UFCSPA
Universidade Federal de Ciências da Saúde de Porto Alegre

Nutrição UFCSPA

Nut. Cláudia Dornelles Schneider
Prof. Adj. Depto. de Nutrição

Necessidades Nutricionais Antes, Durante e Depois do Exercício

Porto Alegre, RS, Brasil
Janeiro de 2013

Nutrição Esportiva

últimas 2 décadas	**+ recentemente**
“Recuperação entre sessões de treino” ↓ ↑ CHO + líquidos (energia, macro e micronutrientes)	“Modular adaptações musculares induzidas pelo treinamento” ↓ Estratégias nutricionais (ex.: *timing*)

UFCSPA

Timing
(ingestão energética, macronutrientes)

- Melhor recuperação; reparo tecidual
- Síntese proteica muscular aumentada
- Melhor estado de humor

Estratégias alimentares

↓

Individualizadas

Características fisiológicas	Características biomecânicas

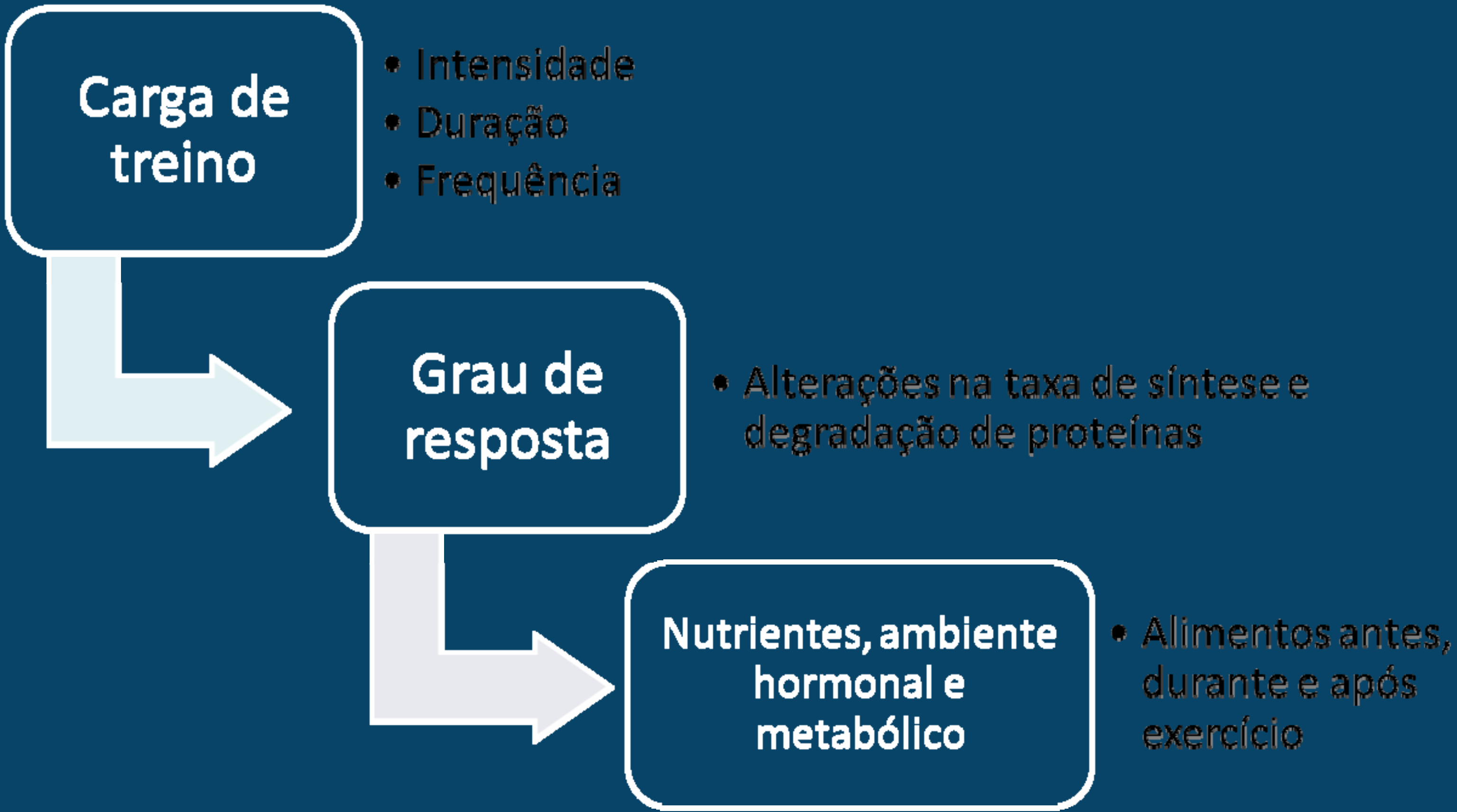
↓

carga de treino + competições

Ronald J. Maughan* and Susan M. Shirreffs *July 2011*

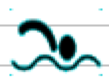
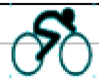
Adaptações ao treinamento

São específicas ao estímulo



UFCSPA

Planilha de treino

	SEGUNDA	TERÇA	QUARTA	QUINTA	SEXTA	SÁBADO	DOMINGO
	28/abr	29/abr	30/abr	1/mai	2/mai	3/mai	4/mai
	200 livre, 400 br	600 livre	1000 livre	600 livre	10x300 c/30"		
	600 [150 fr/50 for]	10x200 c/40" Z2	1x500 c/1'	8x50 c/15" (10br Vel)	1º livre, 2/3/4º d/6'		
	800 Braço	3	1x300 c/1' Pr	3	5º Pr		
	1000 Z1	400 Perna	1x500 c/1'	5x300 c/45" Z2	6/7º 75 fraco/25 for		
			1x300 Braço	4	8/9º Br		
				500 Braço	10º solto		
		40 Km				40 Km	**FUNDO**
		Giro				80%	80 Km
	40 min		**PISTA**		**FUNDO**	45 min, c/ 15 min+	
	70%		5x1000 Z2		1h30min	forte(70/80/90%)	

UFCSPA

1 treino/d	2 treinos/d
CM	CM
Colação	Colação
Almoço	Almoço
Lanche	Lanche
Merenda	Merenda
Jantar	Jantar
Ceia	Ceia

Considerar
- VET
- refeições antes
- ingestão durante
- refeições depois

hora do exercício
versus
hora da refeição

- - - - - - - - - - - - - - - - -

Modalidade de exercício
versus
Possibilidades de alimentação

- - - - - - - - - - - - - - - - -

*Hábito e preferência alimentar
*Educação alimentar

UFCSPA

ISSN exercise & sport nutrition review: research & recommendations

Kreider *et al. Journal of the International Society of Sports Nutrition* 2010, **7**:7

Praticantes não atletas
(3-4xsem, 30-60min)

- 45-55%CHO

3-5 g/kg/d

- 10-15% PRO

0,8 – 1,0 g/kg/d

- 25-35% LIP

0,5 – 1,5 g/kg/d

Atletas
(5-6xsem)

- 2-3 h/d - exercício intenso

55-65%CHO (5-8 g/kg/d)

- 3-6 h/d – exercício intenso

55-65%CHO (8-10g/kg/d CHO)

CHO complexos, IG baixo-moderado, grãos integrais, vegetais e frutas

UFCSPA

Antes do exercício

- *Endurance*: CHO
  - maximizar reservas glicogênio
  - manter níveis glicêmicos estáveis durante exercício

- Exercício de força: CHO, AA, PTN e Cr
  - Melhorar adaptações ao treinamento
  - Reduzir dano muscular associado ao exercício

Antes do exercício

- Só AA essenciais ou PRO ↑ síntese proteica muscular

  Adicionar CHO ↑ ainda mais síntese prot

- Refeição 3 a 4 h antes:

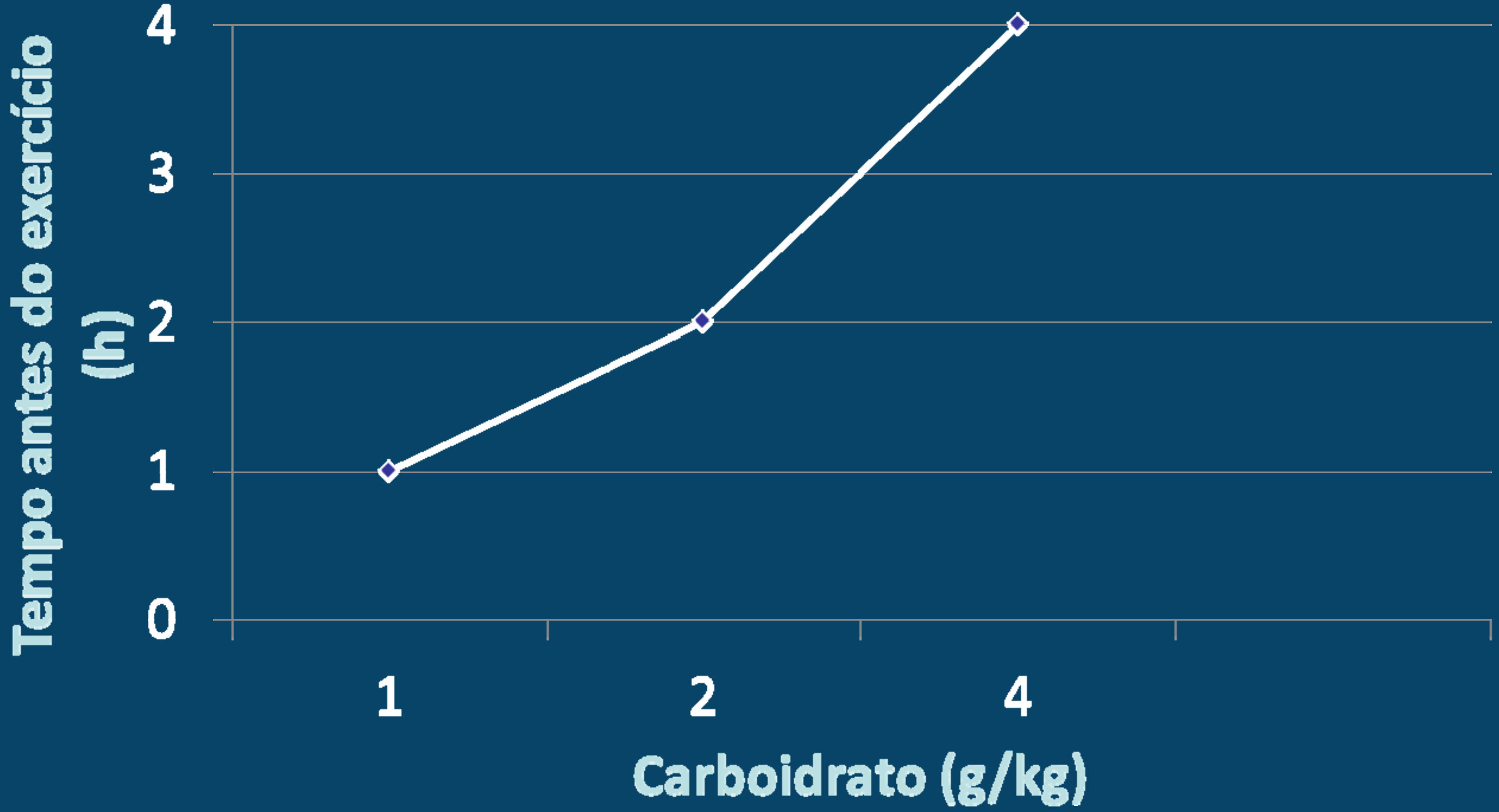
  1 – 2 g CHO/kg + 0,15 – 0,25 g PRO/kg

*Combinar ≠ fonte PRO estimula ganho muscular

Position Stand ISSN – Nutrient Timing, 2008

UFCSPA

Composição da refeição conforme tempo de intervalo até a hora do exercício



UFCSPA

EXERCÍCIO ALTA INTENSIDADE (*SPRINT*)

Que adaptações são induzidas?

aeróbicas/*endurance*

ou hipertróficas/treino de força

Qual efeito da disponibilidade de nutrientes nas respostas agudas ao *sprint*?

Nutrient provision increases signalling and protein synthesis in human skeletal muscle after repeated sprints

Vernon G. Coffey · Daniel R. Moore · Nicholas A. Burd · Tracy Rerecich · Trent Stellingwerff · Andrew P. Garnham · Stuart M. Phillips · John A. Hawley

Eur J Appl Physiol (2011) 111:1473–1483

8 homens saudáveis

2 sessões *sprint* (ciclismo)

30 min pré-exercício:

•24g whey+ 4,8g leucina+50g MD

•placebo não-calórico

•>48% taxa síntese protéica miofibrilar (PRO+CHO)

Ingestão PTN/CHO próximo ao exercício propiciou ambiente que ↑ sinalização celular e síntese proteica

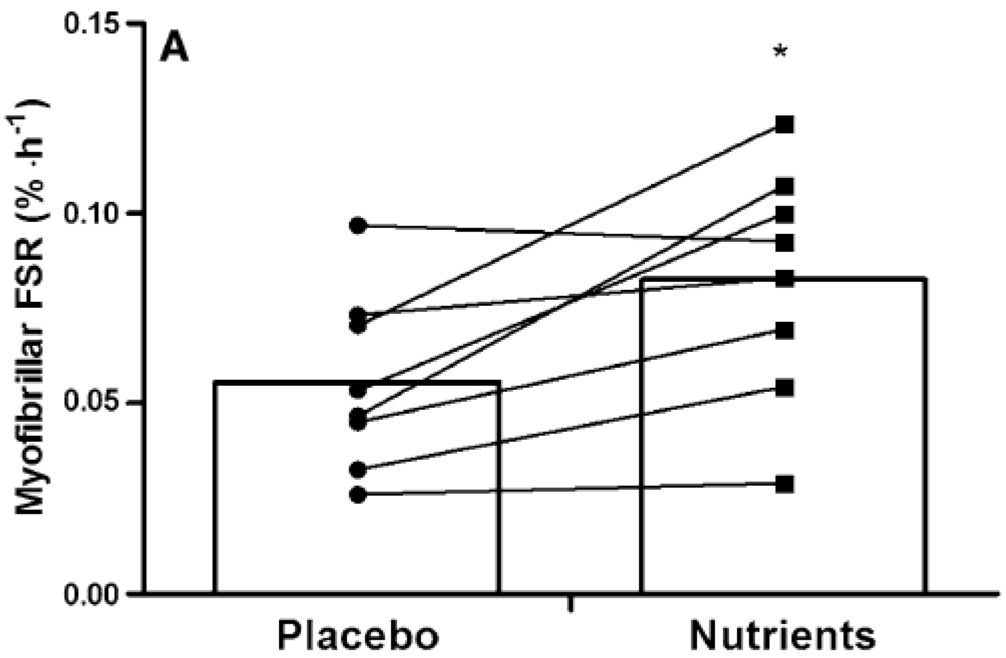


Fig. 6 Myofibrillar (**a**) and mitochondrial (**b**) protein fractional synthetic rates during recovery (15–240 min) from 10 × 6 s maximal effort repeated sprint cycling repetitions after prior ingestion of 500 mL placebo or nutrient beverage 30 min before exercise. Values are mean ± SD (myofibrillar $n = 8$; mitochondrial $n = 6$); Significantly different ($P < 0.05$) between treatments (*asterisk*)

Durante o exercício

- CHO é importante:
  - quando glicogênio está reduzido antes treino
  - + 60 min exercício
  - Diferentes fontes CHO

- Adição PTN ao CHO (3 a 4 CHO:1 PTN)
  - *Endurance:* ↑ *performance*
  - Força: ↑ glicogênio muscular, facilita adaptações treino

Position Stand ISSN – Nutrient Timing, 2008

UFCSPA

Oxidação de CHO durante o exercício

- capacidade de oxidar CHO exógeno a uma taxa de:
  - ~ 1 a 1,1 g/min ou
  - ~ 60 g /h

- Esta taxa varia conforme o tipo de CHO (diferentes transportadores)
  - Sacarose, MD > taxa oxidação
  - Frutose < taxa oxidação

UFCSPA

High Oxidation Rates from Combined Carbohydrates Ingested during Exercise

ROY L. P. G. JENTJENS, JUUL ACHTEN, and ASKER E. JEUKENDRUP

Human Performance Laboratory, School of Sport and Exercise Sciences, University of Birmingham, Edgbaston, UNITED KINGDOM

ABSTRACT

JENTJENS, R. L. P. G., J. ACHTEN, and A. E. JEUKENDRUP. High Oxidation Rates from Combined Carbohydrates Ingested during Exercise. *Med. Sci. Sports Exerc.*, Vol. 36, No. 9, pp. 1551–1558, 2004. Studies that have investigated oxidation of a single carbohydrate (CHO) during exercise have reported oxidation rates of up to 1 $g \cdot min^{-1}$. Recent studies from our laboratory have shown that a mixture of glucose and sucrose or glucose and fructose ingested at a high rate (1.8 $g \cdot min^{-1}$) leads to peak oxidation rates of ~1.3 $g \cdot min^{-1}$ and results in ~20 to 55% higher exogenous CHO oxidation rates compared with the ingestion of an isocaloric amount of glucose. **Purpose:** The purpose of the present study was to examine whether a mixture of glucose, sucrose and fructose ingested at a high rate would result in even higher exogenous CHO oxidation rates (>1.3 $g \cdot min^{-1}$). **Methods:** Eight trained male cyclists (VO_{2max}: 64 ± 1 $mL \cdot kg^{-1}$ $BM \cdot min^{-1}$) cycled on three different occasions for 150 min at 62 ± 1% VO_{2max} and consumed either water (WAT) or a CHO solution providing 2.4 $g \cdot min^{-1}$ of glucose (GLU) or 1.2 $g \cdot min^{-1}$ of glucose + 0.6 $g \cdot min^{-1}$ of fructose + 0.6 $g \cdot min^{-1}$ of sucrose (MIX). **Results:** High peak exogenous CHO oxidation rates were found in the MIX trial (1.70 ± 0.07 $g \cdot min^{-1}$), which were ~44% higher ($P < 0.01$) compared with the GLU trial (1.18 ± 0.04 $g \cdot min^{-1}$). Endogenous CHO oxidation was lower ($P < 0.05$) in MIX compared with GLU (0.76 ± 0.12 and 1.05 ± 0.06 $g \cdot min^{-1}$, respectively). **Conclusion:** When glucose, fructose and sucrose are ingested simultaneously at high rates (2.4 $g \cdot min^{-1}$) during cycling exercise, exogenous CHO oxidation rates can reach peak values of ~1.7 $g \cdot min^{-1}$ and estimated endogenous CHO oxidation is reduced compared with the ingestion of an isocaloric amount of glucose.

Key Words: SUBSTRATE UTILIZATION, STABLE ISOTOPES, METABOLISM, SUCROSE, FRUCTOSE

UFCSPA

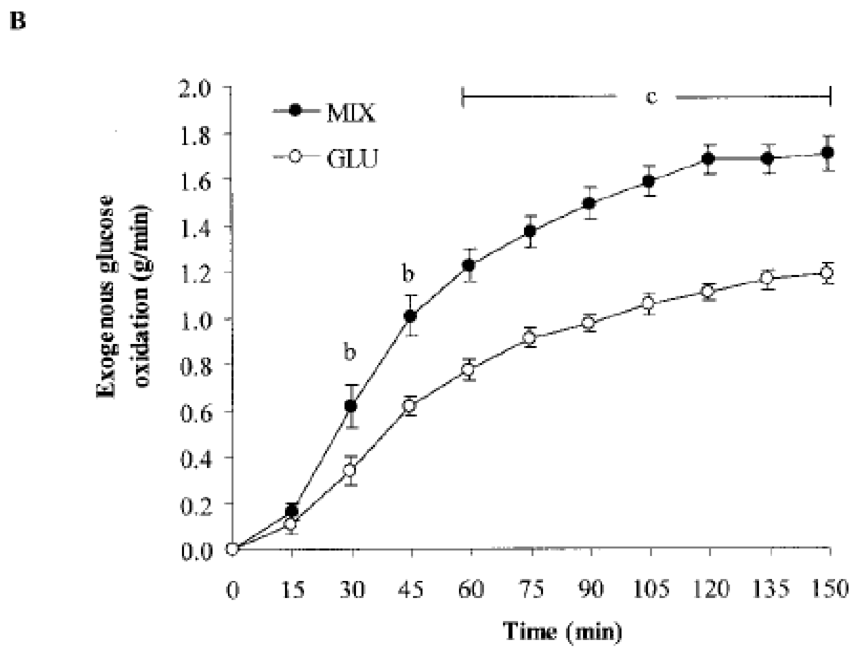


FIGURE 1—Breath $^{13}CO_2$ enrichment (A) and exogenous carbohydrate oxidation (B) during exercise without ingestion of carbohydrate (WAT), with ingestion of glucose (GLU) or with ingestion of glucose+sucrose+fructose (MIX). Values are means ± SE; N = 8, except for the last two time point in the GLU trial where N = 7; a, denotes significant difference between WAT and CHO trials (P < 0.01); b, denotes significant difference between MIX and GLU (P < 0.05); c, denotes significant difference between MIX and GLU (P < 0.01).

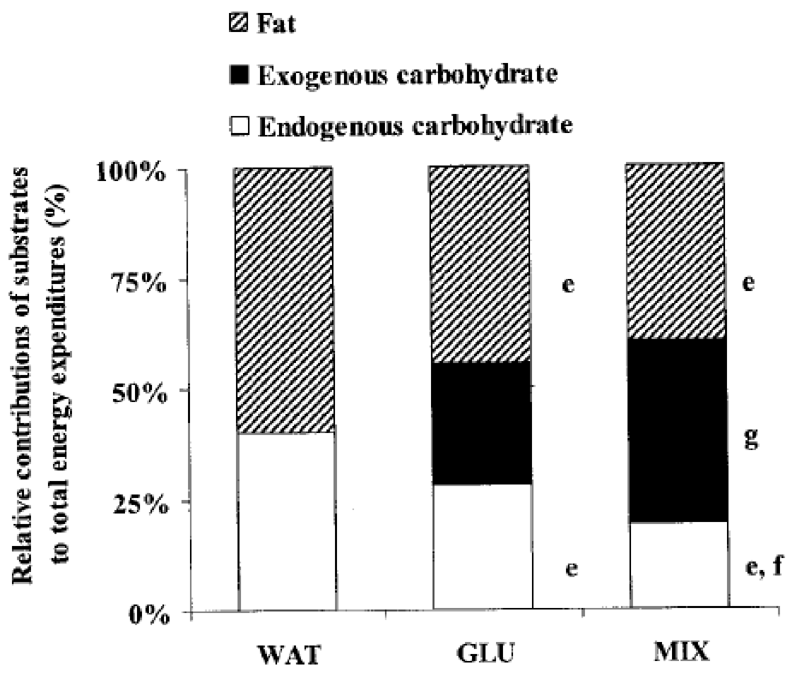


FIGURE 2—Relative contributions of substrates to total energy expenditure calculated for the 60- to 150-min period of exercise without ingestion of carbohydrate (WAT), with ingestion of glucose (GLU), or with ingestion of glucose+sucrose+fructose (MIX). Values are means ± SE; N = 8, except for the GLU trial where N = 7; d, denotes significantly different from WAT (P < 0.05); e, denotes significantly different from WAT (P < 0.01); f, denotes significantly different from GLU (P < 0.05); g, denotes significantly different from GLU (P < 0.01).

UFCSPA

Table 1 Exogenous carbohydrate oxidation rates from various carbohydrate mixtures during moderate-intensity exercise

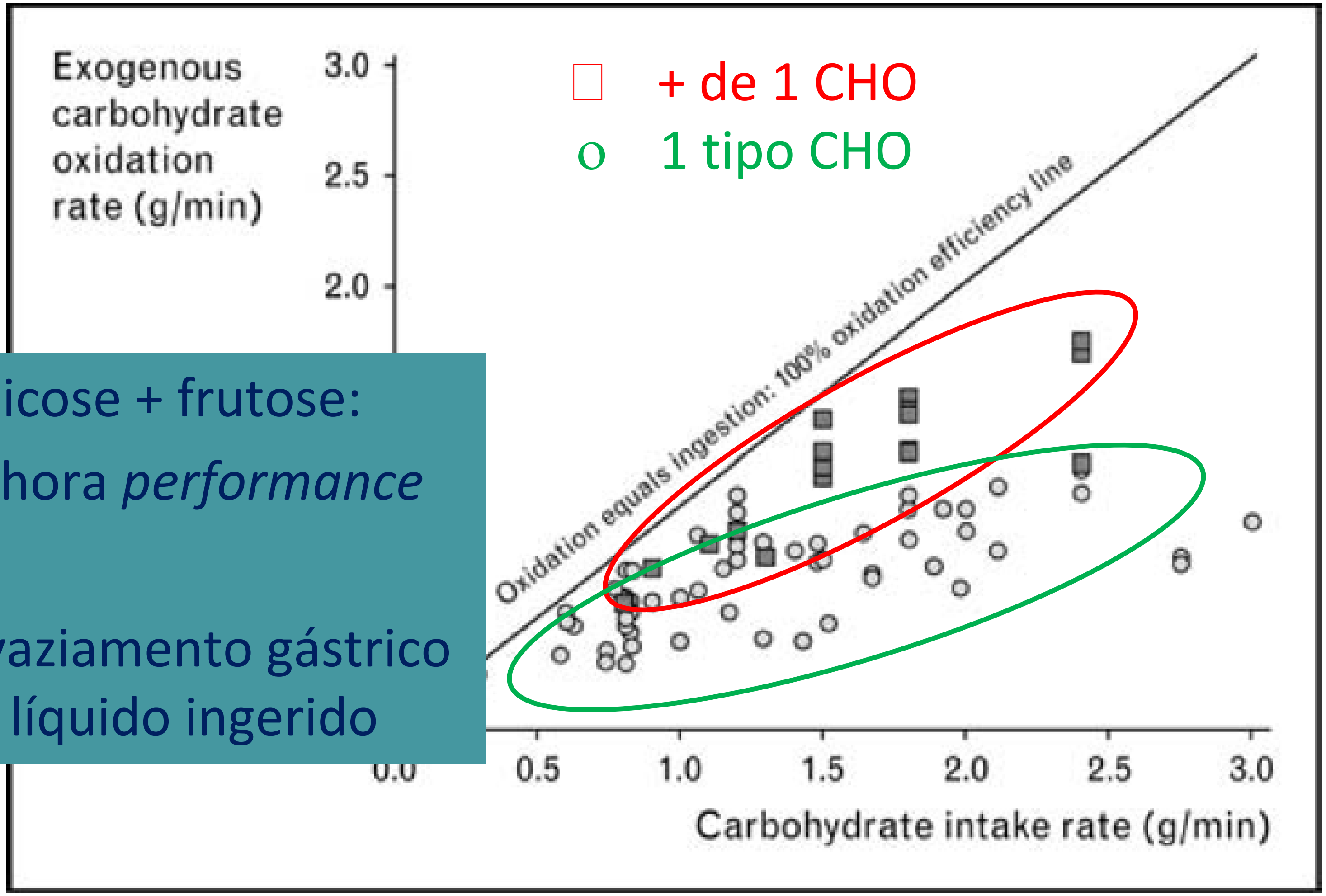
Author (year)	Type of carbohydrate	Ingestion rate (g/min)	Exog CHO oxidation rate (g/min)	Oxidation efficiency	Percentage improvement versus single CHO
Jentjens *et al.* [15]	Glu	1.2	0.83	69%	
	Glu	1.8	0.86	72%	
	Glu : frc (2 : 1)	1.8	1.26	70%	55%
Jentjens *et al.* [16]	Glu	1.8	1.06	59%	
	Glu : mal (2 : 1)	1.8	1.06	59%	
	Glu : suc (2 : 1)	1.8	1.25	69%	18%
Jentjens *et al.* [17]	Glu	2.4	1.18	50%	
	Glu : suc : frc (2 : 1 : 1)	2.4	1.70	71%	44%
Jentjens *et al.* [18]	Glu	1.2	0.77	64%	
	Suc	1.2	0.98	82%	
	Glu : suc (1 : 1)	1.2	0.90	75%	21%
	Glu : suc (1 : 1)	2.4	1.20	50%	–
Jentjens and Jeukendrup [19]	Glu	1.2	1.06	88%	
	Glu : frc (1 : 1)	2.4	1.75	73%	65%
Jeukendrup *et al.* [20]	Glu	1.5	1.24	83%	
	Glu : frc (2 : 1)	1.5	1.40	93%	13%
Jentjens *et al.* [21]	Glu	1.5	0.77	51%	
	Glu : frc (2 : 1)	1.5	1.14	76%	48%
Wallis *et al.* [22]	Maltodextrin	1.8	1.06	59%	
	Maltodextrin : frc	1.8	1.50	83%	42%
Pfeiffer *et al.* [23]	Glu : frc (2 : 1)	1.8	1.34	74%	
	Glu : frc (2 : 1)	1.8	1.25	69%	–
Pfeiffer *et al.* [24]	Glu : frc (2 : 1)	1.8	1.44	80%	
	Glu : frc (2 : 1)	1.8	1.42	79%	–
Pfeiffer *et al.* [25]	Glu : frc (2 : 1)	1.5	1.19	79%	
Hulston *et al.* [					
Rowlands *et al.* [27•]	Maltodextrin	0.6	0.49	82%	
	Maltodextrin : frc (2 : 1)	0.9	0.73	81%	–
	Maltodextrin : frc (6 : 5)	1.1	0.84	76%	–
	Maltodextrin : frc (6 : 7)	1.3	0.78	60%	–

Percentage improvement in exogenous carbohydrate oxidation were only calculated when an equienergetic comparison with glucose or equivalent was possible. Oxidation rates reported are peak oxidation rates when available and average over final 60 min of exercise in all other cases. CHO, carbohydrate; glu, glucose; frc, fructose; mal, maltose; suc, sucrose.

A melhora ocorre após a saturação do transportador

Altas taxas de oxidação podem ser alcançadas:

- com múltiplos transportadores de CHO
- quando ingeridas em altas taxas



Glicose + frutose:

-Melhora *performance*

-↑ esvaziamento gástrico do líquido ingerido

Current Opinion in Clinical Nutrition and Metabolic Care 2010, 13:452–457

UFCSPA

Possível mecanismo do ↑ *performance* após ingestão glicose:frutose

Frutose

Frutose –1-fosfato

↑ *piruvato quinase*

piruvato

Lactato

Oxidado no músculo

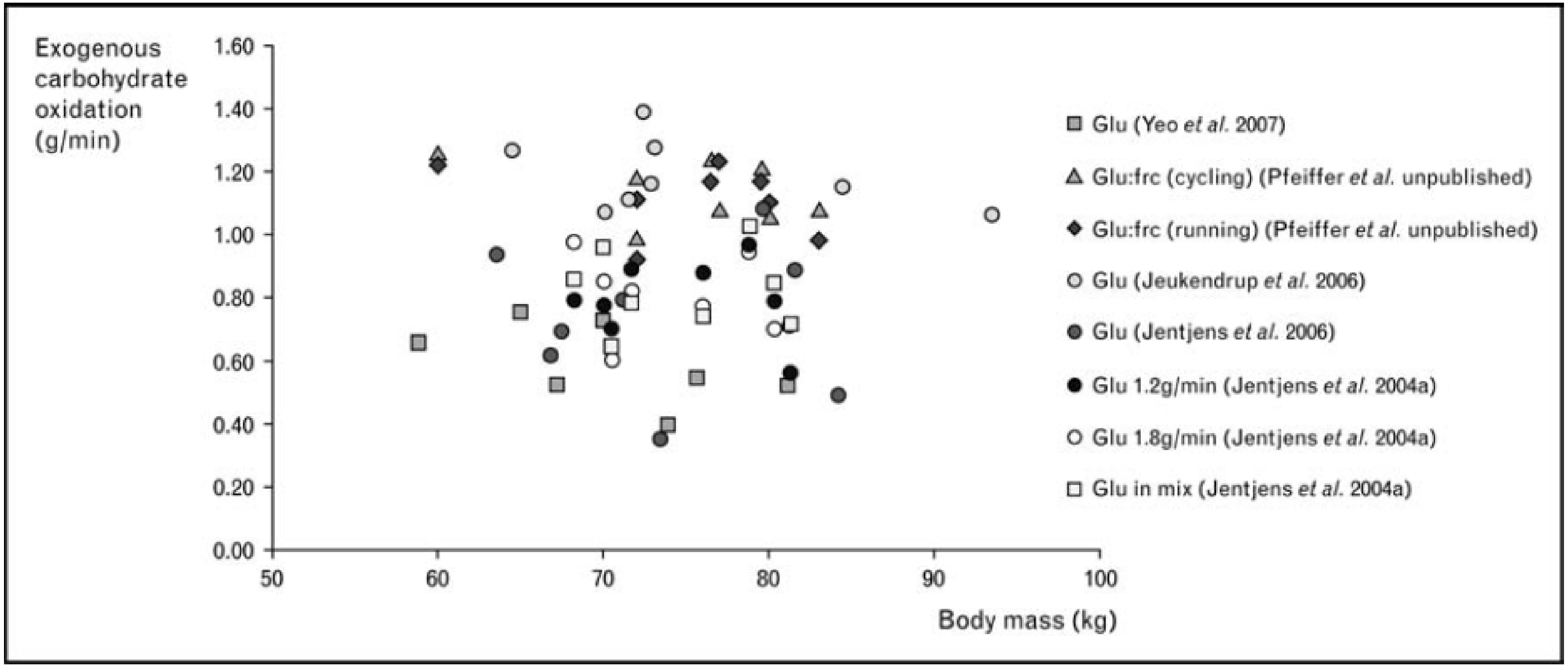
Eficiência de oxidação

"% de CHO ingerido que é oxidado"

↑ Eficiência de oxidação

- Importante:
- Permanece menos CHO no intestino
- reduz má-absorção
- reduz desconforto GI

Figure 2 No correlation between body mass and exogenous carbohydrate oxidation



Absorção de CHO é independente da Massa Corporal

(capacidade absortiva do intestino depende do conteúdo de CHO na dieta)

A recomendação deve ser em quantidades absolutas

Não há razão p/ recomendar g/kg (CHO) **durante** o exercício

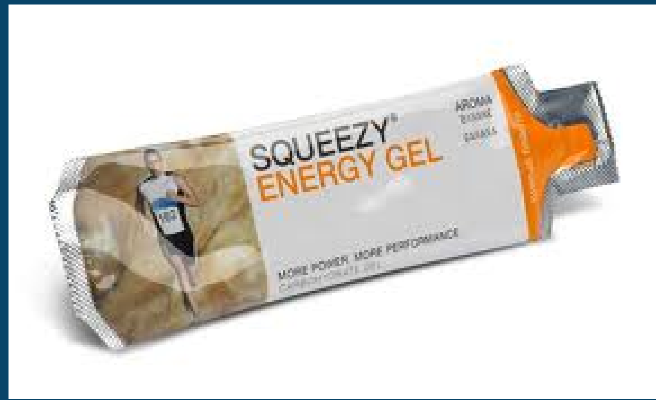
Current Opinion in Clinical Nutrition and Metabolic Care 2010, 13:452–457

UFCSPA

Carboidratos em gel:

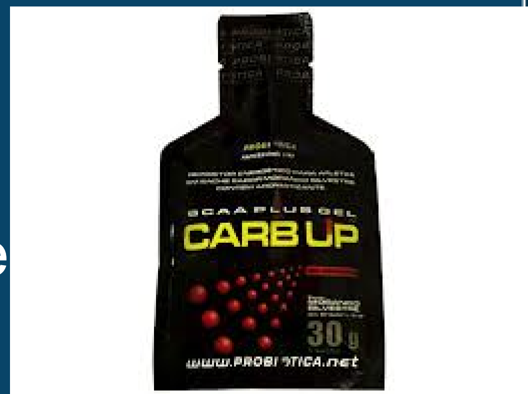
26 g CHO
MD,
frutose,
dextrose
(glicose)

25 g CHO
MD, frutose,
cafeína, BCAA,
vit E e C

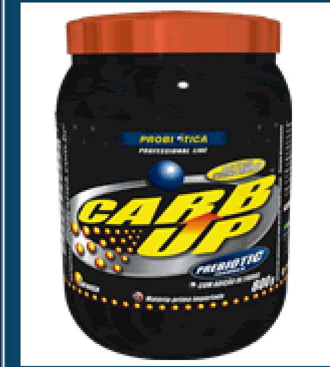


16 g CHO
MD, frutose, vit B1

20g CHO
MD, frutose
<1g whey
40mg Na

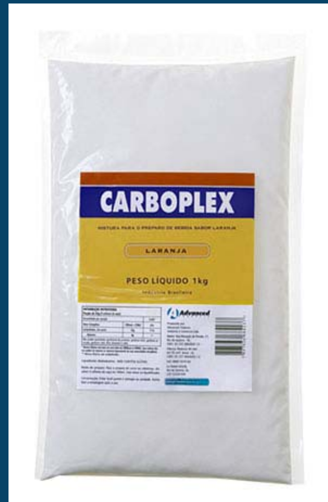


Carboidratos em pó



MD,
frut,
glic

MD, adoçante



MD

MD,
frutose

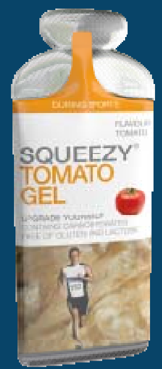
MD, adoçante

MD, adoçante

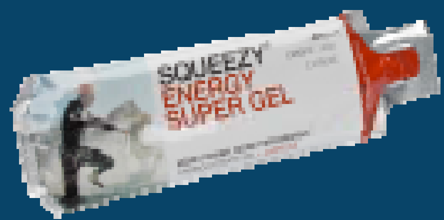
Carboidratos - outros

Balas

Gel em garrafas



Gel salgado



Gel sem frutose
(p/ intolerantes)

UFCSPA

Alta intensidade:

*difícil uso de suplementos durante o exercício

The Effect of Carbohydrate Mouth Rinse on 1-h Cycle Time Trial Performance

JAMES M. CARTER, ASKER E. JEUKENDRUP, and DAVID A. JONES

Human Performance Laboratory, School of Sport and Exercise Sciences, The University of Birmingham, Edgbaston, Birmingham, UNITED KINGDOM

CARTER, J. M., A. E. JEUKENDRUP, and D. A. JONES. The Effect of Carbohydrate Mouth Rinse on 1-h Cycle Time Trial Performance. *Med. Sci. Sports Exerc.*, Vol. 36, No. 12, pp. 2107–2111, 2004. **Purpose and Method:** To investigate the possible role of carbohydrate (CHO) receptors in the mouth in influencing exercise performance, seven male and two female endurance cyclists ($\dot{V}O_{2max}$ 63.2 ± 2.7 (mean ± SE) mL·kg^{-1}·min^{-1}) completed two performance trials in which they had to accomplish a set amount of work as quickly as possible (914 ± 40 kJ). On one occasion a 6.4% maltodextrin solution (CHO) was rinsed around the mouth for every 12.5% of the trial completed. On the other occasion, water (PLA) was rinsed. Subjects were not allowed to swallow either the CHO solution or water, and each mouthful was spat out after a 5-s rinse. **Results:** Performance time was significantly improved with CHO compared with PLA (59.57 ± 1.50 min vs 61.37 ± 1.56 min, respectively, $P = 0.011$). This improvement resulted in a significantly higher average power output during the CHO compared with the PLA trial (259 ± 16 W and 252 ± 16 W, respectively, $P = 0.003$). There were no differences in heart rate or rating of perceived exertion (RPE) between the two trials ($P > 0.05$). **Conclusion:** The results demonstrate that carbohydrate mouth rinse has a positive effect on 1-h time trial performance. The mechanism responsible for the improvement in high-intensity exercise performance with exogenous carbohydrate appears to involve an increase in central drive or motivation rather than having any metabolic cause. The nature and role of putative CHO receptors in the mouth warrants further investigation. **Key Words:** EXERCISE, MALTODEXTRIN SUPPLEMENTATION, MOUTHWASH, MOUTH RECEPTORS

UFCSPA

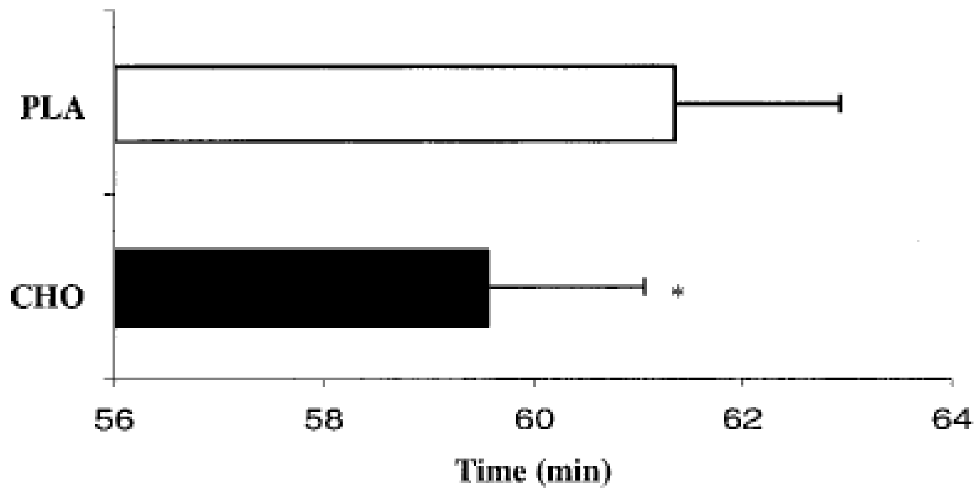


FIGURE 1—Mean performance time in the CHO and PLA trials. * Indicates significantly different from PLA ($P = 0.011$, $N = 9$).

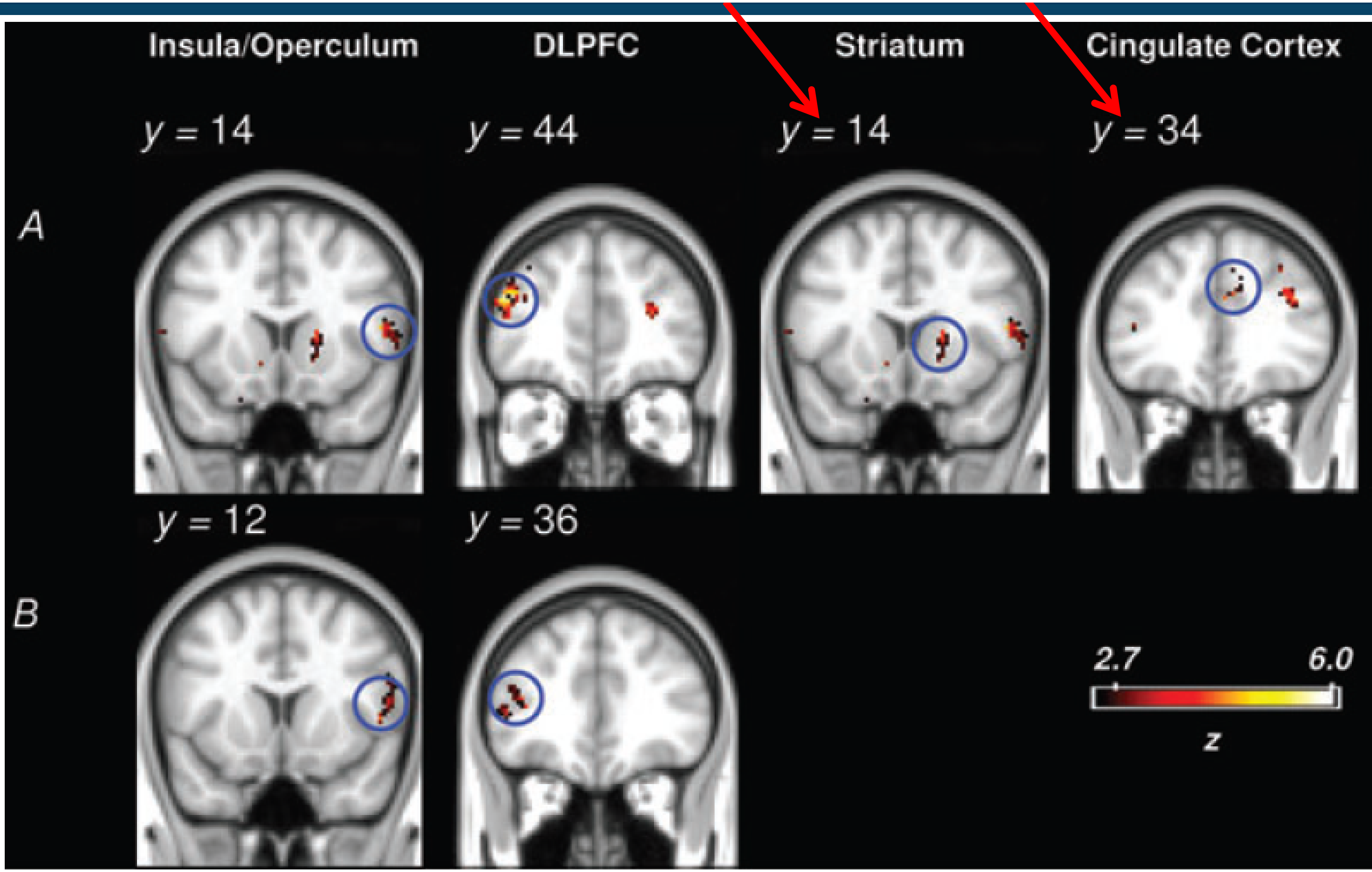
The mechanism responsible for the improvement in high-intensity exercise performance with exogenous carbohydrate is unknown, but may involve CHO receptors in the oral cavity modulating central pathways associated with motivation. The existence of such CHO receptors in the mouth, and their effect on performance, warrants further investigation. These additional studies should involve a variety of rinse formulations and should rule out the possibility of potential placebo effects.

J Physiol 587.8 (2009) pp 1779–1794

Carbohydrate sensing in the human mouth: effects on exercise performance and brain activity

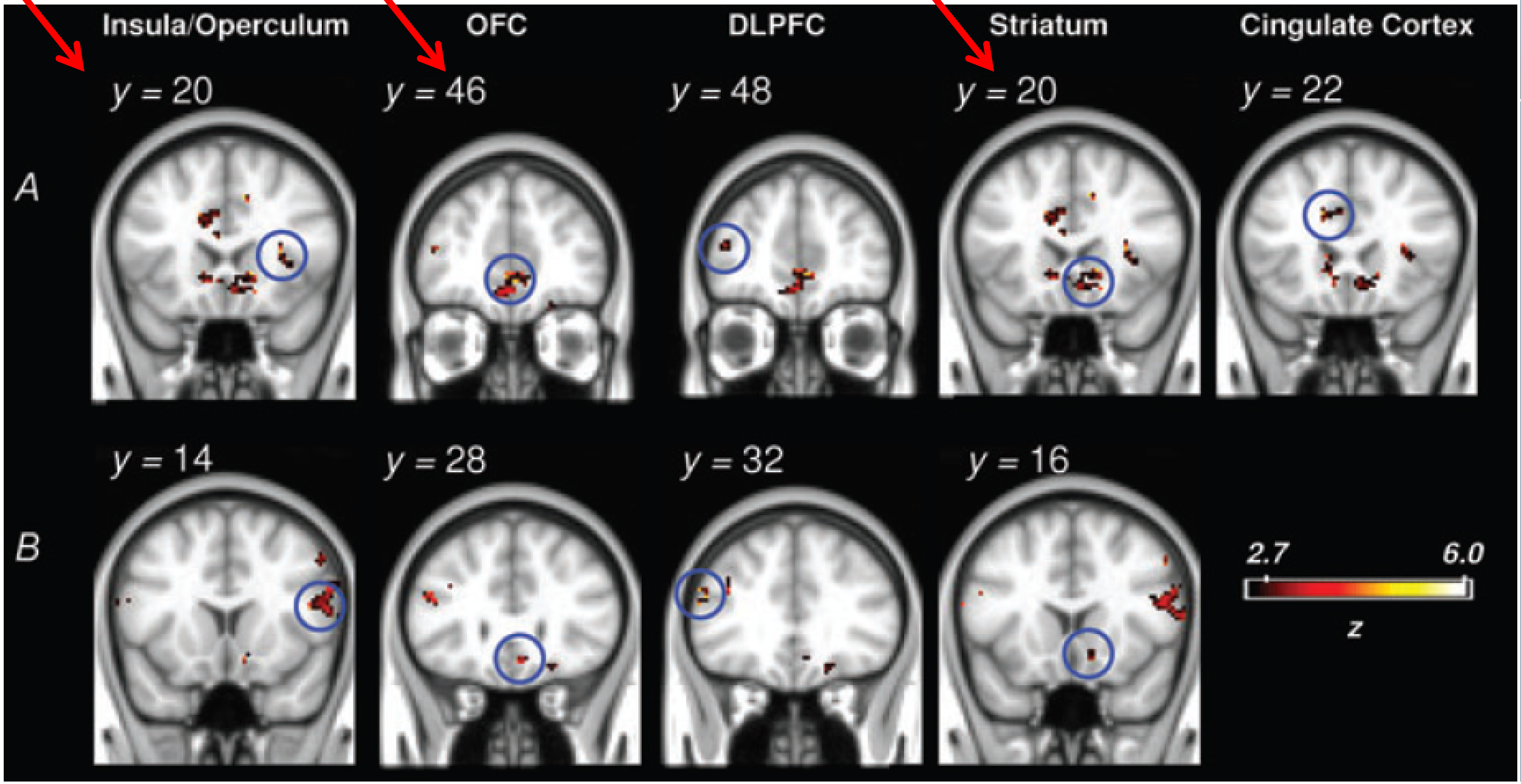
E. S. Chambers[1], M. W. Bridge[1] and D. A. Jones[1,2]

- Objetivo 1: Bebida calórica *vs* não-calórica = *performance*
  - ↑ *performance* 8 ciclistas bochecho solução glicose 6,4% *vs* sacarina
  - ↑ *performance* 8 ciclistas bochecho solução maltodextrina 6,4% *vs* sacarina
- Objetivo 2: Identificar as regiões cerebrais responsáveis ativadas por estas substâncias
  - Carboidrato doce (glicose)
  - Carboidrato não doce (maltodextrina - MD)
  - Placebo doce (sacarina)



A exposição oral à glicose (A) ativou regiões relacionadas à recompensa, incluindo o *estriado* e *cortex cingilado*, que não foram responsivos à sacarina (B)

UFCSPA



A resposta cortical à MD (A) e glicose (B) revelaram um padrão de ativação cerebral, incluindo as áreas :

opérculo frontal/insula, cortex orbitofrontal e *estriado*

UFCSPA

Conclusão

- A melhora da *performance* com a presença de CHO na boca (doce e não-doce) pode ser devido à ativação de regiões cerebrais envolvidas em <u>recompensa</u> e <u>controle motor</u>
- Os resultados suportam a existência de receptores orais sensíveis ao valor calórico do CHO que são <u>independentes do sabor doce</u>

E. S. Chambers[1], M. W. Bridge[1] and D. A. Jones[1,2]

J Physiol 587.8 (2009) pp 1779–1794

UFCSPA

Ingestão inadequada de CHO → medir as cetonas na urina

↓ disponibilidade de CHO → mobiliza AG tecido adiposo

Concentração cetonas urina ↑ quando AG não são completamente oxidados

*Pode ser medido ao mesmo tempo que a avaliação da hidratação (cor da urina)

P. J. Robson-Ansley et al. Journal of Sports Sciences, November 2009

Hidratação

Antes

- Iniciar exercício eu-hidratado
- Volume prévio no estomago (150 a 250ml)

Durante

- Limitar desidratação
- ↓ PSE
- Energia (CHO 5-8%)
- Líquido frio

Depois

- Dieta normal
- Líquido e eletrólitos

UFCSPA

Depois do exercício

- CHO até 30 min pós-exerc estimula ressíntese glicogênio muscular
  - Adicionar PTN ao CHO (3:1) estimula + ainda ressíntese glicog
- AA essenciais logo após (até 3h) estimula síntese muscular
  - Adicionar CHO pode estimular + ainda (ingestão pré-exerc melhor)
- Durante treinamento força prolongado, CHO + PTN melhora força e composição corporal (*versus* placebo ou CHO)
- Adição de Creatina (0,1g/kg/d) ao CHO+PTN pode facilitar mais as adaptações

Position Stand ISSN – Nutrient Timing, 2008

UFCSPA

Depois do exercício

CHO: 1g/kg/h, o + rápido possível (dentro de 4h)

- Dentro de 24h:
  - 5-7g/kg/d – leve a moderado
  - 7-10g/kg/d – moderado a pesado
  - 10-12g/kg/d – extremo (+4h/d)

- Deve haver sintonia fina:
  - individualidade atleta
  - VET conforme planilha treino
  - *feedback* do atleta

Journal of Sports Sciences, November 2009; 27(13): 1409–1420

UFCSPA

Coingestion of protein with carbohydrate during recovery from endurance exercise stimulates skeletal muscle protein synthesis in humans

Krista R. Howarth, Natalie A. Moreau, Stuart M. Phillips, and Martin J. Gibala
Exercise Metabolism Research Group, Department of Kinesiology, McMaster University, Hamilton, Ontario, Canada

J Appl Physiol 106: 1394–1402, 2009

- 6 homens ativos, 2h exercício (↓ glicogênio),

3 bebidas após exercício,

750ml/h a cada 15min (por 3h)

L-CHO = 1,2 g/kg/h CHO

H-CHO = 1,6 g/kg/h CHO

PROCHO = 1,2 g/kg/h CHO + 0,4 g PTN

CHO (maltodextrina)

PTN (*whey* concentrado)

UFCSPA

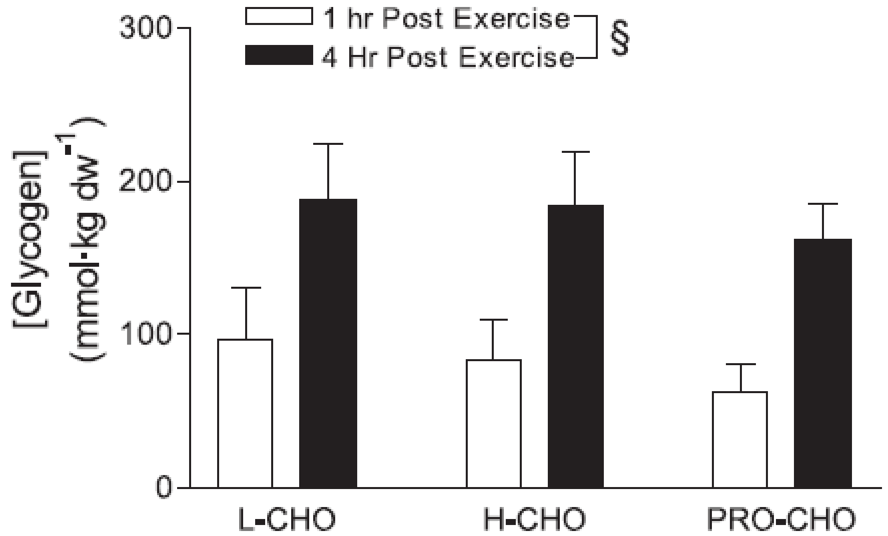


Fig. 5. Muscle glycogen concentration over 4 h of recovery from prolonged exercise while ingesting either 1.2 g CHO·kg^{-1}·h^{-1} (L-CHO), 1.6 g CHO·kg^{-1}·h^{-1} (H-CHO), or 1.2 g CHO + 0.4 g protein·kg^{-1}·h^{-1} (PRO-CHO). Values are means ± SE; $n = 6$. §Main effect for time, $P < 0.05$. dw, dry wt.

Síntese glicogênio não diferiu

Aumentou síntese proteica

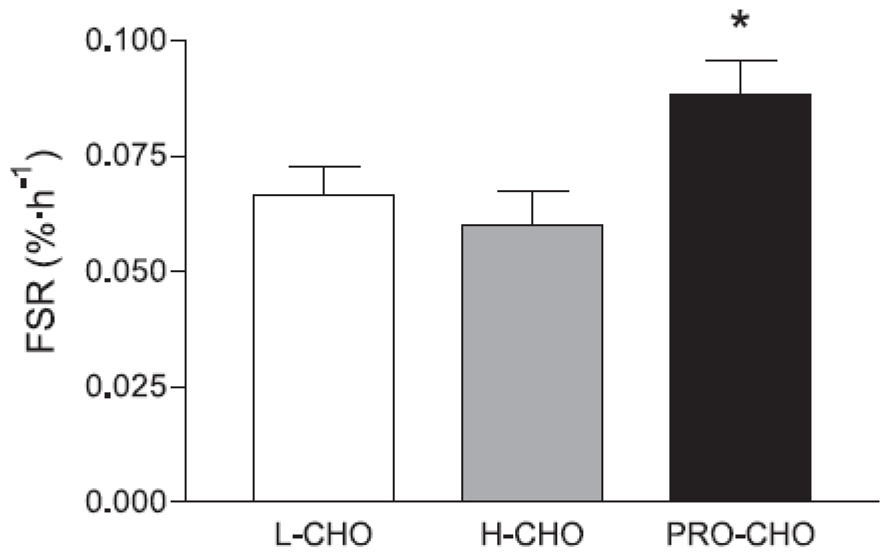


Fig. 4. Mixed muscle protein fractional synthetic rate (FSR) during 4 h of recovery from prolonged exercise while ingesting either 1.2 g CHO·kg^{-1}·h^{-1} (L-CHO), 1.6 g CHO·kg^{-1}·h^{-1} (H-CHO), or 1.2 g CHO + 0.4 g protein·kg^{-1}·h^{-1} (PRO-CHO). Values are means ± SE; $n = 6$. *$P < 0.05$ vs. other treatments.

J Appl Physiol 106: 1394–1402, 2009

Placebo Effects of Caffeine on Cycling Performance

CHRISTOPHER J. BEEDIE, ELIZABETH M. STUART, DAMIAN A. COLEMAN, and ABIGAIL J. FOAD

Canterbury Christ Church University, Canterbury, UNITED KINGDOM

ABSTRACT

BEEDIE, C. J., E. M. STUART, D. A. COLEMAN, and A. J. FOAD. Placebo Effects of Caffeine on Cycling Performance. *Med. Sci. Sports Exerc.*, Vol. 38, No. 12, pp. 2159–2164, 2006. **Purpose:** The placebo effect—a change attributable only to an individual's belief in the efficacy of a treatment—might provide a worthwhile improvement in physical performance. Although sports scientists account for placebo effects by blinding subjects to treatments, little research has sought to quantify and explain the effect itself. The present study explored the placebo effect in laboratory cycling performance using quantitative and qualitative methods. **Method:** Six well-trained male cyclists undertook two baseline and three experimental 10-km time trials. Subjects were informed that in the experimental trials they would each receive a placebo, 4.5 $mg \cdot kg^{-1}$ caffeine, and 9.0 $mg \cdot kg^{-1}$ caffeine, randomly assigned. However, placebos were administered in all experimental conditions. Semistructured interviews were also conducted to explore subjects' experience of the effects of the capsules before and after revealing the deception. **Results:** A likely trivial increase in mean power of 1.0% over baseline was associated with experimental trials (95% confidence limits, −1.4 to 3.6%), rising to a likely beneficial 2.2% increase in power associated with experimental trials in which subjects believed they had ingested caffeine (−0.8 to 5.4%). A dose–response relationship was evident in experimental trials, with subjects producing 1.4% less power than at baseline when they believed they had ingested a placebo (−4.6 to 1.9%), 1.3% more power than at baseline when they believed they had ingested 4.5 $mg \cdot kg^{-1}$ caffeine (−1.4 to 4.1%), and 3.1% more power than at baseline when they believed they had ingested 9.0 $mg \cdot kg^{-1}$ caffeine (−0.4 to 6.7%). All subjects reported caffeine-related symptoms. **Conclusions:** Quantitative and qualitative data suggest that placebo effects are associated with the administration of caffeine and that these effects may directly or indirectly enhance performance in well-trained cyclists. **Key Words:** EXPERIMENTAL DESIGNS, DECEPTIVE ADMINISTRATION, ERGOGENIC AIDS, BELIEF EFFECTS

UFCSPA

claudias@ufcspa.edu.br

MUITO OBRIGADA!

UFCSPA