



Update Kohlenhydrate im Sport – immer mehr, immer schneller?



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ORIGINAL PAPER

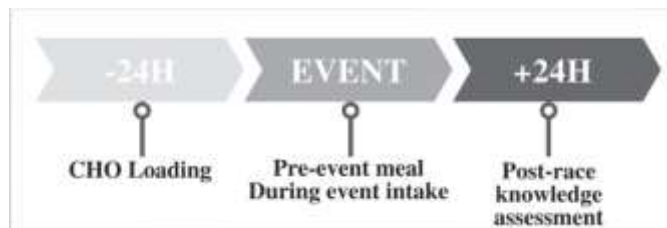


Official ECSS Journal

WILEY

**A broken link: Knowledge of carbohydrate requirements do
not predict carbohydrate intake around competition in
endurance athletes**

Gemma Sampson | James. P. Morton | José. L. Areta



Sampson G, Morton JP, Areta JL. A broken link: Knowledge of carbohydrate requirements do not predict carbohydrate intake around competition in endurance athletes. Eur J Sport Sci. 2024 Aug 28. doi: 10.1002/ejsc.12183.

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D'SE | **VFED**

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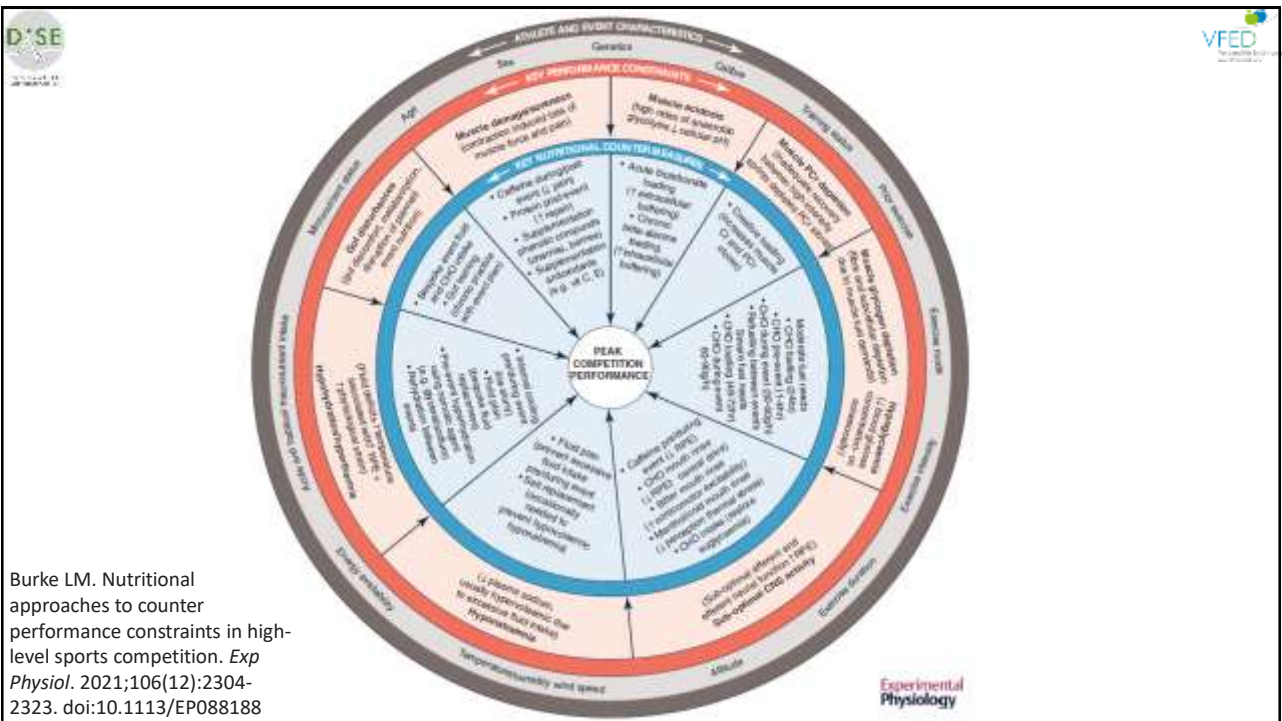
TABLE 2 Proportion of athletes achieving carbohydrate intake guidelines around competition periods.

	CHO intake within competition		CHO Guideline	Athletes who achieved CHO intake guideline, n (%)
	(g)	g · kg ⁻¹ (g · h ⁻¹)		
CHO loading	395 ± 134	6.5 ± 2.2	10–12 g · kg ⁻¹	5 (10)
CHO pre-event meal	91 ± 37	1.5 ± 0.6	1–4 g · kg ⁻¹	40 (80)
CHO during competition	289 ± 226	(52 ± 21)	60–90 g · h ⁻¹	18 (36)

Note: Mean total and relative CHO intakes in relation to CHO loading 24 h prior to competition, CHO consumed in the pre-event meal or CHO consumed during competition and the proportion of athletes achieving CHO guidelines.

Sampson G, Morton JP, Areta JL. A broken link: Knowledge of carbohydrate requirements do not predict carbohydrate intake around competition in endurance athletes. *Eur J Sport Sci.* 2024 Aug 28. doi: 10.1002/ejsc.12183.

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Burke LM. Nutritional approaches to counter performance constraints in high-level sports competition. *Exp Physiol.* 2021;106(12):2304–2323. doi:10.1113/EP088188

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Fatigue Factors							
Muscle Acidosis	Gut Disturbances	Hyponatremia	Hypohydration/Hyperthermia	Muscle Damage	Suboptimal CNS Activity	Muscle CHO Depletion	Muscle PCr Depletion
Decreased cellular pH due to high rates of anaerobic glycolysis	Discomfort and disruption of planned event nutrition	Decreased plasma [sodium] primarily due to overhydration (hypervolemia, hyponatremia). Can be fatal (central oedema)	Fluid deficit > 2% BM. Increased RPE and physiological strain, especially in hot conditions. Cramp etiology is complex	Contraction-induced loss of muscle force and pain	Impairment of afferent and efferent neural function. Increased RPE	Inadequate endogenous and/or exogenous CHO availability for muscle demands	Decreased PCr due to inadequate recovery between sprints
			Muscle Cramp	Muscle Soreness	Hypoglycemia		

Key Nutrition Strategies to Combat Fatigue Factors

Acute bicarbonate loading (extra-cellular buffering) Chronic B-alanine supplementation	Gut training bespoke event fluid and CHO intake plan	Avoidance of excessive fluid intake pre and during event (e.g. intake > wet losses) Hypovolemic hyponatremia (large Na and fluid losses): replacement of Na in event fluid plan	Pre-event rehydration Between event rehydration Pre-event hyperhydration using osmotic agent (e.g. glycerol, Na) Pre/Warning event intake of ice slurry Bespoke event fluid/Na plan Mouth opening with TRP channel activating phytochemicals	Caffeine pre/during event Post-event protein Chronic supplementation with phenolic phytochemicals (e.g. cherries, berries) Chronic supplementation with anti-oxidants (e.g. Vit C, E, NAC)	Caffeine pre/during event CHO mouth sensing to reduce decreased RPE and increase central drive Mouth sensing of menthol or cool fluid in heat Mouth sensing of quinine in trial events LCHF diet or ketone supplements for alternative brain fuel During event CHO intake	CHO intake during 24 h pre-event to meet event glycogen needs Pre-event CHO rich meal During event CHO intake (30-60 g/h) Between event refueling 45h pre-event CHO loading leading to supercompensate glycogen During event CHO intake (90-90 g/h) Adaptation to LCHF diet to promote fat/ketone fuel use Ketone supplement for alternative fuel	Creatine supplementation
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Gold Medal Performance

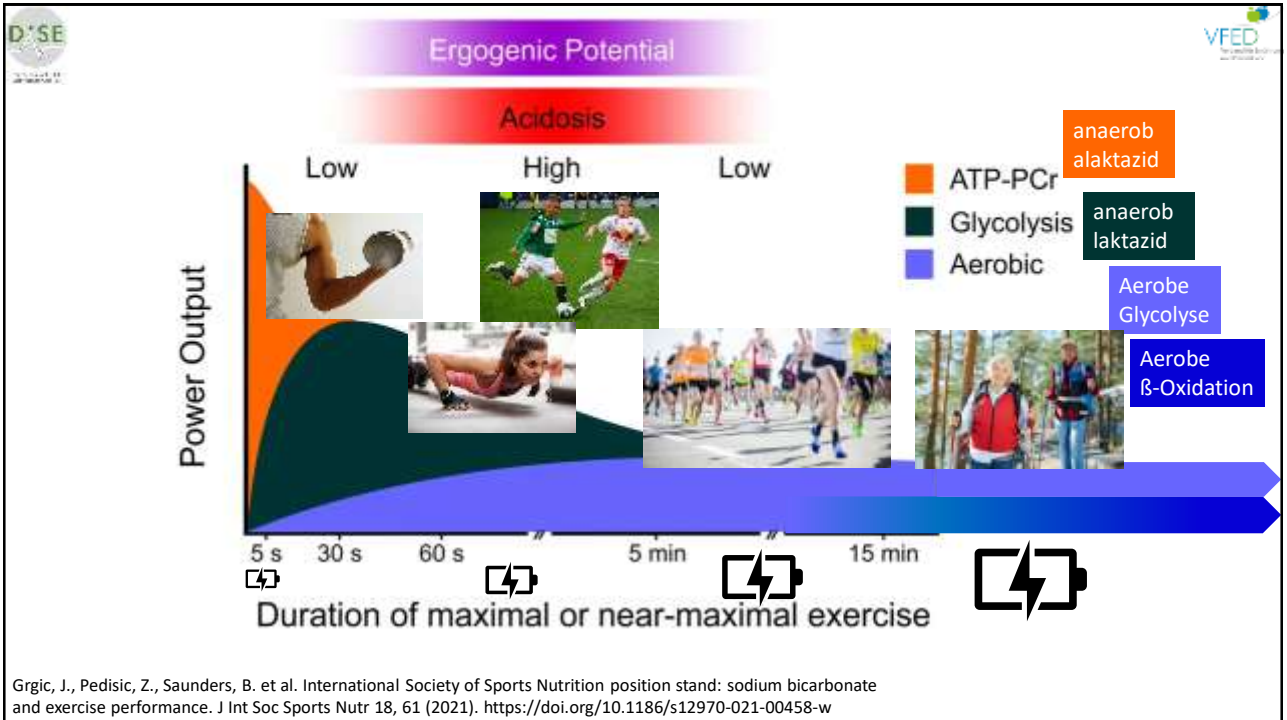
Burke LM, Hawley JA. Swifter, higher, stronger: What's on the menu?. Science. 2018;362(6416):781-787. doi:10.1126/science.aau2093

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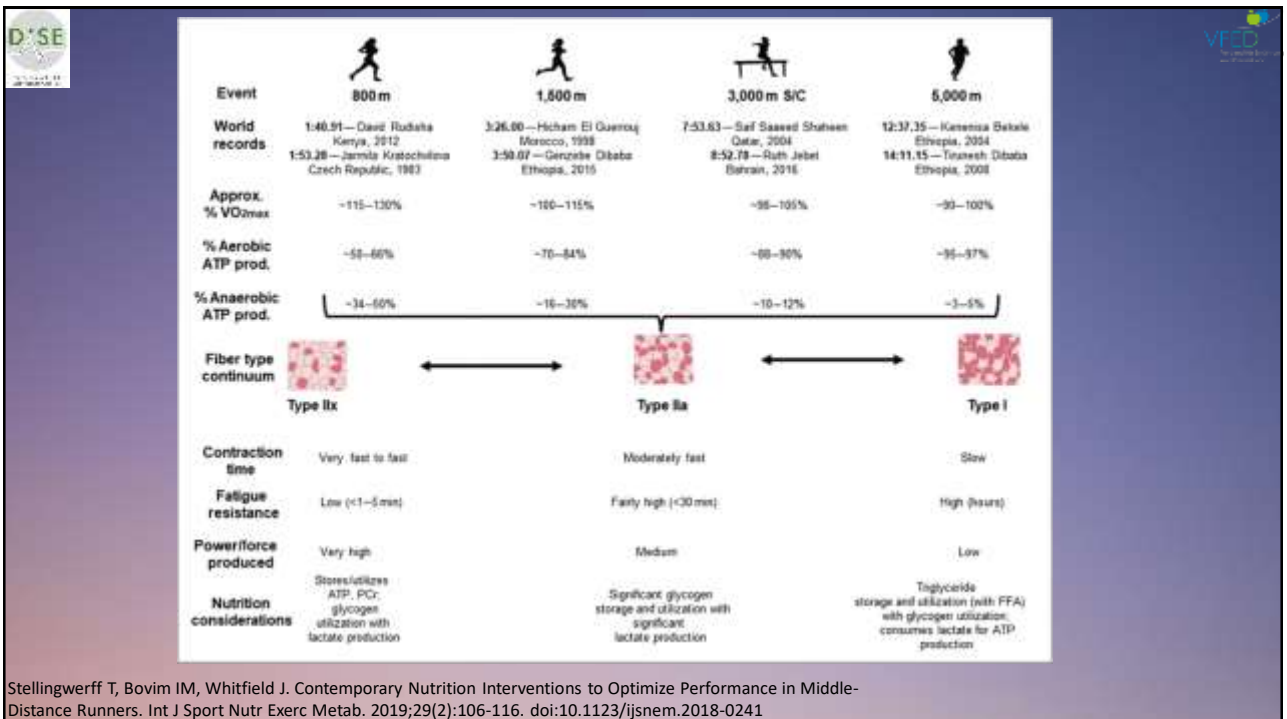
„Fuel for the work required“

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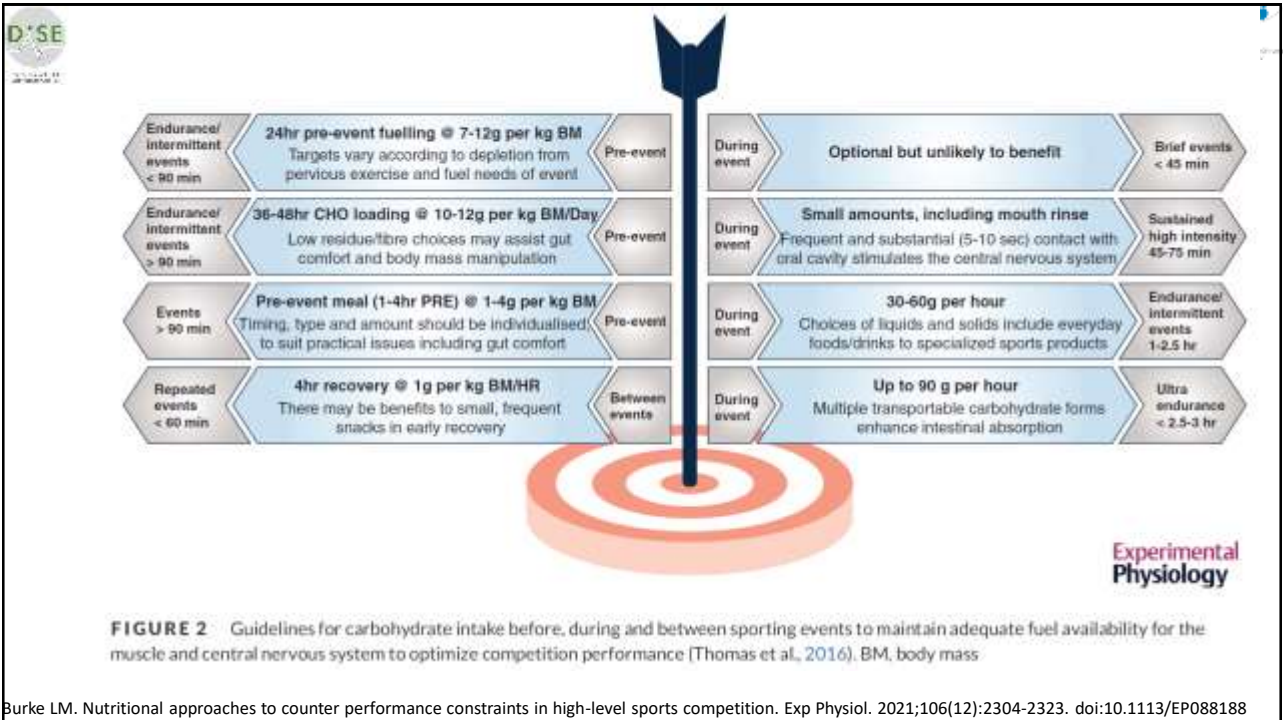
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Periodisierte
KOHLNHYDRATVERFÜGBARKEIT

NUTRIENT TIMING

Old Way

New Way

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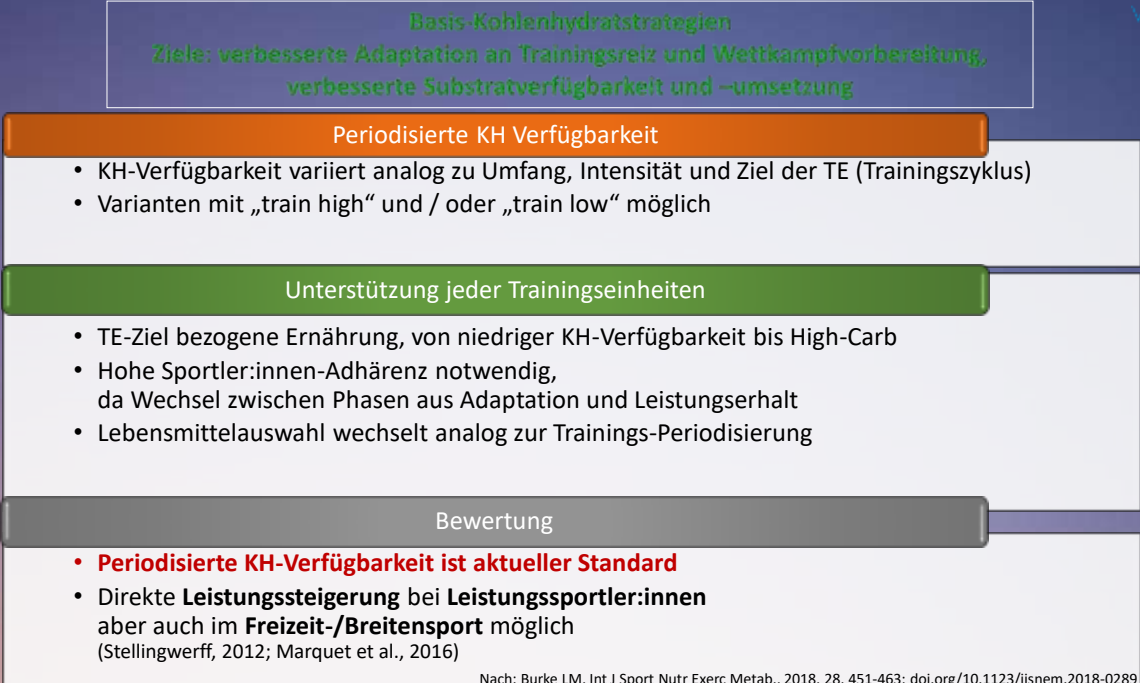


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The Canadian Society
of Exercise Dietitians

Periodisierung der Kohlenhydratzufuhr

→ Strategische Kombination aus Reiz-Setzung (Training) und Einsatz gezielter Ernährungsmaßnahmen (oder ausschließlich Kohlenhydratstrategien), mit dem übergeordneten Ziel optimierter Adaptation zur Unterstützung der Trainings-/Wettkampfleistung

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Basis-Kohlenhydratstrategien
Ziele: verbesserte Adaptation an Trainingsreiz und Wettkampfvorbereitung, verbesserte Substratverfügbarkeit und -umsetzung

Periodisierte KH Verfügbarkeit

- KH-Verfügbarkeit variiert analog zu Umfang, Intensität und Ziel der TE (Trainingszyklus)
- Varianten mit „train high“ und / oder „train low“ möglich

Unterstützung jeder Trainingseinheiten

- TE-Ziel bezogene Ernährung, von niedriger KH-Verfügbarkeit bis High-Carb
- Hohe Sportler:innen-Adhärenz notwendig, da Wechsel zwischen Phasen aus Adaptation und Leistungserhalt
- Lebensmittelauswahl wechselt analog zur Trainings-Periodisierung

Bewertung

- **Periodisierte KH-Verfügbarkeit ist aktueller Standard**
- Direkte **Leistungssteigerung** bei **Leistungssportler:innen** aber auch im **Freizeit-/Breitensport** möglich (Stellingwerff, 2012; Marquet et al., 2016)

Nach: Burke LM, Int J Sport Nutr Exerc Metab., 2018, 28, 451-463; doi.org/10.1123/ijsnem.2018-0289

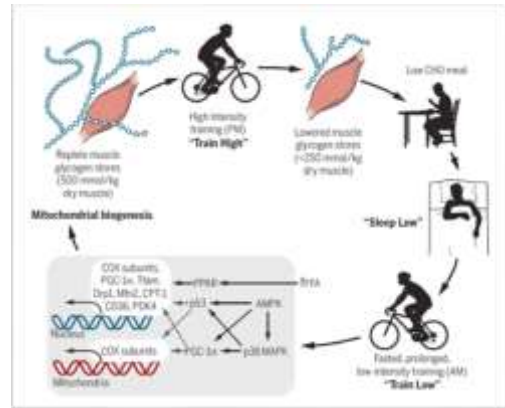
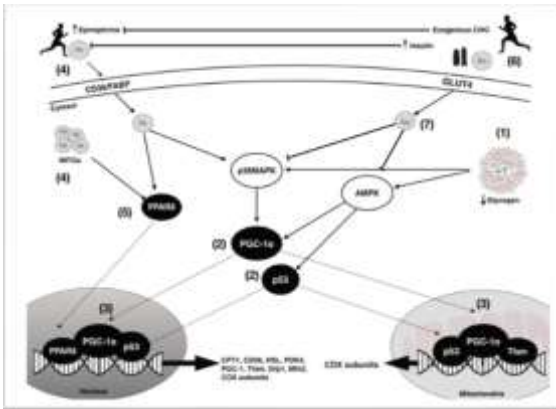
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Stellingwerff T, Morton JP, Burke LM. A Framework for Periodized Nutrition for Athletics. *Int J Sport Nutr Exerc Metab.* 2019;29(2):141-151. doi:10.1123/ijsem.2018-0305

Burke LM, Hawley JA. Swifter, higher, stronger: What's on the menu?. *Science.* 2018;362(6416):781-787. doi:10.1126/science.aau2093

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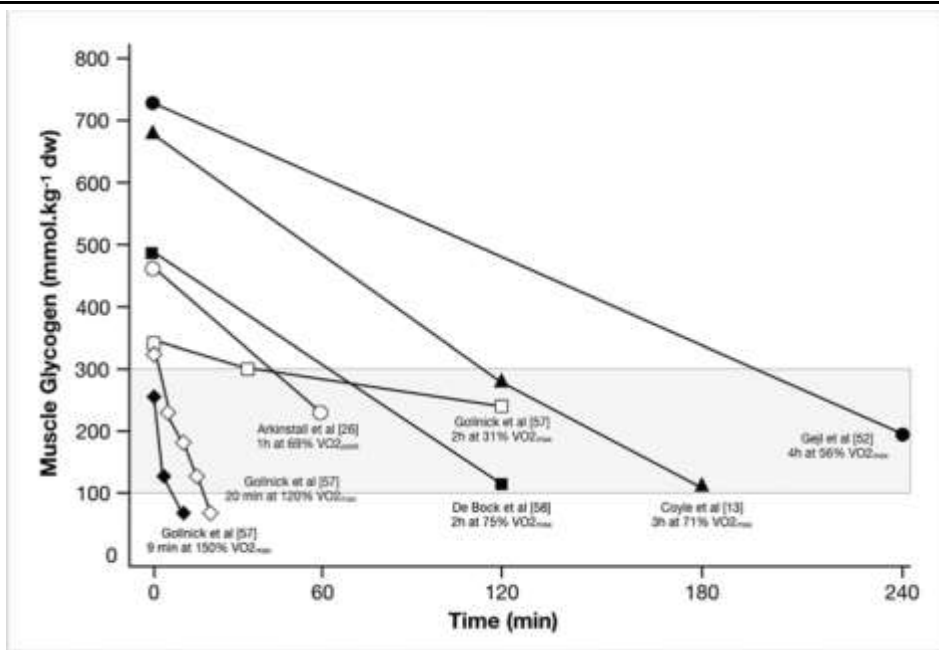
Kohlenhydratstrategien



- **train high**
- Training mit hohem Muskelglykogen
- Training mit hohem Leberglykogen
- Wettkampfernährung trainieren

strategisch und geplant einsetzen (think – plan – act)

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Impey SG et al. Fuel for the Work Required: A Theoretical Framework for Carbohydrate Periodization and the Glycogen Threshold Hypothesis. Sports Med. 2018;48(5):1031-1048. doi:10.1007/s40279-018-0867-7

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Kohlenhydratstrategien

Darmtraining

Verträglichkeit

Magenentleerung

Intestinale Absorption



strategisch und geplant einsetzen (think – plan – act)

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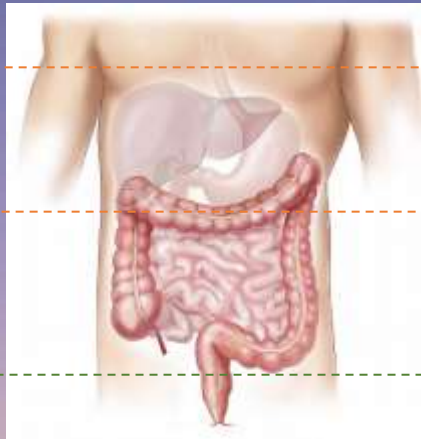
Darm-Training - „train the gut“ Darm-Adaptation an Makronährstoffe

Kohlenhydratreiche Ernährung

Chronisch

Kohlenhydratarme Ernährung

Periodisierte
Kohlenhydratzufuhr
(je nach Ziel unterschiedlich
hohe Kohlenhydratzufuhr am
Tag)



→ Reduzierte
Fettsäureoxidation
→ Erhöhte Kapazität zur
Kohlenhydratoxidation

→ Erhöhte Fettsäureoxidation
→ Reduzierte Kapazität zur
Kohlenhydratoxidation



→ Erhöhte Fettsäureoxidation
→ Erhöhte
Kohlenhydratoxidation
→ Erhöhte Kapazität zur
Kohlenhydratoxidation



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Darm-Training - „train the gut“ – Beispiele für wasserlösliche Ballaststoffe

Ballaststoff	Wirkung auf Mikrobiota
Inulin 	Vermeht Bifidobacterium longum , Bifidobacterium pseudocatenulatum und Bifidobacterium adolescentis
Akazienfaser 	Vermeht Lactobacillen, Bifidobakterien (v.a. B. Longum), Prevotellaceae, Lachnospiraceae, F. Prausnitzii Erhöhtes SCFA, Butyrat
Galactooligosaccharide (GOS)	Vermeht Bifidobacterium spp , Bacteroides spp, Erhöhte Laktat-, Glutamat-, Ornithin Konzentrationen
Xylo-oligosaccharide	Vermeht Bifidobacterium, Bacteroides fragilis Erhöhtes Butyrat, Propionat und verringertes Acetat und pH
HMO (z.B. 2'Fucosyllactose)	Vermeht Bifidobakterien (B. longum, B. bifidum)

z.B. in Curabiom® flora Dr. Wolz

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Postbiotika – *Lactobacillus paracasei*: gezielt inaktivierter Milchsäurebakterienstamm
Lactobacillus paracasei MCC1849 im Vergleich mit höchstem Potenzial

Daher bei gastrointestinalen Problemen
 durch Sport: multimodaler Ansatz aus*

Probiotika



Präbiotika



Postbiotika



*Im DiSE e.V. dafür im Einsatz z.B.
 Darmflora plus select complex Dr. Wolz

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Kohlenhydratstrategien



Nahrungsergänzung

Gels, Gums

Recovery-Produkte

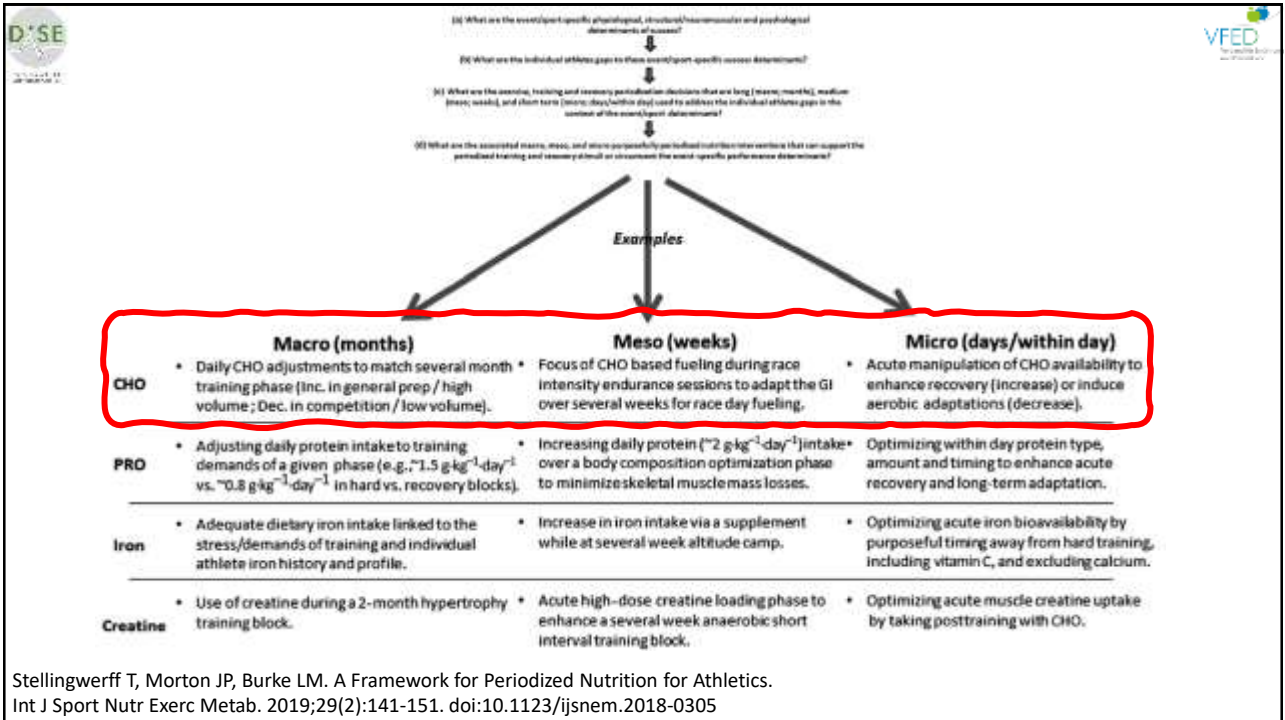
Riegel

Maltodextrin

... Sportgetränke

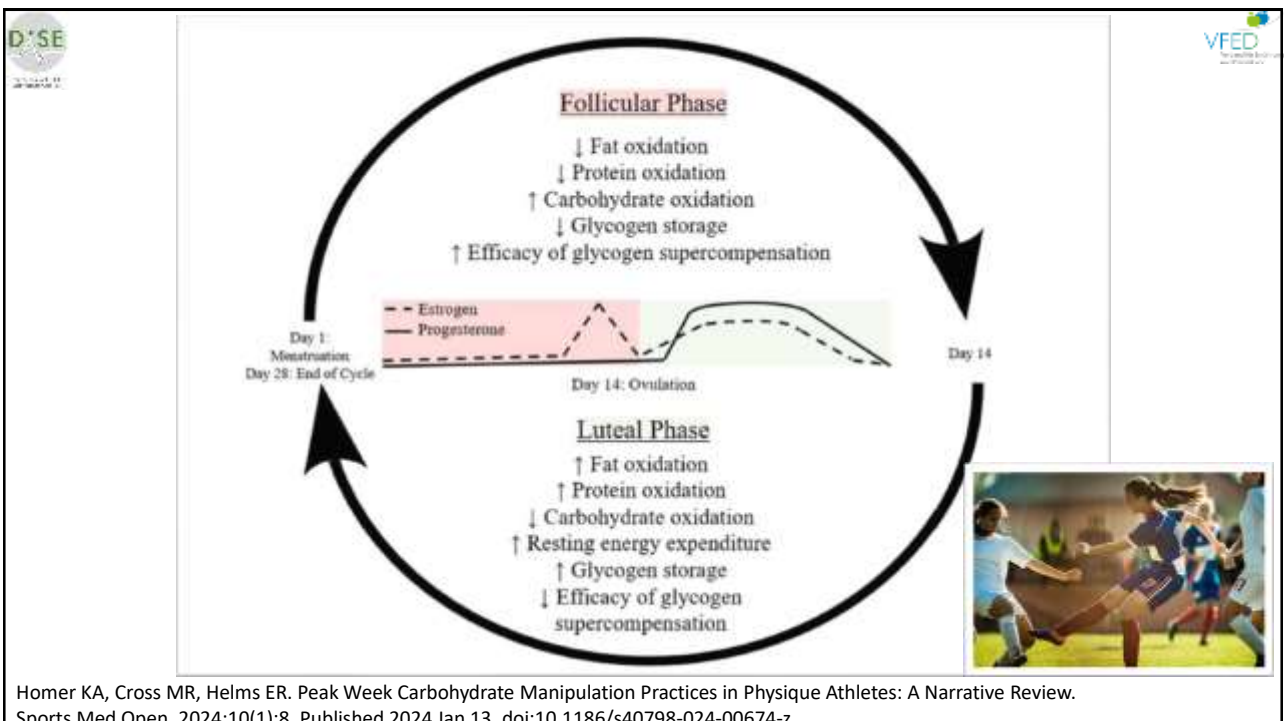
strategisch und geplant einsetzen (think – plan – act)

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Homer KA, Cross MR, Helms ER. Peak Week Carbohydrate Manipulation Practices in Physique Athletes: A Narrative Review. Sports Med Open. 2024;10(1):8. Published 2024 Jan 13. doi:10.1186/s40798-024-00674-z

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D'SE Sports Medicine (2022) 52:2691–2712
<https://doi.org/10.1007/s40279-022-01716-w>

SYSTEMATIC REVIEW

The Ergogenic Effects of Acute Carbohydrate Feeding on Resistance Exercise Performance: A Systematic Review and Meta-analysis

Andrew King¹ · Eric Helms¹ · Caryn Zinn¹ · Ivan Jukic^{1,2}

Accepted: 30 May 2022 / Published online: 9 July 2022
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Key Points

Results of the current meta-analysis indicate that carbohydrate ingestion before and during resistance training allows for greater volume to be completed during sessions lasting longer than 45 min and consisting of at least 8–10 sets.

The ingestion of carbohydrate after a fast of 8 h or more, such as the overnight fast, can be expected to improve resistance training performance.

Post-exercise blood lactate is elevated with carbohydrate ingestion, likely due to the additional volume of work completed. Therefore, a trade-off may exist where the cost of the ergogenic effect of carbohydrate ingestion on RT volume induces additional fatigue and could influence time-course of recovery. Post-exercise blood glucose was elevated with carbohydrate ingestion, where readily digestible sources ingested during training seem to increase blood glucose the most.

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D'SE 

Variabler Einsatz der (richtigen) Kohlenhydrate

=

Kohlenhydrat-periodisierung!

+

Nutrient Timing

KH-Bedarf und Art der KH ist abhängig von:

- Ziele der Trainingseinheit
- Intensität, Dauer, Häufigkeit
- verfügbare Zeit zur Regeneration zw. Trainingseinheiten
- Körperzusammensetzung (Ziele, Gewichtsreduktion?!)
- Umgebungsbedingungen
- Trainingsbackground

Individuelles „fine-tuning“ der KH-Aufnahme:

- spezifische Trainingsanforderungen
- Feedback der Trainingsdurchführung



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Vielen Dank für Ihre/Eure Aufmerksamkeit!

The screenshot shows the Spotify interface for the 'Deutsches Institut für Sporternährung e.V. (DiSE) Podcast'. The page features a dark theme with a sidebar on the left containing navigation options like 'Start', 'Suchen', 'Wohlfühlen', and 'PLAYLISTS'. The main content area displays the podcast's cover art, which includes the DiSE logo and the text 'PODCAST Deutsches Institut für Sporternährung e.V. (DiSE) Podcast DiSE e.V.'. Below the cover art is a green play button and a 'FOLGERN' button. The 'Alle Folgen' section lists two episodes: 'DiSE Podcast Nutrition Teil 1' (4 Folgen, 22 Min.) and 'DiSE Podcast Fuß-/Ballspiel und Ernährung' (16 Folgen, 00 Min.). An 'Informationen' section on the right provides details about the podcast's focus on sports nutrition, therapy, and practice, mentioning the German Olympic Sports Confederation (DOSB) and the German Olympic Sports Confederation (DOSB).