



Sport Nutrition Conference 2008

Repeated Sprinting: Application in Team Sports

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What I am going to tell you

- Sprinters, like marathon runners, need to worry about getting adequate carbohydrate
- Repeated sprinting, as in team sports, carries with the same set of nutrient needs as longer duration sports
- In order of necessity during the event: hydration, carbohydrate
- In order of necessity post-event: hydration, carbohydrate, protein
- Close temporal proximity to the event is likely key in terms of refueling

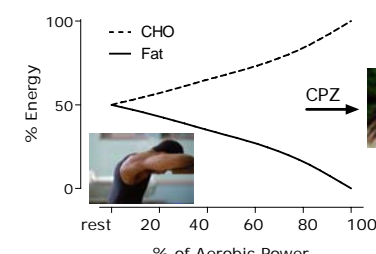
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Carbohydrate fuels athletic activity in the CPZ

- The CPZ or critical performance zone is a zone of muscular activity in which critical performance takes place
- High percentage of peak VO_2 (>80%)
- Can exceed peak VO_2
- May be entered into multiple times in a game:
 - Soccer
 - Basketball
 - Ice Hockey

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Even at rest we're at 50:50; it only goes up from there



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What about sport-specific tasks?

- Soccer



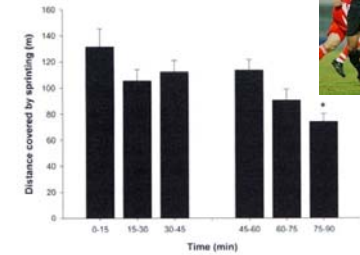
Period	High intensity running (m)
Peak 5-min period	~220
Next 5-min period	~100
Average 5-min period	~120

Mohr et al. J Sports Sci. 2005 Jun;23(6):593-9

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What about sport-specific tasks?

- Soccer



Time (min)	Distance covered by sprinting (m)
0-15	~130
15-30	~100
30-45	~110
45-60	~110
60-75	~90
75-90	~75

Mohr et al. J Sports Sci. 2005 Jun;23(6):593-9

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What about sport-specific tasks?

Basketball



All positions (n = 18)	17.58 (1.78)*	13.64 (1.33)
Guard (n = 6)	19.18 (1.10)**	14.29 (1.48)**
Forward (n = 6)	17.97 (0.69)**	14.13 (0.83)
Centre (n = 6)	15.61 (1.00)**	12.49 (0.89)

Ben Abdelkrim et al. Br J Sports Med. 2007 Feb;41(2):69-75

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What about sport-specific tasks?

- Ice hockey
- Low intensity activities occupied 94% of time
- Heart rate responses were above 70% max for 70% of the total ice time
- Hard skating = 3.5%, Sprinting = 1.5%
- Repeated hard skating/sprinting (i.e., <15s recovery) occurred a mean 19 times
- Mean of 3 hard skate/sprint per bout



Green et al. J Appl Physiol. 1976 Feb;40(2):159-63

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Take Home Point

Many team sports involve a sprint component or a time when intensity is quickly increased... oftentimes, this is repeated

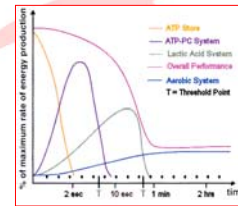
The initial fuel for this 'sprint' is a mix of PCr, glycolysis, and oxidative phosphorylation...

With repeated bouts the shift is squarely toward oxidative phosphorylation and that's powered by muscle glycogen!!

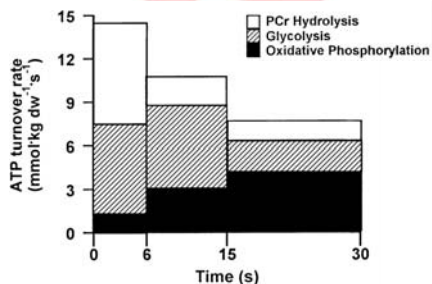
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But isn't sprinting energy fueled by PCr degradation?



During a single 30s maximal bout ~40% energy comes from oxidative metabolism of glucose

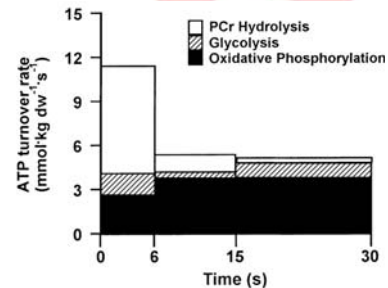


Parolin et al. AJP Endo. Nov.277(5 Pt 1):E890-900, 1999

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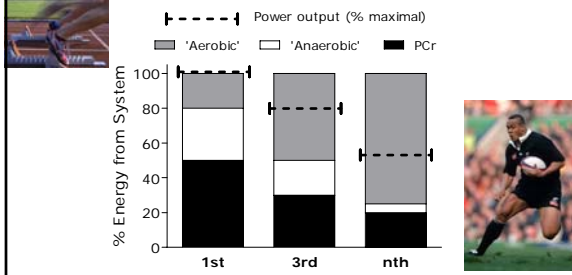
During a repeated 30s maximal bout ~60% energy comes from oxidative metabolism of glucose



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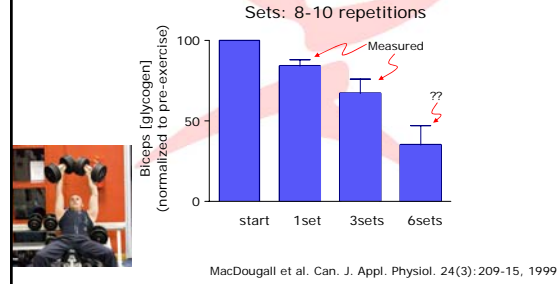
With repeated sprints the energy comes from aerobic systems and is almost exclusively carbohydrate



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Glycogen use during resistance exercise



MacDougall et al. Can. J. Appl. Physiol. 24(3):209-15, 1999

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Bottom Line

There is a significant usage of muscle glycogen during a bout of resistance training...

Could this substrate become limiting?
Premature fatigue due to inadequate dietary CHO?

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The nutritional strategy to improve performance in Repeated Sprint Activity (RSA)

Get adequate fluid and carbohydrate...

Pre-exercise: get adequate carbohydrate & hydrate

- To 'top-off' glycogen stores and prevent hunger, eat 2 - 4h before match
- What foods? 60% carb (mostly starch and 2-3g fiber), 25% protein, 15% fat
- *If the players like it, keep doing it!*
- Water or Sport drink to achieve free-flowing clear urine

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For example...

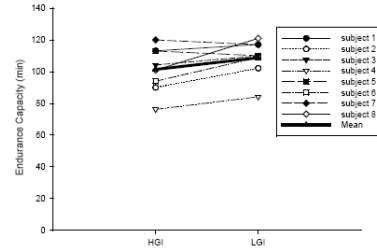
- 116kg rugby player eats 4.5h before his 3pm game:
 - 2 slices whole-wheat toast with peanut butter (1tbsp)
 - 1 banana
 - 1 'custom' smoothie - 400 kcal: 30g protein
 - 1L Gatorade
- 72kg soccer player eats 2h before her game:
 - 1 bagel with 1 tsp cream cheese
 - 1 banana
 - 1L Gatorade

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What about glycemic index?

A low glycemic index meal before exercise improves endurance running capacity in men



Wu & Williams. Int J Sport Nutr Exerc Metab. 2006 Oct;16(5):510-27
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The GI of the diet does not affect sprint and endurance performance

- Exhaustion between trials:
 - HGI 25.3 ± 4.0
 - LGI 22.9 ± 5.6
- No differences were found in the number of sprints attempted or the total distance covered:
 - HGI 43 ± 7
 - LGI 39 ± 10

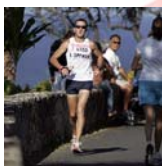
 - HGI 3474 ± 531 m
 - LGI 3097 ± 793 m

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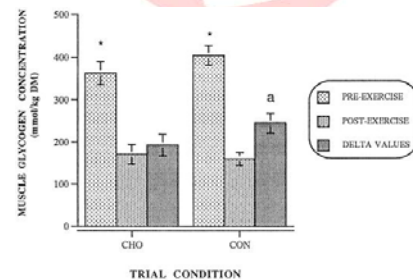
Take Home Point
It is difficult to make a firm conclusion about how GI of pre-performance meals affects subsequent performance

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What about during exercise?

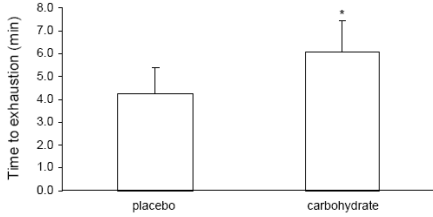


Consumption of fluid and ~6% carbohydrate solution reduces muscle glycogen use in repeat sprint exercise



Nicholas et al. Med Sci Sports Exerc. 1999 Sep;31(9):1280-6
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Consumption of 'sport gel' during high intensity shuttle running delays fatigue



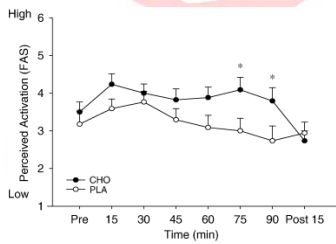
Patterson & Gray Int J Sport Nutr Exerc Metab. 2007 Oct;17(5):445-55
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Consumption of 'sport gel' during high intensity shuttle running had no effect on gut fullness or abdominal discomfort or RPE

	Time					
	Before	15 min	30 min	45 min	60 min	75 min
Gut fullness (1-10)						
placebo	0 ± 0	0.6 ± 1.1	0.9 ± 1.1	1.4 ± 1.5	1.3 ± 1.7	1.4 ± 1.4
carbohydrate	0.3 ± 0.5	1.0 ± 1.8	0.7 ± 1.5	0.7 ± 1.1	1.0 ± 1.2	1.4 ± 1.4
Abdominal discomfort (1-10)						
placebo	0 ± 0	0.3 ± 0.5	0.4 ± 0.8	1.1 ± 2.0	1.0 ± 1.7	1.1 ± 2.3
carbohydrate	0.1 ± 0.4	0.9 ± 1.9	0.7 ± 1.5	0.7 ± 1.5	0.9 ± 1.2	1.0 ± 1.5
Rating of perceived exertion (6-20)						
placebo	6 ± 0	10 ± 2*	12 ± 2*	12 ± 1*	13 ± 1*	15 ± 1*
carbohydrate	6 ± 0	11 ± 2*	11 ± 2*	12 ± 2*	13 ± 2*	14 ± 1*

Patterson & Gray Int J Sport Nutr Exerc Metab. 2007 Oct;17(5):445-55
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Carbohydrate ingestion during prolonged high-intensity intermittent exercise increases perceived activation during late stage exercise



Backhouse et al. Scand J Med Sci Sports. 2007 Oct;17(5):605-10
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Take Home Points
 During high intensity exercise provision of CHO is a good Strategy to offset fatigue and enhance performance
 Mechanisms are not well defined but may include delayed glycogen depletion, elevated blood glucose, And or psychological
 Well tolerated: solutions and solid gels

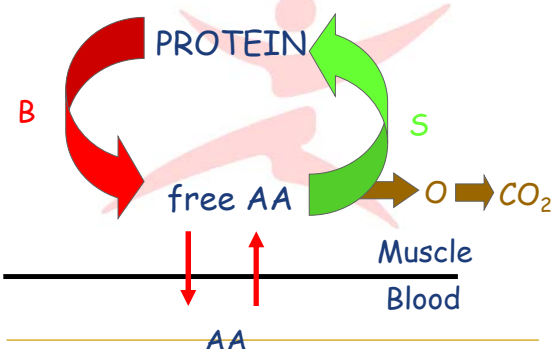
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Post-game/Post-practice

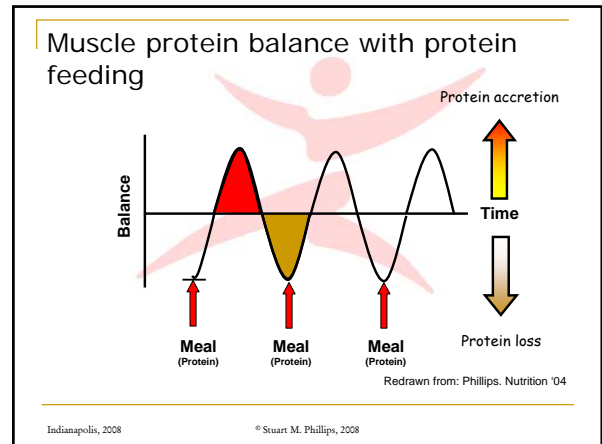
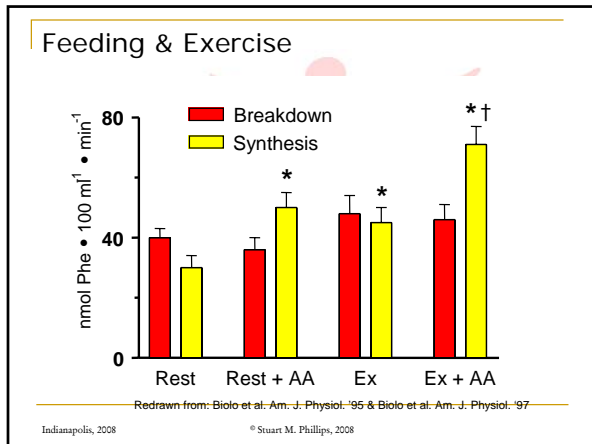
Eat early, eat often, eat carbohydrates, rehydrate...



Muscle protein turnover

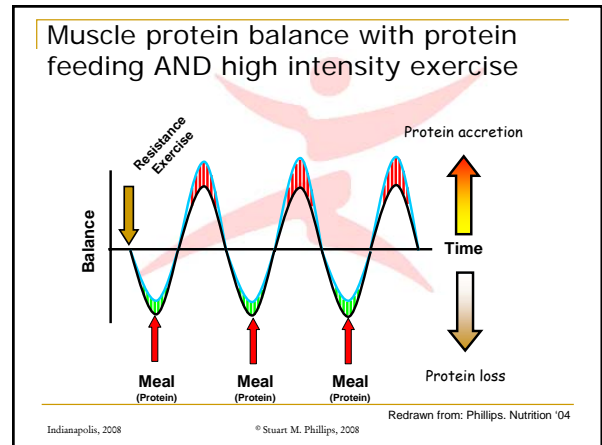


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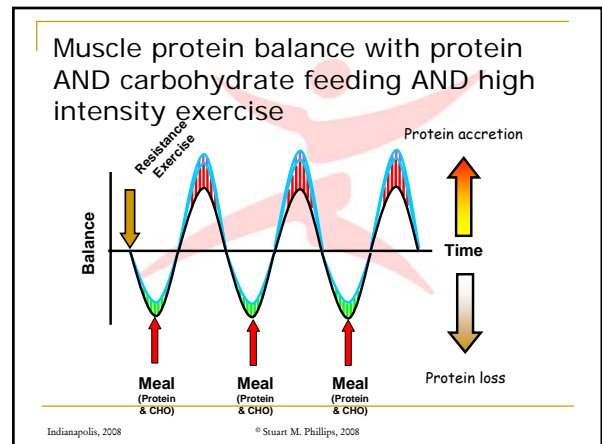
Take Home Point
 Protein consumption stimulates muscle protein synthesis the new proteins made simply replace old and possibly damaged proteins

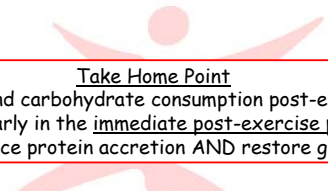
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Take Home Point
 Protein consumption post-exercise enhances the normal feeding-induced protein accretion, ultimately resulting in muscle protein gains (hypertrophy)

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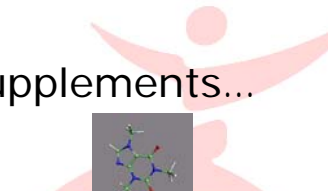




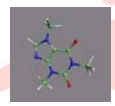
Take Home Point
Protein and carbohydrate consumption post-exercise particularly in the immediate post-exercise period can enhance protein accretion AND restore glycogen

Important
Most of the stimulation of protein synthesis is protein/AA-mediated; the incremental benefits of adding CHO are minimal by comparison... but glycogen is restored..


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Supplements...



Creatine, Caffeine, Bicarbonate/Citrate



THANKS

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