVERVIEW

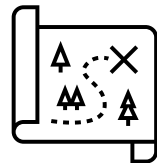
This lecture will break down the components of altering body composition into the following stages:



**The starting point-** interpreting the results of body composition test.



**The ending point-** setting the goal for the athlete.



**Getting there-** connecting the starting and ending points- setting the nutrition and training plan.

# CHOOSING A TESTING METHOD

Selection of the measurement (or measurements) will impact your results



- Is the measurement the gold standard for the alteration of interest?
  - Ex. If looking at muscle, we would ideally use a measurement that considers 3 compartments (DXA) rather than 2 (BodPod).

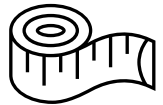


- Will the athlete have access to this measurement tool again in the future?
  - If not (Ex. If it is expensive, in a distant location) this will impact reliability and make comparison of any intervention difficult.

# TESTING METHODS REVIEW



Height, weight, BMI



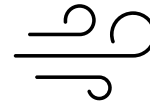
Waist-to-Hip ratio (and body girth measurements)



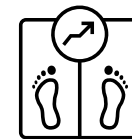
Skinfold measurements



Hydrostatic (underwater) weighing



Air displacement plethysmography (ex. BodPod)



Bioelectrical impedance analysis (BIA)



Dual-energy X-ray absorptiometry (DXA)

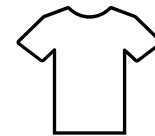
# MEASUREMENT ACCURACY

It is important to remember there is a margin of error for any method of measuring body composition.

As a reminder, to limit this margin **avoid the following** prior to your measurement:



Exercise



Wearing bulky clothing



Food/water intake  
(should be fasted ~8 hours)



Testing late in the day

\*\*\* It may be best to perform measurements in the morning before eating, drinking, exercising.

# INTERPRETING RESULTS - VALUES

Values that you may see as a result of a body composition test are:

## Fat/Adipose

% body fat

lbs/kg of body fat

Regional body fat  
(Subcutaneous vs. Visceral)

Whole body or segmental fat  
distribution  
(Ex. Android & gynoid)

## Muscle

lbs/kg of fat free mass (FFM)  
FFM = bone, muscle, organs, water  
content  
(Skinfolds, BodPod, BIA)

lbs/kg of fat and bone-free mass  
(FBFM)  
FBFM = muscle, water, organs  
(DXA)

Whole body or segmental  
FFM/FBFM  
Ex. Leg lean mass

## Bone

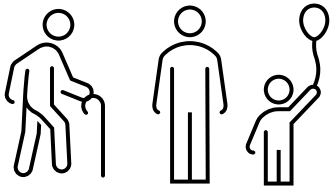
Bone mineral density (BMD) in  
 $\text{g}/\text{cm}^2$

Bone mineral content (BMC) in  
grams  
(DXA)

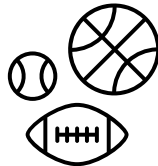
DXA is the Gold standard for  
BMD and BMC

# INTERPRETING RESULTS

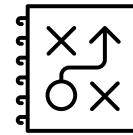
Consider how the results compare to normative data based on:



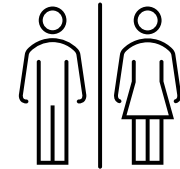
Age



Sport



Position



Sex

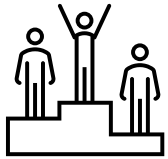
- ⑩ Is this the first measurement? Follow up?
- How do these results compare to a previous result?
  - ⑩ Was the same measurement instrument used?
- Does a goal need to be set to alter body composition?

# SETTING THE GOAL

Setting the goal = ending indicator



The goal should be to alter body composition while:



Maintaining or enhancing optimal performance



Decreasing risk of injury

What is best for the individual compared to the normative data or are there outliers?

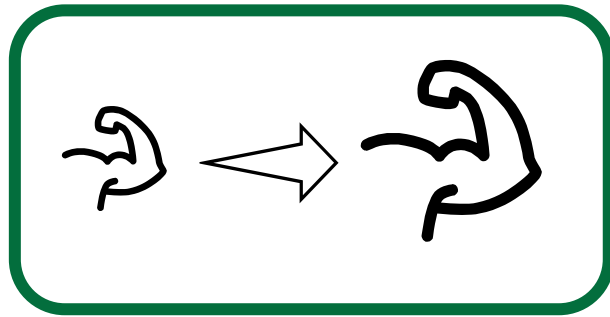
Consideration of the individuals' history of body composition:

If no history exists, normative data is best to abide by until more data points from the individual can be collected.

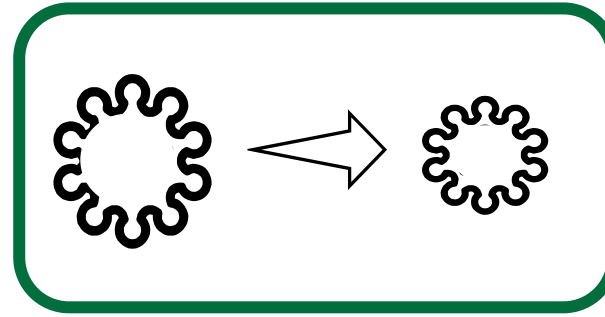


# SETTING THE GOAL

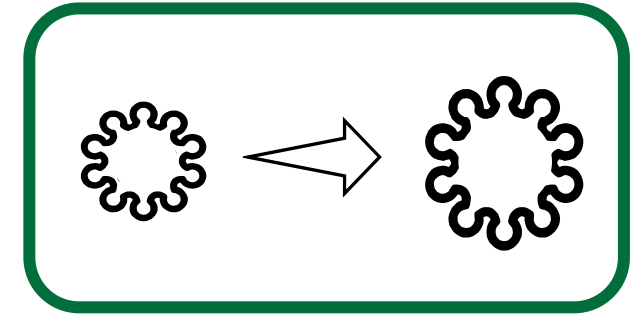
What needs to be achieved?



Lean mass gain  
(~0.5 lb per week)



Fat mass loss  
(1-2 lbs per week)



Fat mass gain  
(Very slowly, nutrient  
stores/fat soluble vitamins)

## Things to consider:

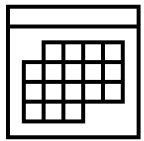
Time allotment to reach goal.

How much mass per week.

Best if done in offseason to allow for adaptations of muscles and connective tissues.

# SETTING THE GOAL

Deciding how much monitoring is appropriate:

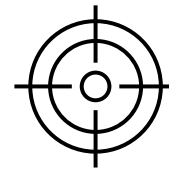


Biweekly?

Monthly?

At each monitoring session consider:

- What follow up tests are appropriate?
- Does the goal need to change?
- Is the goal still realistic and achievable?
  - ⑩ Caloric restriction should not be too drastic (for weight loss) to minimize muscle mass loss.



# REACHING THE GOAL

How to reach your goal from an energy and macronutrient level given the principles of:

Muscle protein synthesis (MPS)

Muscle protein breakdown (MPB)

**Energy Requirements:** ↑ if increasing body mass, ↓ if decreasing mass



**Resistance Exercise:** ↑ if increasing muscle mass

**Endurance Exercise:** ↑ if maintaining  $\text{VO}_2$



**Protein, Carb, Fat ingestion:** How do these ratios affect our goals?

# ENERGY RESTRICTION & BODY COMPOSITION

Typically when we calorie restrict, we lose:

 Muscle mass  
&  
 Fat mass

Typically when we go back to habitual caloric intake we regain:

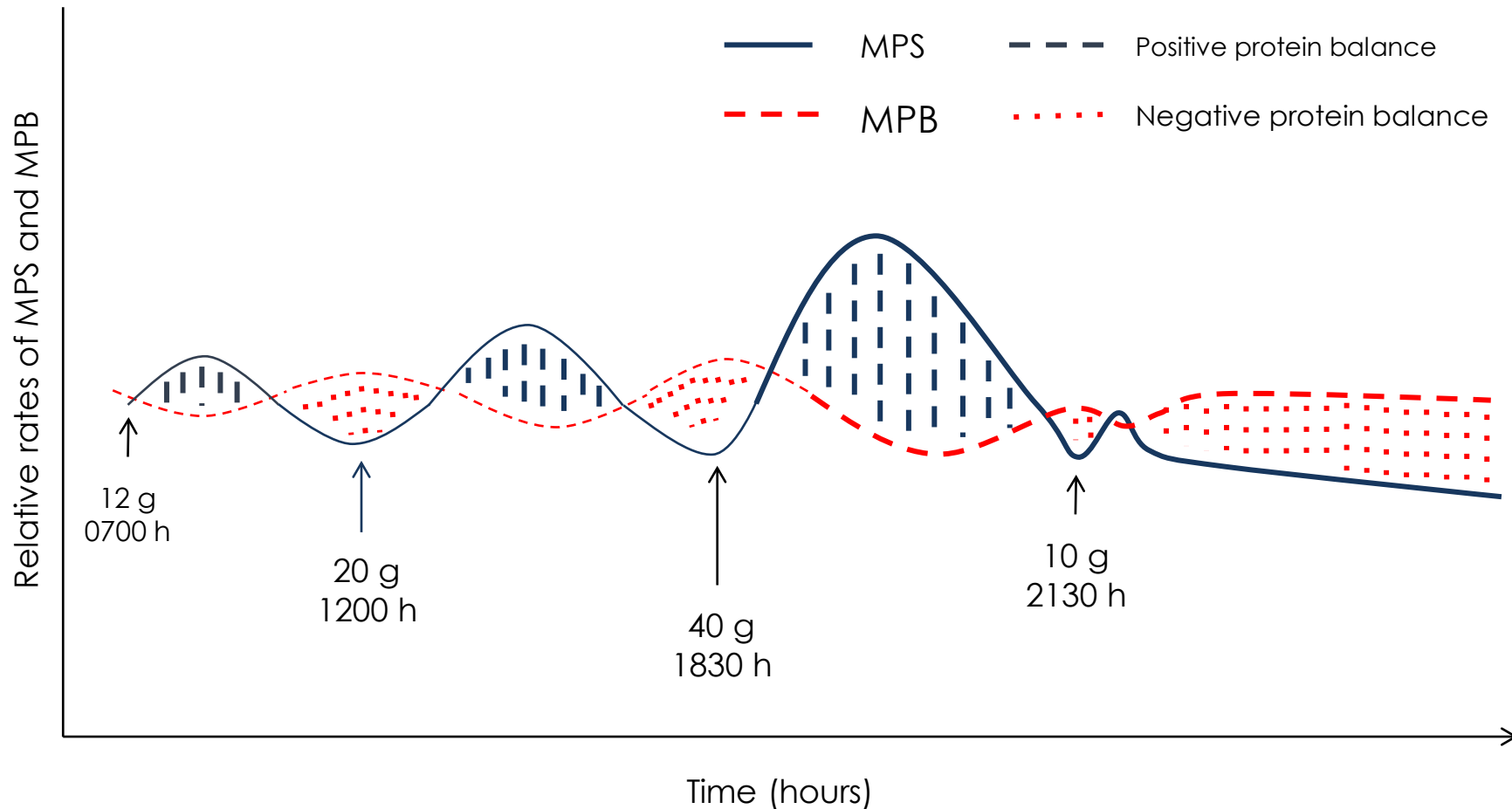
 Muscle mass  
&  
 Fat mass

**Ideally, we would regain the muscle mass that we lost!**

If this is the case, what can we do to mitigate muscle loss during weight loss?

# ENERGY RESTRICTION & BODY COMPOSITION

Energy restriction: Recall muscle protein synthesis and breakdown



Without calorie restriction,

areas of



protein balance roughly

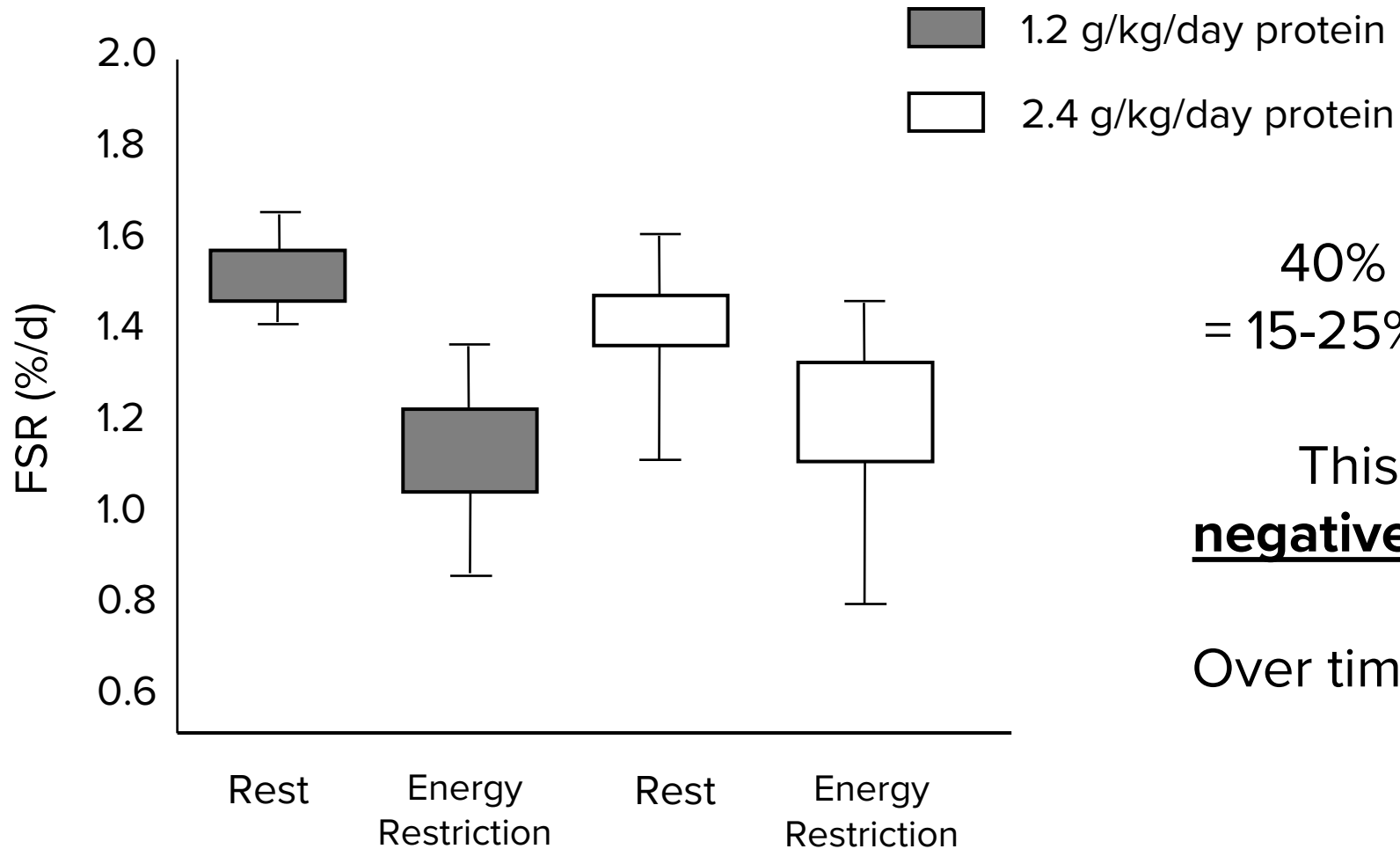
equal areas of



protein balance

# ENERGY RESTRICTION & BODY COMPOSITION

BUT during energy restriction (ER) rates of MPS are suppressed



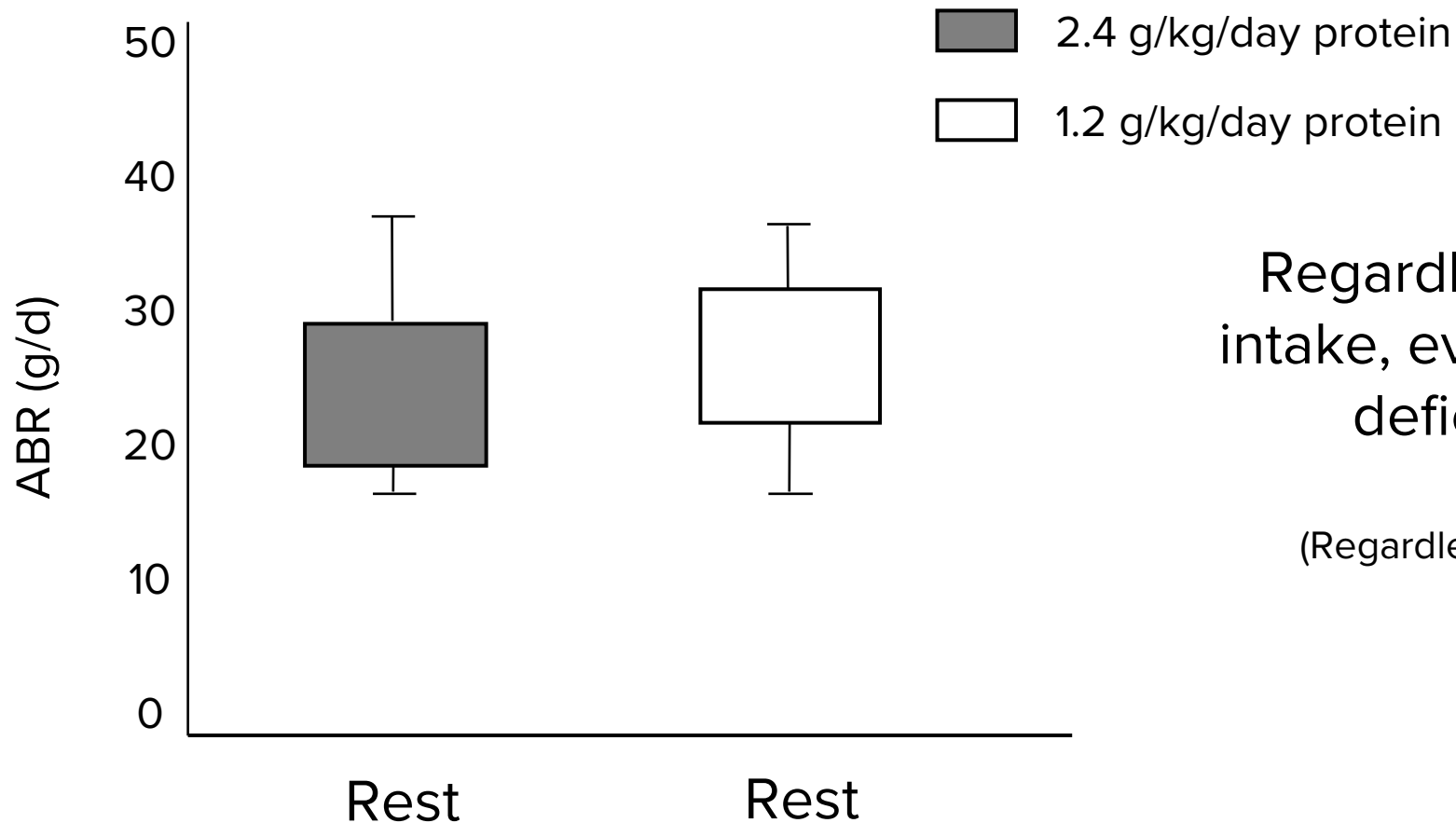
40% energy restriction  
= 15-25% **DECREASE** in MPS

This results in overall  
**negative net protein balance**

Over time, this would result in  
**muscle loss**

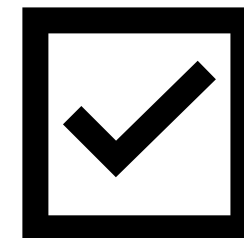
# ENERGY RESTRICTION & BODY COMPOSITION

What about muscle protein breakdown?



Regardless of a high protein intake, even with a 40% energy deficit, MPB remains unchanged

(Regardless of protein intake amount)



# ENERGY RESTRICTION & BODY COMPOSITION

Connecting the dots - Mitigating MPS decline during an energy deficit

Remember the main drivers of MPS are:



Resistance Exercise/  
Weight training



High quality  
protein intake

**When reducing calorie intake to reduce body mass, increase resistance exercise and protein intake to attenuate muscle mass loss.**



# GOAL: GAINING LEAN MASS

## Nutrition

### Calories:

- Seek a **calorie surplus (hypercaloric diet)**.
- It is best to establish a baseline from what the individual is already consuming and add to this regimen (250 to 500 additional kcal/day or 10 to 20% above typical calorie intake).

### Protein:

- May establish protein intake as high as 1.6 to 2.2 g/kg of bodyweight spread evenly throughout the day.

### Carbohydrates and Fat

- Carbohydrates should be the focus of the remaining calorie surplus demands when considering fat intake levels should remain at 20-35% of kcals .

## Exercise



A progressive resistance training aimed at volumes to promote muscle **hypertrophy**.



HIIT may be more appropriate over slow, steady aerobic training.

# GOAL: LOSING FAT MASS

## Nutrition

### Calories:

- Seek a **calorie deficit (hypocaloric diet)**.
- It is best to establish a baseline from what the individual is already consuming and subtract from this regimen (250 to 500 less kcal/day or 10 to 20% below typical calorie intake).

### Protein:

- Levels of 1.2 to 1.6 g/kg bodyweight spread evenly throughout the day including a pre sleep bolus have been found to be protective of lean mass loss.

### Carbohydrates and Fat:

- Carbohydrates and fat may be reduced from baseline to satisfy the needed caloric deficit “at the expense” of protein.
- However, enough carbohydrate to maintain performance should be encouraged.

## Exercise



A resistance training program to limit muscle atrophy.



**Slow, steady**, aerobic training with a mixture of **HIIT**.



# GOAL: GAINING FAT MASS TO HEALTHY LEVELS

## Nutrition

### Calories:

- Make sure athletes are meeting daily calorie demands (**calorie balance**) for optimal energy availability.
- Optimal energy availability= >40 kcal/kg FFM/d (males) and >45 kcal/kg FFM/d (females).
- Low energy availability= < 30 kcal/kg/FFM/d.

### Protein:

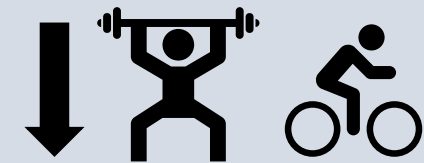
- 1.2-2.0 g/kg bodyweight spread evenly throughout the day.

### Carbohydrates and Fat

- Depending on tolerance and activity level, carbohydrates may be as high as 6-12 g/kg.
- Fat intake should not be below 20-35% of kcals.



## Exercise

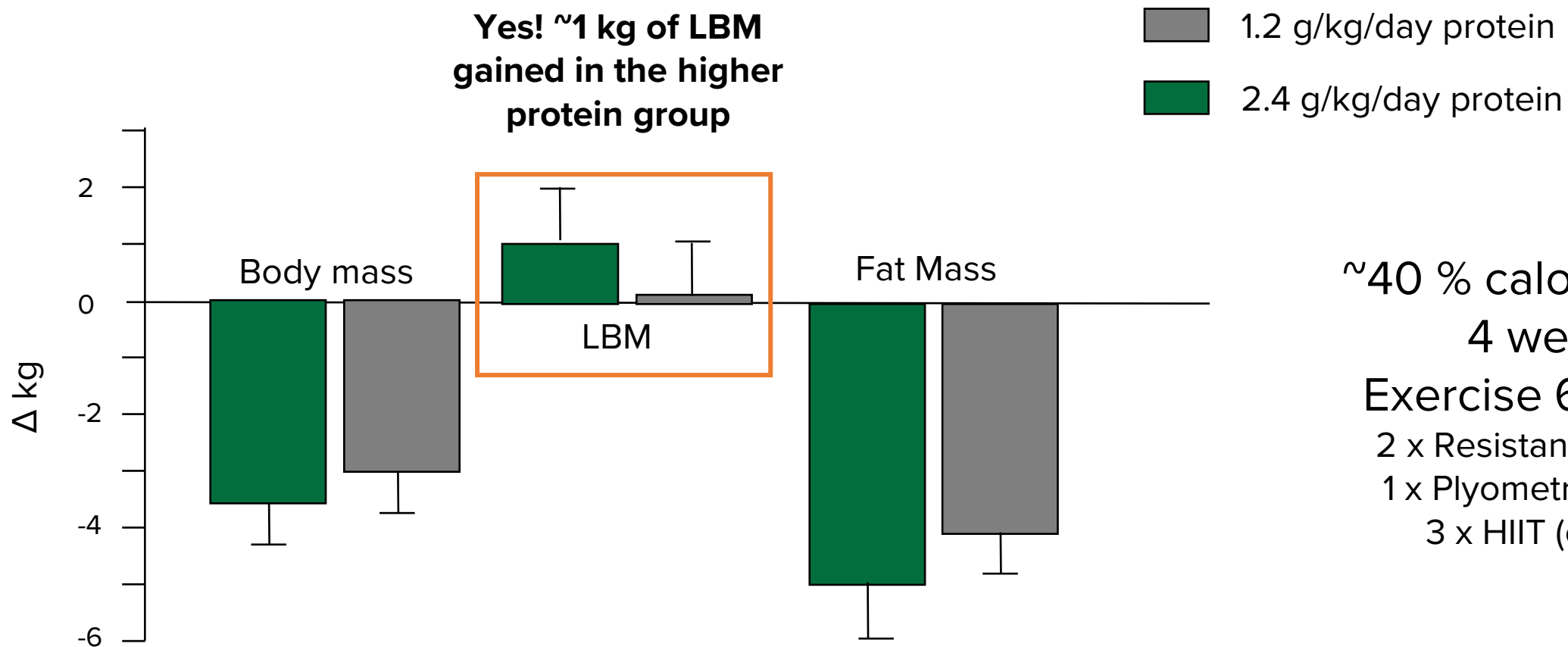


May be decreased to allow for calorie surplus.  
If unable to limit energy expenditure from training, eliminate any extra sessions.

# MUSCLE GAIN

Gaining muscle while losing fat, can it be done?

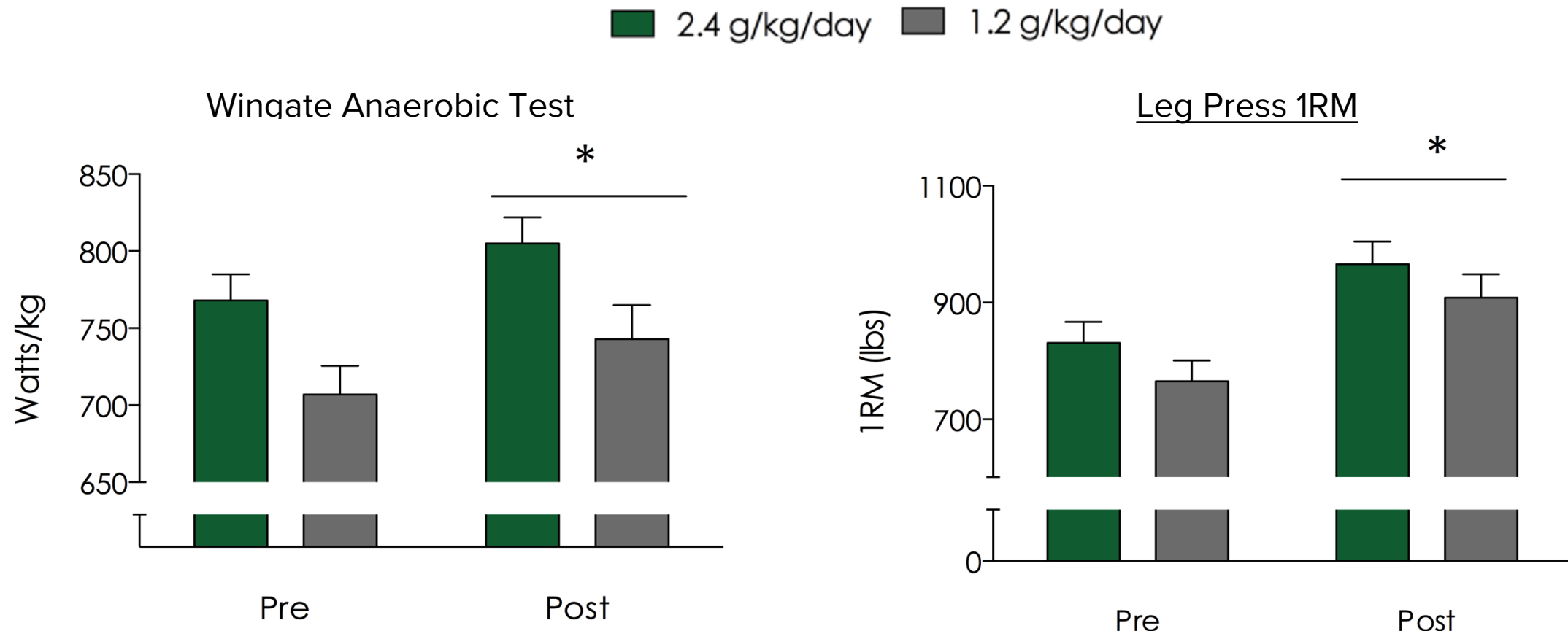
**Yes! ~1 kg of LBM  
gained in the higher  
protein group**



~40 % calorie deficit  
4 weeks  
Exercise 6x /week  
2 x Resistance training  
1 x Plyometric training  
3 x HIIT (cycling)

# PERFORMANCE

Losing fat mass and gaining muscle - In untrained individuals there were differences in performance outcomes 4 weeks following 40% energy restriction and a high protein diet



## Football Player Off-Season Body Composition Changes



*For specifics on body composition and American Football and for more information about body composition methods, see:*

SSE#145



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# CASE STUDY



## Player Profile

**Age:** 25 yo  
**Height:** 6' 6"  
**Weight:** 275 lbs  
**Body Fat:** 20%  
**Fat Mass:** 55 lbs  
**Fat Free Mass:** 220 lbs



## Assessment Details

**Mode:** BodPod  
**Time:** 6:30 am  
**Food Intake:** Fasted  
**Clothing:** Compression shorts  
**Scheduling:** Beginning of off-season, 20 weeks before regular season



## Goals

**Weight:** 265 lbs (-10 lbs)  
**Body Fat:** 17% (-3%)  
**Fat Mass:** 45 lbs (-10 lbs)  
**Fat Free Mass:** 220 lbs (-0 lbs)

Discussion: As the Sports Dietitian working the team, what is the first thing you would do to start changing this player's diet to achieve his goals? From a big picture perspective, what do you think the main changes to his diet might be?

# CASE STUDY

The Sports Dietitian collected a 3-day food record from the athlete and created an evidence-based plan:

	<b>Current Intakes</b>	<b>Initial Changes</b>	<b>Further Changes after ~ 1 month</b>
Total Calories (kcal)	5200	4700	4100
Carbohydrate (g)	700	635	575
Protein (g)	150 (1.2 g/kg)	160 (~1.3 g/kg)	200 (~1.6 g/kg)
Fat (g)	200	170	115

Discussion: When the athlete re-tests at the start of the regular football season, what changes do you expect to see in his body composition?



# KEY TAKEAWAYS

- ✓ Ensure an appropriate measurement method:
  - Appropriate compartments
  - Accessibility
- ✓ Create a realistic goal based on the athletes' age, sport, sex
- ✓ Mitigate muscle mass loss with protein and resistance training when in caloric deficit.



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